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Path Analysis Studies in Okra [*Abelmoschus esculentus* (L.) Moench]

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ABSTRACT

The experiment was evaluated with thirty two okra genotypes in Randomized Block Design (RBD) with two replications. Thirteen characters were measured for randomly selected plants for path analysis. Path analysis studies revealed high direct effect of days to initiation for first flowering, number of branches per plant, fruit length, weight of fruit and number of fruits per plant also recorded desirable direction with yield. Hence, the genotypes which exhibited better performance for these characters can be used in further improvement of okra.

Key words: *Okra, Path analysis, Randamized Block Design*

Introduction

The green tender fruits of okra are good source of carbohydrate, protein, vitamins (A, B and C) and rich in calcium, potassium and other mineral matters. Okra or ladies' finger is a herbaceous annual plant and good source of minerals, antioxidants, fiber and vitamins. The word Abelmoschus perhaps originated from the Arabian word "abul-l-mosk" meaning "source of musk," referring to the musky smell of the seeds (Charrler, 1984). It's contains 1.9 g protein, 1.2 g fiber, 1.5 mg Fe and 88 IU Vit-A per 100 g of edible portion. The most frequently observed somatic chromosome number, however, is 2n=130, although Datta and Naug (1968) suggest that the numbers 2n=72, 108, 120, 132 and 144 are in regular aeries of polyploidy with n=12. In our country, a wide variation amongst the okra varieties expressing variation for quantitative and qualitative traits. A logical way to start any crop improvement programme is to assess the variation existing in the available materials. Yield is a complex character resulting from multiplicative interactions of various yield components. Therefore, correlation studies between yield and other traits will be of interest to breeders in planning the hybridization programme and evaluating the individual plants in segregating populations. Path analysis splits the correlation coefficient into measures of direct and indirect effects, thus providing understanding of the direct and indirect contribution of each character towards yield.

Materials and Methods

The experiment was laid out in a Randomized Block Design (RBD) with two replications. In each replication, each genotype was grown in double row plot. Individual plot was of 3.0 m length and 1.2 m in width. An inter-row spacing of 60 cm and an intra-row spacing of 30 cm was maintained. Ten plants

per row and 20 plants per plot and genotypes were maintained. Recommended package of practices and plant protection measures were carried out to raise a successful crop. The experimental material comprising of 32 okra genotypes obtained from VRS, SKLTSHU, Rajendranagar, Hyderabad were systematically evaluated for 13 quantitative and qualitative traits.

Table 1. List of germplasm lines of okra selected for genetic diversity studies

S. No.	Genotype	Source
1.	RHBG-1	VRS, SKLTSHU, HYDERABAD
2.	HBG-2	VRS, SKLTSHU, HYDERABAD
3.	RHBG-3	VRS, SKLTSHU, HYDERABAD
4.	RHBG-4	VRS, SKLTSHU, HYDERABAD
5.	RHBG-5	VRS, SKLTSHU, HYDERABAD
6.	RHBG-6	VRS, SKLTSHU, HYDERABAD
7.	RHBG-7	VRS, SKLTSHU, HYDERABAD
8.	VRO-6	VRS, SKLTSHU, HYDERABAD
9.	IC-42490	NBPGR- New Delhi
10.	IC-43743	NBPGR- New Delhi
11.	IC-45730	NBPGR- New Delhi
12.	IC-90219	NBPGR- New Delhi
13.	IC-10533	NBPGR- New Delhi
14.	IC-10265	NBPGR- New Delhi
15.	RHBG-8	VRS, SKLTSHU, HYDERABAD
16.	IC-18960	VRS, SKLTSHU, HYDERABAD
17.	IC-04328	VRS, SKLTSHU, HYDERABAD
18.	RHBG-9	VRS, SKLTSHU, HYDERABAD
19.	RHBG-13	VRS, SKLTSHU, HYDERABAD
20.	IC-90004	NBPGR- New Delhi
21.	IC-111515	NBPGR- New Delhi
22.	RHBG-10	VRS, SKLTSHU, HYDERABAD
23.	RHBG-11	VRS, SKLTSHU, HYDERABAD
24.	RHBG-12	VRS, SKLTSHU, HYDERABAD
25.	Arka Anamika	IIHR-Banglore
26.	Pusa Sawani	IARI-New Delhi
27.	Arka Abhay	IIHR-Banglore
28.	Pusa A-4	IARI-New Delhi
29.	EC-755648	NBPGR- New Delhi
30.	IC-29119	NBPGR- New Delhi
31.	IC-22237	NBPGR- New Delhi
32.	EC-755647	NBPGR- New Delhi

