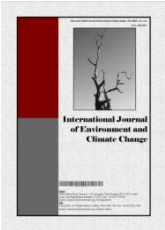

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Studies on Correlation and Path Coefficient for Direct Selection between Pair of Traits Using Green Fruit Yield as Dependent Characters in Okra

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was carried out at the Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut (U.P.). The fourteen quantitative traits, thirty genotypes of okra were tested in a Randomized Block Design (RBD) with three replications during the summer season of 2021. Fruit yield per plant showed highly significant and positive correlation with plant height, fruit diameter, number of branches per plant, fruit length, number of flowers per plant, test weight and number of fruits per plant at both genotypic and phenotypic level, indicating mutual association of these characters. Path coefficient analysis exhibits positive direct effect was observed towards fruit yield per plant for number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop at genotypic level. At the phenotypic level also the estimates of direct and indirect were generally less than genotypic level. The magnitudes of residual effects were found to be small at both the phenotypic and genotypic levels. These traits could be utilized in a selection procedure for okra crop enhancement in the future.

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Keywords: Abelmoschus esculentus; correlation; okra; path coefficient; yield.

1. INTRODUCTION

Okra [*Abelmoschus esculentus (L.)* Moench], popularly known as Lady's finger or bhindi, is a Malvaceae family with a 2n=130 somatic chromosomal number.

Okra's origins are debated, with advocates claiming South Asian, Ethiopian, and African roots. Okra is originated in Ethiopian region [1,2]. Many countries, including India, Japan, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Myanmar, Malaysia, Thailand, India, Brazil, Ethiopia, Cyprus, and the Southern United States, cultivate okra economically [3]. This crop can be grown as a garden crop or on huge commercial farms. Okra is a popular fruit vegetable because of its many advantages, including its high nutritional and therapeutic value, simplicity of production, wide adaptability, year-round cultivation, easy transportation, export potential, and abundant yields [4]. It's a valuable income crop for small, medium, and big farmers, with the potential to improve food, nutritional, and health security, promote rural development, and assist long-term land management [4]. It is a popular vegetable crop farmed for its young sensitive fruits, which are canned, dehydrated, and processed in small amounts. Okra is a prized vegetable because of its great nutritional value [5]. Okra green fruits are generally high in carbohydrate, protein, dietary fibre, calcium, magnesium, potassium, and vitamins A and C, among other nutrients. Water 88.6 g, energy 144.00 kJ (36 kcal), protein 2.10 g, carbohydrate 8.20 g, fat 0.20 g, fibre 1.70 g, Ca 84.00 mg, P 90.00 mg, Fe 1.20 mg, -carotene 185.00 g, riboflavin 0.08 mg, thiamin 0.04 mg, niacin 0.60 mg, ascorbic acid 47.00 mg, Vitamin B_6 0.22 [6].

Correlation and path coefficient analyses are required for the selection of superior genotypes and improvement of any trait in any crop, including okra. Correlation analysis aids in the selection of superior genotypes from heterogeneous genetic populations in plant breeding by providing information on yield components. Correlation studies merely look at the relationships between yield and other characteristics. Partitioning into direct and indirect effects for a set of pair-wise cause-effect inter linkages can improve the usefulness of the information acquired from the correlation coefficients [7].

Path coefficient analysis allows the direct and indirect impacts of a correlation coefficient to be separated. It is a standardised partial regression approach that deals with a closed system of linearly connected variables. This data provides a realistic foundation for allocating proper weightage to various yield components.

2. MATERIALS AND METHODS

The experiment was place in the Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, during the summer of 2021. Thirty different germplasm samples (Table-1) were gathered from various locations throughout India. The collections were made from a variety of sources, including both indigenous and foreign methods of collection. The above genotypes were sowed in three replications in the experimental plot using Randomized Block Design (RBD). Seeds were planted at a depth of 2.5-3 cm in the soil. Row to row 45 cm and plant to plant 30 cm were sown in each plot. Various cultural processes were scheduled according to crop needs during the course of the inquiry. The agricultural processes and packing used to raise an okra crop's standards. The observation was recorded for five randomly selected plants for fourteen quantitative characters viz., days to first flower initiation, plant height, number of branches per plant, number of flowers per plant, days to first fruit set, fruit length, fruit diameter, number of fruits per plant, days to first fruits harvesting, days to second fruit harvesting, number of seeds per pod, test weight, duration of crop and fruit yield per plant. For statistical analysis, mean values of five randomly selected plants were used. Fruit yield was used as the dependent variable, with the remainder of the attributes being treated as independent variables with simultaneous equations for genotypic and phenotypic correlation coefficient levels and route coefficient analyses. which expressed the fundamental relationship between path coefficients that were solved to estimate direct and indirect impacts using Dewey and Lu's method [8]. Using the OPSTAT software, the data was evaluated for several correlation and path analysis characteristics.

