Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5739

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 1795-1799 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Correlation and path co-efficient analysis for yield attributing traits in Okra (*Abelmoschus esculentus* (L.) Moench)

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Received: 16.07.2017 | Revised: 27.07.2017 | Accepted: 28.07.2017

ABSTRACT

Twenty-three genotypes of c were evaluated in completely randomized block design with three replications for correlation and path coefficient analysis were carried out to study the character association and contribution respectively. Correlation coefficient revealed high and positive significant with marketable yield per plant, fruits per plant, marketable fruits per plant, seeds per fruit and fruit weight. Path coefficient analysis revealed that fruits per plant and marketable yield per plant had direct effect and strong association with fruit yield per plant.

Key words: *Genotypes, Correlation, Seeds, Okra.*

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) also known as ‘bhindi’ or ‘Lady’s finger’, belongs to family Malvaceae. Chromosome number 2n=130.It is native of Africa. It is widely distributed and cultivated in the tropics, sub-tropics and warmer portions of temperate region of world on a varying scale[5]. It is a multipurpose crop due to its various uses. despite of many benefits, okra is neglected because of the non-availability of high yielding and locally adopted cultivars and its vulnerability to Yellow Vein Mosaic Virus, Fruit and Shoot Borer. Correlation and path coefficient analyses are prerequisites for improvement of any crop including okra for selection of superior genotypes and improvement of any trait. In plant breeding, correlation analysis provides information about yield components and thus helps in selection of superior genotypes from diverse genetic populations. The correlation studies simply measure the associations between yield and other traits. Usefulness of the information obtained from the correlation coefficients can be enhanced by partitioning into direct and indirect effects for a set of a pair-wise cause-effect inter relationships[7]. Path coefficient analysis permits the separation of correlation coefficient into direct and indirect effects. It is basically a standardized partial regression analysis and deals with a closed system of variables that are linearly related. Such information provides a realistic basis for allocation of appropriate weightage to various yield components.

Cite this article: Shafiqurrahaman, M. and Marker, S., Correlation and path co-efficient analysis for yield attributing traits in Okra (*Abelmoschus esculentus* (L.) Moench), *Int. J. Pure App. Biosci.* **5(4):** 1795-1799 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5739

MATERIALS AND METHODS

The present investigation conducted in Completely Randomized Block Design with three replications at Experimental Research Field, Department of Genetics and Plant breeding, Allahabad School of Agriculture, SHIATS during the Kharif season. The experimental material for this study comprised 23 genotypes including four standard checks varieties collected from Indian Institute Vegetable Research, Varanasi, U.P. Data were recorded on five randomly selected plants in each genotype in each replication. Data was recorded on days to 50% flowering, first flowering node, first fruiting node, fruit length (cm), fruit width (cm), fruit girth (cm), fruit weight (g), fruits per plant, marketable fruits per plant, total yield per plant (g), marketable yield per plant (g), plant height (cm), branches per plant, leaves per plant, internodal distance (cm), seeds per fruit, 100 seed weight (cm). The analysis was carried out by standard statistical techniques for analysis of variance to significance level among genotypes. Correlation coefficient at genotypic and phenotypic levels are calculated according to[1] and path coefficient analysis by Deway [3] in 1959.

RESULT AND DISCUSSION

The correlation in general were higher than corresponding phenotypic correlations for most of the traits indicating that genotypes are superior but their expression are lessened under the influence of environment[11]. The above results are also indicating that the characters are more related genotypically than phenotypically indicating environment lessened the expression of traits are presented in (Table 1 and 2). Total yield per plant showed positive highly significant correlation with marketable yield per plant (0.94**), fruits per plant (0.87**), fruit weight (0.81**), marketable fruits per plant (0.77**), seeds per fruit (0.64**), leaves per plant (0.58**) and fruit width (0.36**). Indicating that fruit yield per plant could be improved by making selection for marketable yield per plant, fruits per plant, fruit weight, marketable fruits per plant, seeds per fruit, leaves per plant and fruit width. Similarly, [8]reported fruit weight was significantly positively correlated with fruit yield and plant height negatively correlated. [13]also reported significant positive association of fruit yield with fruits per plant, fruit weight, seeds per fruit and yield per hectare. The significant and positive correlation between leaves per plant and total yield per plant may be explained by the greater photo synthate accumulated in leaves which account for high fruit yield[2].