Path coefficients were obtained by solving the following simultaneous equations.

$r_{ly} = P_{ly} + r_{12}P_{2y} + r_{13}P_{3y} + \ldots\ldots\ldots + r_{lk}P_{ky}$

Where,

r_{ly} = Simple correlation coefficient between x_1 and y, the dependent character

P_{ly} = Direct effect of x_1 on y, the dependent character

$r_{12}P_{2y}$ = Indirect effect of x_1 on y through x_2.

r_{12} = Correlation coefficient between x_1 and x_2.

$r_{lk}P_{ky}$ = Indirect effect of x_1 only through k^{th} variable.

The direct and indirect contribution of various characters to yield were calculated through path coefficient analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

Table 2. Scales for path coefficients

Values of direct (or) indirect effects	Rate (or) scale
0.00 to 0.09	Negligible
0.10 to 0.19	Low
0.20 to 0.29	Moderate
0.30 to 0.99	High
> 1.00	Very high

Results and Discussion

Path analysis was carried out at phenotypic and genotypic levels considering fruit yield plant^{-1} as dependent character and its attributes as independent characters *viz.*, plant height (cm), days to initiation for first flowering, days to 50% flowering, number of branches plant^{-1}, fruit length (cm), diameter of fruit (cm), weight of fruit (g), number of fruits plant^{-1}, number of fruits plot^{-1}, fiber content (%), overall YVMV PDI (%). Each component has two path actions *viz.*, direct effect on yield and indirect effect through components which are not revealed by correlation studies.

Path Analysis

Plant height (cm) had negligible direct negative effect on fruit yield plant^{-1} at phenotypic level (-0.0355) and high negative direct effect at genotypic level (-0.3133). Further, it exhibited high indirect positive effect through weight of fruit (0.7979) and low negative indirect negative effect (-0.1410) on fruit yield plant^{-1} through days to initiation for first flowering at genotypic level. Days to initiation for first flowering had negligible direct negative effect on fruit yield plant^{-1} at phenotypic level (-0.0025) and low positive direct effect at genotypic level (0.1922). Further, it exhibited moderate indirect positive effect (0.7979) through plant height and high negative indirect negative effect (-0.1410) on fruit yield plant^{-1} through weight of fruit at genotypic level. At both phenotypic (0.0021) and genotypic level (0.0630), fruit length exhibited negligible positive direct effect

on fruit yield plant^{-1}. Further, it exhibited high indirect positive effect (0.4155) through weight of fruit and low indirect negative effect (-0.0950) on fruit yield plant^{-1} through plant height at genotypic level. Diameter of fruit exhibited negligible negative direct effect on fruit yield plant^{-1} at both phenotypic (-0.0519) and genotypic level (-0.0867). Further, it exhibited low indirect positive effect (0.1986) through number of fruits plant^{-1} and negligible indirect negative effect (-0.0649) on fruit yield plant^{-1} through plant height at genotypic level. At both phenotypic (0.7123) and genotypic level (0.9270), weight of fruit exhibited high positive direct effect on fruit yield plant^{-1}. Further, it exhibited moderate indirect positive effect (0.2645) through number of fruits plant^{-1} and moderate indirect negative effect (-0.2697) on fruit yield plant^{-1} through plant height at genotypic level. Number of fruits plant^{-1} exhibited very high positive direct effect on fruit yield plant^{-1} at phenotypic level (1.1918) and high positive direct effect genotypic level (0.4250). Further, it exhibited high indirect positive effect (0.5770) through weight of fruit and moderate indirect negative effect (-0.2649) on fruit yield plant^{-1} through plant height at genotypic level. At both phenotypic (-0.0116) and genotypic level (-0.0084), fiber content exhibited negligible negative direct effect on fruit yield plant^{-1}. Further, it ex-