Table 1. The details of germplasm with their source

S. No.	Germplasm	Source	S. No.	Germplasm	Source
1.	Hisar Naveen	HAU, Hisar	16.	IIVR-II	IIVR, Varanasi
2.	Varsha Uphar	HAU, Hisar	17.	VRO-4	IIVR, Varanasi
3.	Punjab Kranti	PAU, Ludhiana	18.	VRO-5	IIVR, Varanasi
4.	Arka Anamika	IIHR, Bengaluru	19.	VRO-6	IIVR, Varanasi
5.	Arka Abhay	IIHR, Bengaluru	20.	368-A	IARI, New Delhi
6.	Pusa Sawani	IARI, New Delhi	21.	Hisar Unnat	HAU, Hisar
7.	Pusa A-4	IARI, New Delhi	22.	IC-18530	Dr. PDKV, Akola
8.	Parbhani Kranti	MPKV, Rahuri	23.	EC-305642	Dr. PDKV, Akola
9.	Kashi Pragati	IIVR, Varanasi	24.	EC-305643	Dr. PDKV, Akola
10.	Mona	Lawad, Meerut	25.	EC-305644	Dr. PDKV, Akola
11.	Kashi Kranti	IIVR, Varanasi	26.	EC-305645	Dr. PDKV, Akola
12.	U.S-8063	IARI, New Delhi	27.	EC-305639	Dr. PDKV, Akola
13.	IC-090491	IARI, New Delhi	28.	IC-014026	Dr. PDKV, Akola
14.	Y.V.S-9	IARI, New Delhi	29.	EC-305637	Dr. PDKV, Akola
15.	IC-316/2,4,5	IARI, New Delhi	30.	EC-305635	Dr. PDKV, Akola

3. RESULTS AND DISCUSSION

Correlation coefficient study identifies the component character on which selection can be conducted for genetic yield improvement by measuring the mutual link between plant features. Investigation of the presence of components and the nature of their connection is necessary and required for yield improvement. The correlation coefficient shows the degree of link between two traits and suggests whether or not simultaneous improvement of the connected traits is achievable.

The genotypic and phenotypic correlations for fourteen characters analysed are presented in Table-2. For the majority of the features studied, genotypic correlation coefficients were greater than their phenotypic correlation coefficients. At both genotypic and phenotypic correlation level, Fruit yield per plant exhibited highly significant and positive connectionwith plant height, fruit diameter, number of branches per plant, fruit length, number of flowers per plant, test weight and number of fruits per plant. The character number of seeds per pod showed positive but significant association with fruit yield per plant. Two characters showed positive and non-significant correlation with fruit yield per plant that is duration of crops and days to first fruit set. Characters showed negative and non-significant correlation with fruit yield per plant were days to first flower initiation, days to second fruit harvesting and days to first fruit harvesting. These characters that the phenotypic expression of correlation is reduced due to the influence of environment. These results were close in conformity with findings of Shashi K. and Reddy [9-15]

The phenotypic and genotypic correlation coefficients of all the component traits evaluated with fruit yield were partitioned into direct and indirect effects using path-coefficient analysis. At the genotypic and phenotypic levels, the results of many causes impacting fruit yield (direct and indirect effects). The results obtained in terms of the direct and indirect effects of various components on plant fruit yield. Direct and indirect impacts at the genotypic level were slightly higher than direct and indirect effects at the phenotypic level, according to path coefficient analyses.

Path coefficient highest positive direct effect on fruit yield per plant was observed by number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop while negative direct effect was exerted by number of flowers per plant followed by days to second fruit harvest, test weight and fruit length on fruit yield per plant at genotypic level. Highest positive direct effect on fruit yield per plant was recorded by plant height, days to first fruit harvesting, fruit diameter, number of branches per plant, days to first fruit set, number of seeds per pod number of flowers per plant, days to first flower initiation and duration of crop. Whereas, negative direct effect was showed via fruit length, days to second fruit harvesting, test weight and number of fruits per plant on fruit yield per plant at phenotypic level. Similar findings were previously published [16-19].

