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Correlation coefficient and path analysis in okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
The present experiment was carried out entitled "Correlation coefficient and Path analysis in Okra [*Abelmoschus esculentus* (L.) Moench]" was conducted at Horticulture Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya- Vihar, Rae Bareli Road, Lucknow (U.P.) during the summer season from February 2017 to May 2017. The experiment was laid out in Randomized Block Design with three replications. The experimental materials consisting sixteen variable genotypes of okra *viz.* Pusa Sawni, Parbhani Kranti, IC-093724, Arka Abhay, IC-04484-B, VRO-4, VRO-5, IC-117263, VRO-6, Kashi Kranti, IC-128095, IC-117027, IC-033329, IC-117265, IC-042451and IC-090184. The maximum genotypic correlation coefficient and phenotypic correlation coefficient was observed for number of fruit per plant. The genotypic path coefficient revealed highest positive direct effect on fruit yield by plant height.

Keywords: Correlation coefficient and path analysis

Introduction

Okra or Lady's finger [(*Abelmoschus esculentus* (L.) Moench] belongs to family Malvaceae. Okra originated from tropical and sub-tropical Africa and is native to West Africa**.** The crop was introduced to other parts of the world by the Portuguese. India is considered as the secondary center of diversity with a possibility of polyphylectic origin. In India, okra is commercially grown in state of Gujarat, Maharashtra, Tamil Nadu, Haryana, Punjab, Uttar Pradesh, Odisha, Bihar, West Bengal, Andhra Pradesh and Karnataka as a kharif as well as summer season crop. India is now, the second largest producer of vegetables in the world with a total production of 175.01 million tonnes from 10.29 million hectare area and grown in 2.8% of total cultivated land which share 13.38% of world production with a productivity of 17.01 million tonnes. The per capita availability of vegetables in India is low i.e. 175 g/day as against 285 g per day as per the recommendation of Food and Agriculture Organization (FAO). The prediction indicates that there is a further need of 27.2 million tons of vegetables other than potato and tubers to meet the nutritional requirements of the growing population i.e. 1200 million people by the year 2020- 2021. In India, okra covers an area of 0.538 million hectare and production of 6.145 million tonnes**.** It is an annual herbaceous vegetable crop that is grown for its tender fruits often consumed as vegetable (Chattopadhyay *et al*., 2001) and other meal. The plant is a robust, erect, annual herb, ranging 1-2m in height, with simple leaves, which are alternate and palmately veined. It is generally amphidiploids in nature with 2n= 130 chromosomes. It is often cross-pollinated where the natural cross pollination occurs from 8.75 – 9.61%. Okra is highly susceptible to frost and requires warm climate for fruit production. It has various uses as vegetables, soups, gravies stews in meat, seeds as a substitute for coffee and has nutritional and medicinal value. Okra is rich in vitamins, calcium, potassium and other minerals. Fresh okra fruit contains 2.1 g protein, 0.2 g fat, 8 g carbohydrate, 36 calories, 1.7 g fiber, 175.2 mg minerals and 88 ml of water per 100 g of edible portion**.** Its edible leaf per 100 g contains about 81 ml water, 56 calories, 11 g carbohydrate and 4.4 g protein. Okra fruit is also useful in curing ulcers and suppressing the pains and effects of haemorrhoids. The mucilage has been used as a plasma replacement or blood volume expander.

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Materials and Methods

The present investigation was done at Horticulture Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya- Vihar, Rae Bareli Road, Lucknow (U.P.) during the summer season from February 2017- May 2017. The experiment was laid out in Randomized Block Design with three replications. Lucknow is characterized by sub-tropical climate with hot, dry summer and cold winter. The soil of experimental farm was saline with soil pH 8.2, Electrical conductivity 4.0 and sodium exchangeable percentage 15.0. During the period of experiment, meterological observation were recorded from Indian Institute of Sugarcane Research, Lucknow. The experimental materials consisting sixteen genotypes of okra i.e. Pusa Sawni, Parbhani Kranti, IC-093724, Arka Abhay, IC-04484-B, VRO-4, VRO-5, IC-117263, VRO-6, Kashi Kranti, IC-128095, IC-117027, IC-033329, IC-117265, IC-042451and IC-090184. Observation were recorded like number of leaves per plant, plant height (cm), stem diameter (cm), number days taking flowering, number of flowers per plant, number of days taken to 1st fruit formation, branches per plant, number of fruits per plant, number of fruits per branch, length of fruits (cm), fruit girth (cm), weight of fruits (g), yield per plot, yield per ha., acidity analysis, vitamin C (Ascorbic acid), fruit moisture content , fruit yield per plant were recorded.

Results and Discussion

Phenotypic and genotypic variation between fruit yield per plant and yield contributing traits were calculated. The details of numerical magnitude of correlation are given in Table 1.