Table 3. Phenotypic (P) and genotypic (G) path coefficient analysis indicating direct and indirect effects of component characters on fruit yield in 32 genotypes of okra

Characters		Plant height (cm)	Days to initiation for first flowering	Days to 50% flowering	Number of branches plant^{-1}	Fruit length (cm)	Diameter of fruit (cm)	Weight of fruit (g)	Number of fruits plant^{-1}	Fiber content (%)	Overall YVMV PDI (%)
Plant height (cm)	P	-0.0355	0.0242	0.0062	0.0006	-0.0101	-0.0066	-0.0290	-0.0290	0.0275	0.0305
	G	-0.3133	0.2299	0.0657	0.0049	-0.0950	-0.0649	-0.2697	-0.2649	0.2603	0.2858
Days to initiation for first flowering	P	0.0017	-0.0025	-0.0018	-0.0010	0.0009	0.0001	0.0019	0.0012	-0.0018	-0.0017
	G	-0.1410	0.1922	0.1424	0.0851	-0.0872	-0.0132	-0.1700	-0.1106	0.1645	0.1543
Days to 50% flowering	P	-0.0025	0.0104	0.0145	0.0074	-0.0047	0.0010	-0.0061	0.0005	0.0037	0.0036
	G	0.0158	-0.0560	-0.0756	-0.0507	0.0351	-0.0074	0.0388	-0.0012	-0.0280	-0.0243
Number of branches per plant	P	-0.0001	0.0028	0.0036	0.0071	-0.0044	0.0027	-0.0029	0.0020	0.0018	0.0007
	G	-0.0018	0.0495	0.0750	0.1118	-0.0724	0.0508	-0.0497	0.0345	0.0290	0.0107
Fruit length (cm)	P	0.0006	-0.0008	-0.0007	-0.0013	0.0021	-0.0003	0.0009	0.0001	-0.0005	-0.0005
	G	0.0191	-0.0286	-0.0292	-0.0408	0.0630	-0.0092	0.0282	0.0007	-0.0184	-0.0162
Diameter of fruit (cm)	P	-0.0096	0.0016	-0.0037	-0.0200	0.0066	-0.0519	0.0029	-0.0205	-0.0021	0.0099
	G	-0.0180	0.0059	-0.0084	-0.0394	0.0127	-0.0867	0.0040	-0.0405	-0.0013	0.0168
Weight of fruit (g)	P	0.5827	-0.5584	-0.2991	-0.2908	0.3121	-0.0402	0.7123	0.4150	-0.5869	-0.5353
	G	0.7979	-0.8200	-0.4754	-0.4126	0.4155	-0.0424	0.9270	0.5770	-0.8476	-0.7649
Number of fruits plant^{-1}	P	0.9753	-0.5835	0.0380	0.3382	0.0333	0.4702	0.6944	1.1918	-0.7145	-0.8027
	G	0.3594	-0.2445	0.0070	0.1311	0.0045	0.1986	0.2645	0.4250	-0.2760	-0.2995
Fiber content (%)	P	0.0090	-0.0084	-0.0029	-0.0030	0.0030	-0.0005	0.0095	0.0069	-0.0116	-0.0083
	G	0.0070	-0.0072	-0.0031	-0.0022	0.0025	-0.0001	0.0077	0.0055	-0.0084	-0.0070
Overall YVMV score	P	-0.0025	0.0021	0.0007	0.0003	-0.0007	-0.0006	-0.0022	-0.0020	0.0021	0.0029
	G	0.1058	-0.0931	-0.0374	-0.0111	0.0298	0.0225	0.0957	0.0817	-0.0963	-0.1160