Inter association among yield attributing components in the present studies are positively associated are days to 50% flowering with first flowering node, first fruiting node, fruit weight, branches per plant, leaves per plant and seeds per fruit. First flowering node with first fruiting node, fruit weight, plant height, branches per plant, leaves per plant and internodal distance. first fruiting node with plant height, branches per plant, leaves per plant and internodal distance. Fruit Length with fruit girth, fruit weight, marketable yield per plant and seeds per fruit. Fruit weight with fruit girth, fruit weight, fruits per plant, marketable fruits per plant, marketable yield per plant, leaves per plant and seeds per fruit. Fruit weight with fruits per plant, marketable fruits per plant, marketable yield per plant, leaves per plant and seeds per fruit. Fruits per plant with marketable fruits per plant, marketable yield per plant, leaves per plant and seeds per fruit. Marketable fruits per plant with marketable yield per plant, branches per plant, leaves per plant and seeds per fruit. marketable yield per plant with branches per plant, leaves per plant and seeds per fruit. Plant height with branches per plant and internodal distance. Branches per plant with leaves per plant. leaves per plant with seeds per fruit.

Inter association among yield attributing components in the present studies are negatively associated are days to 50% flowering with fruit length and fruit weight, first flowering node with fruit length, first fruiting node with seeds per fruit, fruit length with 100 seed weight, fruit width with plant height and internodal distance, fruit weight with 100 seed weight, fruits per plant with internodal distance, marketable fruits per plant with internodal distance, marketable yield per plant with internodal distance and 100 seed weight, plant height with seeds per fruit and 100 seed weight, plant height with seeds per fruit and 100 seed weight, leaves per plant with 100 seed weight, internodal distance with seeds per fruit, seeds per fruit with 100 seed weight.

Path coefficient analysis provides an effective means of finding out the direct and indirect process of association and presents a critical examination of produce a given correlation and measure the relevant importance of each casual factor. Further, the genotypic path coefficients were observed to be higher than phenotypic path coefficient indicating the masking effect of environment. The results revealed high residual effects for genotypic (0.0290) and phenotypic (0.0267) respectively. The estimates of direct and indirect effects of the 16 yield attributing traits on fruit yield per plant are presented in (Table 3 and 4). At genotypic level, fruits per plant and marketable yield per plant had revealed high positive direct effect on fruit yield per plant. These traits had also exhibited highly significant and strong positive association with fruit yield per plant. Similar results were reported for fruit yield per plant by[10] and marketable yield per plant by[4]. High direct effects of these traits appear to be main factors for their association with fruit yield per plant. Hence, these traits should be considered as important selection criteria in okra improvement programme and direct selection for these traits is recommended for fruit yield improvement. Further, first flowering node had also recorded high positive direct effect on fruit yield per plant. However, their association with fruit yield per plant was noticed to be non-significant in the present studies indicating the need for adoption of restricted selection model to nullify the undesirable indirect effects and make use of the high direct effects.

High negative direct effects where notice for first fruiting node, fruit weight, marketable fruits per plant and leaves per plant in the present investigation. However, the association of the traits with fruit yield per plant was observed to be non-significant indicating a major role of indirect effects these traits where observed to influence fruit yield per plant mostly through fruit length, fruit weight, first fruiting node, leaves per plant and seeds per fruit.

Further negligible direct effects were observed for days to 50 % flowering, fruit length fruit width, fruit girth, plant height, branches per plant, internodal distance, seeds per fruit and 100 seed weight association of these traits with fruit yield per plant. However non-significant indicating the role of in direct effects of these traits on fruit yield per plant through other characters. High indirect effects of these traits were also noticed through fruit length, fruit weight, first fruiting node, leaves per plant and seeds per fruit.