Table 2. Correlation coefficient estimates at the genotypic and phenotypic levels in Okra

Characters		Days to first flower initiation	Plant height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
Days to first flower initiation	G	1.000	-0.210*	-0.220*	-0.027	0.327**	0.042	-0.155	0.016	0.198	0.249*	0.000	-0.258*	0.437**	-0.185
	P	1.000	-0.180	-0.179	-0.020	0.271**	0.049	-0.119	0.040	0.134	0.174	0.038	-0.229*	0.356**	-0.146
Plant height (cm)	G		1.000	0.802**	0.629**	-0.109	0.755**	0.825**	0.581**	-0.071	0.036	0.175	0.555**	0.055	0.772**
	P		1.000	0.752**	0.587**	-0.090	0.726**	0.760**	0.562**	-0.066	0.020	0.122	0.470**	0.069	0.698**
Number of branches per plant	G			1.000	0.796**	-0.125	0.896**	0.830**	0.815**	0.200	0.326**	-0.006	0.651**	-0.058	0.495**
	P			1.000	0.750**	-0.095	0.836**	0.751**	0.771**	0.180	0.272**	0.015	0.584**	-0.033	0.466**
Number of flowers per plant	G				1.000	-0.108	0.744**	0.632**	0.873**	0.263*	0.305**	-0.254*	0.410**	-0.333**	0.396**
	P				1.000	-0.071	0.703**	0.578**	0.824**	0.224*	0.259*	-0.205	0.367**	-0.288**	0.356**
Days to first fruit set	G					1.000	-0.077	-0.141	0.136	0.022	0.055	0.178	0.033	0.102	0.028
	P					1.000	-0.074	-0.140	0.116	-0.009	0.008	0.176	0.023	0.080	0.016
Fruit length (cm)	G						1.000	0.852**	0.788**	0.157	0.283**	-0.007	0.512**	0.126	0.447**
	P						1.000	0.804**	0.749**	0.161	0.234*	-0.011	0.425**	0.109	0.401**
Fruit diameter (cm)	G							1.000	0.607**	0.056	0.176	0.189	0.451**	0.143	0.580**
	P							1.000	0.565**	0.047	0.167	0.160	0.378**	0.111	0.505**
Number of fruits per plant	G								1.000	0.284**	0.389**	-0.120	0.500**	-0.129	0.339**
	P								1.000	0.251*	0.315**	-0.093	0.447**	-0.090	0.316**
Days to first fruits harvesting	G									1.000	0.886**	-0.225*	0.101	-0.066	-0.099
	P									1.000	0.771**	-0.194	0.081	-0.040	-0.093
Days to second fruit harvesting	G										1.000	-0.289**	0.008	0.025	-0.135
	P										1.000	-0.195	0.027	0.031	-0.113
Number of seeds per pod	G											1.000	0.083	0.359**	0.243*
	P											1.000	0.099	0.310**	0.201
Test weight	G												1.000	0.062	0.359**
	P												1.000	0.072	0.294**
Duration of crop	G													1.000	0.045
	P													1.000	0.035
Fruit yield per plant	G														1.000
	P														1.000

**, ** significant at 5% and 1% level, respectively*

Table 3. Path coefficient analysis at genotypic and phenotypic levels with fruit yield per plant in Okra