R SQUARE = 0.9947 RESIDUAL EFFECT = 0.0731

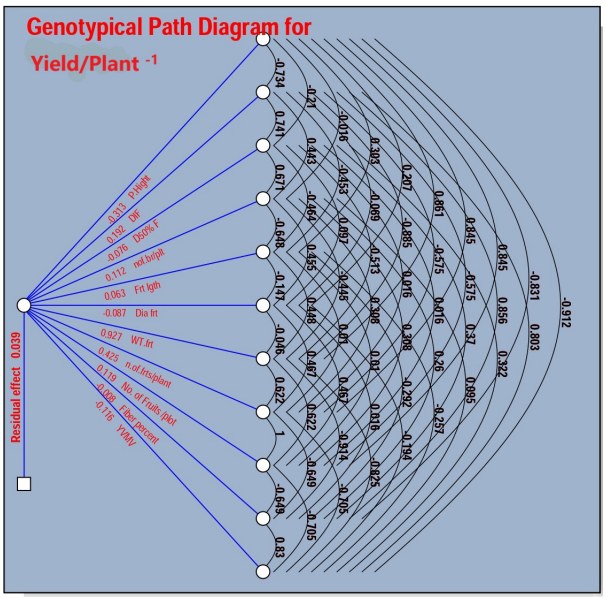

Fig. 1. Genotypic path diagram respecting direct and indirect effects on fruit yield plant^{-1}

hibited moderate indirect positive effect (0.2603) through plant height and high indirect negative effect (-0.8476) on fruit yield plant^{-1} through weight of fruit at genotypic level. Overall YVMV PDI (%) had negligible direct positive effect on fruit yield plant^{-1} at phenotypic level (0.0029) and low negative direct effect at genotypic level (-0.1160). Further, it exhibited low indirect positive effect (0.2858) through plant height and high negative indirect negative effect (-0.7649) on fruit yield plant^{-1} through weight of fruit at genotypic level.

The path coefficient analysis done in this study reveals that, the improvement of yield by improving the characters number of branches plant^{-1}, fruit length, weight of fruit and number of fruits plant^{-1}. Among all the traits under study, days to initiation for first flowering, number of branches plant^{-1}, fruit length, weight of fruit and number of fruits plant^{-1}, have recorded positive with yield. This suggested that direct selection based on these traits were considered for crop yield improvement.

Conclusion

Direct selection based on these traits would result in simultaneous improvement of above mentioned traits and yield *per se* in okra. Days to initiation of first flowering, number of branches plant^{-1}, fruit length, weight of the fruit and number of fruits plant^{-1} are important characters to be considered for genetic improvement in fruit yield plant^{-1}, since these characters to be have direct and indirect effect on yield.

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References

Charrler, A. 1984. Genetic resources of the genus *Abelmoschus Med.* (Okra). *Inter. board for plant genetic resources*; IBPGR Secretariat-Rome. *http:// pdf.usaid.gov/ pdf_docs/ PNAAT275.pdf.*

Datta, P. C. and Naug, A. 1968. A few strains of (*Abelmoschus esculentus* (L.) Moench) their karyological in relation to phylogeny and organ development. Be*itr. Biol. Pflanzen*. 45: 113-126.

Dewey, D. R. and Lu, K. H. 1959. A correlation and path co-efficient analysis of components of crested wheat grass seed production. *Agron. J.* 51: 515-518.

Wright, S. 1921. The methods of the path coefficients. *The Annals math. Stat*. 5: 161-215.