The estimates of direct and indirect effects of the 16 yield related characters on fruit yield per plant are presented in Table. At phenotypic level, fruits per plant and marketable yield per plant had revealed high positive direct effect on fruit yield per plant. These traits had also exhibited highly significant and positive association with fruit yield per plant. Similar results were reported for fruit yield per plant by[10] and marketable yield per plant by[4]. High direct effects of these traits appear to be main factors for their association with fruit yield per plant. Hence, these traits should be considered as important selection criteria in okra improvement programme and direct selection for these traits is recommended for fruit yield improvement. Further, marketable fruits per plant had also recorded high positive direct effect on fruit yield per plant. However, their association with fruit yield per plant was noticed to be non-significant in the present studies indicating the need for adoption of restricted selection model to nullify the undesirable indirect effects and make use of the high direct effects.

Further, negligible direct effects were observed for days to 50 % flowering, first flowering node, first fruiting node, fruit length, fruit width, fruit girth, fruit weight, plant height, branches per plant, leaves per plant, internodal distance, seeds per fruit and 100 seed weight with fruit yield per plant. However non-significant indicating the role of in direct effects of these traits on fruit yield per plant through other characters. High indirect effects of these traits were also noticed through fruit length, fruit weight, first fruiting node, leaves per plant and seeds per fruit.

Table 1: Genotypic correlation for various quantitative characters in Okra

character	FFloN	FFruN	FL	FW	FG	FWt	F/P	M F/P	M Y/P	PH	B/P	L/ P	ID	S/F	100 SW	Y/P
DFF	0.36**	0.22	-0.17	0.37**	-0.30*	-0.22	0.02	0.09	0.07	-0.00	0.58**	0.68**	0.00	0.31**	-0.12	-0.04
FFloN	**1.00**	0.95**	-0.16	0.15	-0.07	-0.16	-0.13	-0.02	-0.07	0.57**	0.69**	0.43**	0.24*	-0.22	-0.12	-0.16
FFruN		**1.00**	-0.05	0.08	0.01	-0.07	-0.17	-0.07	-0.09	0.67**	0.68**	0.37**	0.27*	-0.28*	-0.15	-0.15
FL			**1.00**	0.31**	0.61**	0.41**	0.03	0.11	0.22	0.08	-0.14	-0.04	-0.03	0.33**	-0.39**	0.21
FW				**1.00**	0.58**	0.39**	0.40**	0.45**	0.57**	-0.20	0.27*	0.69**	-0.38**	0.59**	-0.16	0.51**
FG					**1.00**	0.36**	-0.10	-0.04	0.12	0.06	-0.11	0.07	-0.13	0.22	-0.00	0.13
FWt						**1.00**	0.43**	0.39**	0.72**	-0.21	-0.04	0.31**	-0.20	0.48**	-0.51**	0.80**
F/P							**1.00**	0.89**	0.86**	-0.17	0.18	0.51**	-0.47**	0.54**	-0.08	0.87**
M P/P								**1.00**	0.90**	-0.19	0.27*	0.54**	-0.40**	0.53**	-0.07	0.78**
M Y/P									**1.00**	-0.26*	0.22	0.61**	-0.38**	0.66**	-0.31*	0.94**
PH										**1.00**	0.28*	-0.03	0.68**	-0.39**	-0.27*	-0.25*
B/P											**1.00**	0.68**	0.03	0.21	-0.10	0.13
L/P												**1.00**	-0.12	0.57**	-0.34**	0.55**
ID													**1.00**	-0.41**	-0.18	-0.42**
S/F														**1.00**	-0.23*	0.65**
100 SW															**1.00**	-0.36**