Characters		Days to first flower initiation	Plant height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
Days to first flower initiation	G	0.299	-0.255	-0.309	0.026	0.052	-0.045	-0.042	0.010	0.306	-0.469	0.000	0.197	0.046	-0.185
	P	0.0242	-0.1412	-0.0219	-0.0012	0.0239	-0.0155	-0.0148	-0.0019	0.0242	-0.0414	0.0025	0.0165	0.0007	-0.146
Plant height (cm)	G	-0.063	0.213	0.475	-0.100	-0.017	-0.308	0.873	0.361	-0.109	-0.068	-0.068	-0.423	0.006	0.772**
	P	-0.0044	0.7851	0.0917	0.0355	-0.0079	-0.2284	0.0943	-0.0263	-0.0118	-0.0048	0.0082	-0.0339	0.0001	0.698**
Number of branches per plant	G	-0.066	0.973	0.703	-0.759	-0.020	-0.259	0.224	0.506	0.308	-0.615	0.002	-0.497	-0.006	0.495**
	P	-0.0043	0.5906	0.1220	0.0454	-0.0084	-0.2631	0.0931	-0.0360	0.0323	-0.0646	0.0010	-0.0422	-0.0001	0.466**
Number of flowers per plant	G	-0.008	0.763	1.116	-0.954	-0.017	-0.796	0.170	0.542	0.406	-0.576	0.099	-0.313	-0.035	0.396**
	P	-0.0005	0.4611	0.0915	0.0605	-0.0062	-0.2213	0.0717	-0.0385	0.0404	-0.0616	-0.0137	-0.0265	-0.0006	0.356**
Days to first fruit set	G	0.098	-0.132	-0.176	0.103	0.159	0.083	-0.038	0.084	0.035	-0.104	-0.069	-0.025	0.011	0.028
	P	0.0066	-0.0705	-0.0116	-0.0043	0.0882	0.0234	-0.0174	-0.0054	-0.0016	-0.0018	0.0118	-0.0017	0.0002	0.016
Fruit length (cm)	G	0.012	0.916	0.258	-0.710	-0.012	-0.070	0.230	0.489	0.242	-0.533	0.003	-0.391	0.013	0.447**
	P	0.0012	0.5701	0.1020	0.0425	-0.0065	-0.3146	0.0996	-0.0350	0.0290	-0.0558	-0.0007	-0.0306	0.0002	0.401**
Fruit diameter (cm)	G	-0.046	0.801	0.864	-0.603	-0.022	-0.111	0.270	0.377	0.086	-0.332	-0.373	-0.344	0.015	0.580**
	P	-0.0029	0.5970	0.0916	0.0350	-0.0124	-0.2529	0.1240	-0.0264	0.0084	-0.0397	0.0107	-0.0273	0.0002	0.505**
Number of fruits per plant	G	0.005	0.705	0.744	-0.433	0.022	-0.843	0.164	0.621	0.437	-0.734	0.047	-0.382	-0.014	0.339**
	P	0.0010	0.4412	0.0940	0.0498	0.0102	-0.2356	0.0701	-0.0467	0.0452	-0.0749	-0.0062	-0.0322	-0.0002	0.316**
Days to first fruits harvesting	G	0.059	-0.086	0.281	-0.251	0.004	-0.168	0.015	0.176	0.541	-0.673	0.088	-0.077	-0.007	-0.099
	P	0.0033	-0.0515	0.0219	0.0136	-0.0008	-0.0506	0.0058	-0.0117	0.1800	-0.1836	-0.0130	-0.0059	-0.0001	-0.093
Days to second fruit harvesting	G	0.074	0.043	0.457	-0.291	0.009	-0.302	0.047	0.241	0.365	-0.887	0.112	-0.006	0.003	-0.135
	P	0.0042	0.0157	0.0331	0.0157	0.0007	-0.0737	0.0207	-0.0147	0.1388	-0.2380	-0.0131	-0.0020	0.0001	-0.113
Number of seeds per pod	G	0.000	0.212	-0.009	0.242	0.028	0.007	0.051	-0.075	-0.347	0.545	-0.388	-0.064	0.038	0.243*
	P	0.0009	0.0955	0.0019	-0.0124	0.0155	0.0034	0.0198	0.0043	-0.0349	0.0464	0.0670	-0.0071	0.0007	0.201
Test weight	G	-0.077	0.673	0.913	-0.391	0.005	-0.548	0.122	0.310	0.156	-0.015	-0.032	-0.763	0.007	0.359**
	P	-0.0056	0.3688	0.0713	0.0222	0.0020	-0.1337	0.0468	-0.0209	0.0146	-0.0065	0.0066	-0.0721	0.0002	0.294**
Duration of crop	G	0.131	0.067	-0.081	0.318	0.016	-0.135	0.039	-0.080	-0.101	-0.048	-0.139	-0.047	0.106	0.045
	P	0.0086	0.0542	-0.0040	-0.0175	0.0071	-0.0343	0.0138	0.0042	-0.0073	-0.0075	0.0208	-0.0052	0.0021	0.035

Genotypic Resi = 0.172
Phenotypic Resi = 0.452
**, ** significant at 5% and 1% level, respectively*

4. CONCLUSION

The conclusion was that fruit yield had a positive and substantial relationship with plant height, number of branches per plant, number of flowers per plant, fruit length, fruit diameter, number of fruits per plant, number of seeds per pod, test weight, duration of crop and days to first fruit set.

Path coefficient analysis exhibits high positive and direct effect on fruit yield per plant was recorded for number of branches per plant followed by number of fruits per plant, days to first fruit harvesting, days to first flower initiation, fruit diameter, plant height, days to first fruit set and duration of crop.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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