The correlation coefficient at genotypic level are presented in (Table 1), it was observed that fruit yield per plant had positive significant correlation with fruit per plant (0.386) followed by fruit length (0.327). fruit moisture % show positive and significant correlation with fruit acidity (0.548) followed by days to first flowering (0.333) and vitamin-C positive and significant correlated with plant height (0.472).followed by flower per plant (0.334) fruit acidity However negatively and significant correlated with plant height (-0.397) followed by fruit per plant (-0.234) and fruit weight negatively and significant correlated with days to first fruit formation (-0.411) followed by branches per plant (-0.277).and fruit girth had positive significant correlation with stem diameter (0.476) followed by plant height (0.296) and fruit length had positive significant correlation with days to

first flowering (0.459) followed by leaves per plant (0.447) and fruit per plant had positive significant correlation with flower per plant (0.432) followed by fruit per branch (0.269). and fruit per branch positive significant correlation with branches per plant (0.336) followed by flower per plant (0.166).and branches per plant positive significant correlation with days to first fruit formation (0.420) followed by days to first flowering (0.377) and days to first fruit formation had positive significant correlation with leaves per plant (0.632) followed by flower per plant (0.221) and flower per plant positive and significant correlated with leaves per plant (0.714) followed by days to first flowering (0.010) and days to first flowering negatively and significant correlated with stem diameter (-0.268) followed by plant height (-0.016) and stem diameter negatively and significant correlated with plant height (-0.429) followed by leaves per plant (-0.213).

The phenotypic level are presented in (Table-2), it was observed that fruit yield per plant had positive significant correlation with fruit per plant (0.262) followed by leaves per plant (0.151) and fruit moisture % negatively and significant correlated with plant height (-0.348) followed by fruit weight (-0.159) and vitamin- C had positive significant correlation with plant height (0.315) followed by fruit per branch (0.291) and fruit acidity negatively and significant correlated with leaves per plant (-0.380) followed by fruit per plant (-0.233) and fruit weight had positive significant correlation with fruit length (0.116) followed by (0.101) and fruit girth negatively and significant correlated with fruit length (-0.425) followed by fruit per branch (-0.237) and fruit length had positive significant correlation with flower per plant (0.385) followed by fruit per plant (0.269) and fruits per plant had positive significant correlation with flower per plant (0.327) followed by branches per plant (0.236) and fruit per branch positive significant correlation with branches per plant (0.208) followed by plant height (0.143) and branches per plant positive significant correlation with flower per plant (0.314) followed by days to first flowering (0.214) and days to first fruit formation positive significant correlation with leaves per plant (0.216) followed by flowers per plant (0.049) and flowers per plant positive significant correlation with leaves per plant (0.167) followed by days to first flowering (0.134) and days to first flowering positive significant correlation with (0.074) followed by plant height (0.021) and stem diameter negatively and significant correlated with plant height (-0.177) followed by leaves per plant (-0.061).

Table 1: Genotypic (G) and Phenotypic (P) correlation coefficient for different pairs of characters in 16 parents of okra

Character	Symbol	Plant height (cm)	Stem diameter (cm)s	Days to first flowering	Flowers per plant	Days to first fruit formation	Branches per plant	Fruits per branch	Fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Fruit acidity	Vitamins C	Fruits moisture %	Frui yield per plant
Number of leaves per plant	G	-0.693	-0.213	0.268	0.714	0.632	0.260	0.095	0.172	0.447	-0.570	-0.125	-0.724	-0.093	0.050	0.493
	P	-0.212	-0.061	0.074	0.167	0.216	0.170	0.097	0.082	0.244	-0.141	-0.042	-0.380**	-0.030	-0.117	0.151
Plant height (cm)	G		-0.429	-0.016	-0.382	-0.010	-0.147	0.140	0.059	-0.601	0.296*	0.043	-0.397	0.472	-0.796	-0.044
	P		-0.177	0.021	-0.242	-0.156	0.004	0.143	-0.027	-0.275	0.105	-0.099	-0.072	0.315*	-0.348*	0.068
Stem diameter (cm)	G			-0.268	0.001	-0.213	0.147	0.000	-0.073	-0.008	0.476	0.164	0.084	-0.274	0.222	-0.799
	P			-0.113	-0.062	-0.154	-0.034	0.017	-0.105	-0.014	0.292*	0.101	0.103	-0.189	0.060	-0.445
Days to first flowering	G				0.010	0.113	0.377**	0.023	0.051	0.459	-0.155	0.129	0.002	-0.165	0.333*	-0.114
	P				0.134	0.019	0.214	-0.085	0.067	0.210	-0.084	0.014	-0.103	-0.121	-0.129	-0.045
Flowers per plant	G					0.221	0.621	0.166	0.432	0.586	-0.277	0.138	0.116	0.334*	0.385	0.092
	P					0.049	0.314*	0.119	0.327*	0.385**	-0.195	0.039	0.042	0.225	0.211	0.029*
Days to first fruit formation	G						0.420	-0.346	-0.152	-0.270	0.286	-0.411	-0.145	-0.616	-0.117	0.199
	P						0.145	-0.367*	-0.083	-0.266	0.109	-0.157	-0.147	-0.327*	-0.151	0.169
Branches per plant	G							0.336*	0.265	0.753	-0.272	-0.277	-0.068	-0.073	0.291*	0.367
	P							0.208	0.236	0.234	-0.138	-0.099	-0.124	-0.011	0.064	0.129
Fruits per branch	G								0.269	0.571	-0.572	-0.155	-0.102	0.389	-0.464	-0.139
	P								0.077	0.227	-0.237	-0.162	0.003	0.291*	-0.085	-0.052