Table 2: Phenotypic correlation for various quantitative characters in Okra

character	FFloN	FFruN	FL	FW	FG	FWt	F/P	M F/P	M Y/P	PH	B/P	L/ P	ID	S/F	100 SW	Y/ P
DFF	0.43**	0.35**	-0.25*	0.43**	-0.05	-0.28*	-0.06	0.01	-0.02	-0.12	0.37 **	0.41**	0.13	0.23 *	-0.19	-0.12
FFloN	**1.00**	0.93**	-0.25*	0.24*	0.08	-0.22	-0.18	-0.06	-0.12	0.43**	0.57**	0.31**	0.30*	-0.23	-0.18	-0.22
FFruN		**1.00**	-0.18	0.20	0.17	-014	-0.22	-0.12	-0.16	0.48**	0.52**	0.22	0.33**	-0.27 *	-0.21	-0.22
FL			**1.00**	0.12	0.26*	0.44**	0.10	0.16	0.28*	0.16	-0.04	0.06	-0.11	0.32 **	-0.25 *	0.27*
FW				**1.00**	0.59**	0.26*	0.28*	0.35**	0.43**	-0.26*	0.17	0.51**	-0.23 *	0.51 **	-0.23	0.36**
FG					**1.00**	0.19	-0.16	-0.09	0.01	-0.05	-0.17	-0.04	-0.01	0.16	-0.10	-0.00
FWt						**1.00**	0.45**	0.41**	0.73**	-0.14	0.00	0.35 **	-0.24*	0.48 **	-0.42**	0.81**
F/P							**1.00**	0.88**	0.85**	-0.11	0.22	0.53**	-0.48**	0.54 **	-0.04	0.87**
M P/P								**1.00**	0.90**	-0.14	0.28*	0.54**	-0.41**	0.53 **	-0.04	0.77**
M Y/P									**1.00**	-0.19	0.24*	0.62**	-0.40**	0.66**	-0.24 *	0.94**
PH										**1.00**	0.31**	0.03	0.56**	-0.36**	-0.20	-0.16
B/P											**1.00**	0.69**	-0.02	0.22	-0.06	0.18
L/P												**1.00**	-0.18	0.56**	-0.26 *	0.58**
ID													**1.00**	-0.40**	-0.22	-0.44**
S/F														**1.00**	-0.21	0.64**
100 SW															**1.00**	-0.28*

Table 3: Genotypic path co-efficient for various quantitative characters in Okra

character	DFF	FFloN	FFruN	FL	FW	FG	FWt	F/P	M F/P	M Y/P	PH	B/P	L/ P	ID	S/F	100 SW	Y/ P
DFF	**0.10**	0.03	0.02	-0.02	0.04	-0.03	-0.02	0.00	0.01	0.01	0.00	0.06	0.07	0.00	0.03	-0.01	-0.04
FFloN	0.23	**0.62**	0.59	-0.10	0.09	-0.05	-0.10	-0.08	-0.02	-0.05	0.36	0.43	0.27	0.15	-0.14	-0.08	-0.16
FFruN	-0.13	-0.57	**-0.60**	0.03	-0.05	-0.01	0.04	0.10	0.05	0.06	-0.41	-0.41	-0.23	-0.17	0.17	0.09	-0.15
FL	0.00	0.00	0.00	**0.03**	0.01	0.02	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	-0.01	0.21
FW	-0.03	-0.01	-0.01	-0.03	**-0.09**	-0.05	-0.04	-0.04	-0.04	-0.05	0.02	-0.02	-0.06	0.03	-0.05	0.02	0.51**
FG	-0.04	-0.01	0.00	0.08	0.08	**0.13**	0.05	-0.01	-0.01	0.02	0.01	-0.02	0.01	-0.02	0.03	0.00	0.13
FWt	0.23	0.17	0.07	-0.42	-0.40	-0.37	**-1.01**	-0.44	-0.40	-0.73	0.22	0.04	-0.32	0.20	-0.49	0.52	0.80**
F/P	0.03	-0.16	-0.20	0.04	0.48	-0.12	0.51	**1.18**	1.06	1.02	-0.21	0.22	0.61	-0.56	0.65	-0.10	0.87**
M P/P	-0.31	0.08	0.26	-0.38	-1.49	0.15	-1.29	-2.92	**-3.25**	-2.93	0.63	-0.88	-1.76	1.32	-1.74	0.25	0.78**
M Y/P	0.30	-0.30	-0.40	0.94	2.38	0.52	3.01	3.57	3.74	**4.15**	-1.11	0.93	2.56	-1.59	2.77	-1.29	0.94**
PH	0.00	0.14	0.17	0.02	-0.05	0.02	-0.05	-0.04	-0.05	-0.07	**0.25**	0.07	-0.01	0.17	-0.10	-0.07	-0.25*
B/P	0.15	0.18	0.18	-0.04	0.07	-0.03	-0.01	0.05	0.07	0.06	0.07	**0.26**	0.18	0.01	0.06	-0.03	0.13
L/P	-0.60	-0.39	-0.33	0.04	-0.62	-0.07	-0.28	-0.46	-0.48	-0.55	0.03	-0.61	**-0.89**	0.11	-0.51	0.30	0.55**
ID	0.00	0.01	0.01	0.00	-0.02	-0.01	-0.01	-0.03	-0.02	-0.02	0.04	0.00	-0.01	**0.05**	-0.02	-0.01	-0.42**
S/F	-0.01	0.01	0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	0.01	0.00	-0.01	0.01	**-0.02**	0.01	0.65**
100 SW	-0.02	-0.02	-0.03	-0.07	-0.03	0.00	-0.09	-0.01	-0.01	-0.05	-0.05	-0.02	-0.06	-0.03	-0.04	**0.17**	-0.36**