Character	Type							
Fruits per plant	G	0.655	-0.252	0.457	-0.234	0.284	-0.066	0.386
	P	0.269	-0.109	0.312*	-0.233	0.231	-0.095	0.262
Fruit length (cm)	G		-0.936	0.233	0.072	0.168	0.695	0.327*
	P		-0.425**	0.116	-0.033	-0.032	0.324*	0.055
Fruit girth (cm)	G			-0.064	0.121	-0.138	-0.059	-0.409
	P			-0.004	0.098	-0.270	-0.021	-0.305*
Fruit weight (g)	G				0.104	-0.207	-0.299	0.037
	P				0.075	-0.243	-0.159	0.060
Fruit acidity	G					-0.311*	0.548	-0.406
	P					-0.167	0.216	-0.253
Vitamins C	G						-0.013	0.072
	P						0.042	0.003
Fruit moisture %	G							0.112
	P							-0.216

Table 2: Direct (Diagonal) and indirect effects of different traits contributing to yield in okra (Genotypic level)

Sl. No.	Characters	Number of leaves per plant	Plant height (cm)	Stem diameter (cm)	Days to first flowering	Flowers per plant	Days to first fruit formation	Branches per plant	Fruits per branch	Fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Fruit yield per plant (kg)	Fruit acidity	Moisture %
1.	Number of leaves per plant	-0.246	0.168	0.053	-0.066	-0.176	-0.155	-0.064	0.099	0.043	-0.109	0.14	0.03	0.178	-0.053	-0.013
2.	Plant height (cm)	-0.300	0.440	-0.189	-0.007	-0.168	-0.005	-0..065	-0.024	-0.026	-0.265	0.13	0.019	0.175	0.208	-0.35
3.	Stem diameter (cm)	0.038	0.077	-0.178	0.048	-0.001	0.038	-0.027	0.062	0.013	0.002	-0.085	-0.03	-0.015	0.049	-0.04
4.	Days to first flowering	-0.061	0.004	-0.001	-0.227	-0.003	-0.026	-0.086	0.000	-0.012	-0.103	0.036	-0.03	0.000	0.038	-0.076
5.	Flowers per plant	-0.155	0.083	0.011	-0.002	-0.217	-0.048	-0.135	-0.006	-0.094	-0.128	0.06	-0.03	-0.026	-0.073	-0.084
6.	Days to first fruit formation	-0.033	0.001	0.016	-0.006	-0.012	-0.052	-0.022	0.018	0.008	0.014	-0.015	0.022	0.008	0.032	0.007
7.	Branches per plant	0.028	-0.016	0.000	0.04	0.065	0.044	0.105	0.035	0.028	0.079	0.186	-0.029	-0.007	-0.008	0.031
8.	Fruits per branch	-0.031	-0.046	-0.028	-0.008	-.054	0.013	-109	-0.326	-0.088	-0.186	-0.029	0.051	0.033	-0.127	0.151
9.	Fruits per plant	0.066	0.023	0.001	0.011	0.166	-0.059	0.102	0.01	0.384	0.251	-0.097	0.175	0.09	0.109	-0.025
10.	Fruit length (cm)	-0.012	0.016	-0.016	-0.012	-0.015	0.007	-0.019	-0.014	-0.017	-0.025	0.024	-0.006	0.001	-0.005	-0.018
11.	Fruit girth (cm)	0.067	-0.035	0.056	0.018	0.033	-0.034	0.032	0.067	0.03	109	-0.117	0.008	0.014	0.016	0.007
12.	Fruit weight (g)	-0.041	0.014	0.054	0.042	0.045	-0.133	-0.089	-0.05	0.148	0.076	-0.02	0.324	0.034	-0.067	-0.097
13.	Fruit yield per plant (kg)	-0.513	-0.044	0.71	-0.114	0.092	0.199	0.367	-0.139	0.386	0.326	-0.409	0.037	-406	0.072	0.112
14	Fruit acidity	-0.039	0.151	0.012	-0.001	-0.044	0.056	0.026	0.039	0.09	-0.028	-0.047	-0.04	0.382	0.119	-0.209
15	Vitamins C	-0.058	-0.147	0.085	0.052	-0.104	0.192	0.023	-0.12	-0.089	-0.052	0.043	0.043	0.097	-0.31	0.004
16	Moisture %	0.095	-0.136	0.038	0.057	0.066	-0.02	0.05	-0.08	-0.012	0.119	-0.01	-0.051	0.094	-0.003	0.171

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