Table 4: Phenotypic path co-efficient for various quantitative characters in Okra

character	DFF	FFloN	FFruN	FL	FW	FG	FWt	F/P	M F/P	M Y/P	PH	B/P	L/ P	ID	S/F	100 SW	Y/P
DFF	**-0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.12
FFloN	-0.01	**-0.03**	-0.03	0.01	-0.01	0.00	0.01	0.01	0.00	0.00	-0.01	-0.02	-0.01	-0.01	0.01	0.01	-0.22
FFruN	0.01	0.02	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	-0.01	0.00	-0.22
FL	0.00	0.00	0.00	**-0.02**	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.27*
FW	0.00	0.00	0.00	0.00	**-0.01**	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36**
FG	0.00	0.00	0.00	0.00	0.01	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.00
FWt	-0.04	-0.03	-0.02	0.06	0.03	0.03	**0.13**	0.06	0.05	0.10	-0.02	0.00	0.05	-0.03	0.06	-0.06	0.81**
F/P	-0.04	-0.12	-0.14	0.07	0.18	-0.11	0.29	**0.64**	0.56	0.54	-0.07	0.14	0.34	-0.31	0.35	-0.03	0.87**
M P/P	-0.01	0.04	0.08	-0.11	-0.24	0.06	-0.27	-0.58	**-0.66**	-0.59	0.09	-0.19	-0.36	0.27	-0.35	0.03	0.77**
M Y/P	-0.02	-0.12	-0.15	0.26	0.41	0.01	0.68	0.79	0.83	**0.93**	-0.18	0.23	0.58	-0.37	0.61	-0.23	0.94**
PH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	0.00	0.00	0.00	0.00	0.00	-0.16
B/P	0.01	0.02	0.02	0.00	0.01	-0.01	0.00	0.01	0.01	0.01	0.01	**0.03**	0.02	0.00	0.01	0.00	0.18
L/P	-0.02	-0.01	-0.01	0.00	-0.02	0.00	-0.02	-0.02	-0.02	-0.03	0.00	-0.03	**-0.04**	0.01	-0.02	0.01	0.58**
ID	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	-0.01	0.00	0.00	**-0.01**	0.01	0.00	-0.44**
S/F	0.00	0.00	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	0.01	0.00	-0.01	0.01	**-0.02**	0.00	0.64**
100 SW	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-0.01**	-0.28*

DFF : Days to 50% flowering, FFloN : First Flowering Node, FFruN : First Fruiting Node, FL : Fruit Length, FW: Fruit Width, FG : Fruit Girth, FWt : Fruit Weight, F/P : Fruits/ Plant, M Y/P : Marketable Fruits/ Plant, M Y/P : Marketable Yield/ Plant, PH : Plant Height, B/P : Branches/ Plant, L/P : Leaves/ Plant, ID : Internodal Distance, S/F : Seeds/ Fruit, 100 SW : 100 Seed Weight, Y/P : Yield per plant

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