Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; Sp 9(5): 488-493
Received: 26-08-2020
Accepted: 13-10-2020

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Phenotypic and genotypic path coefficient analysis studies in okra (*Abelmoschus esculentus* (L) Moench)

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Abstract
The present investigation was undertaken during *Kharif*, 2019. Total 44 genotypes were grown in randomized block design with two replication at field of section Agricultural Botany, College of Agriculture, Badnapur, Dist-Jalna (VNMKV, Parbhani, M.S.) The phenotypic coefficients of variation were slightly higher than genotypic coefficients of variation which suggest the role of environment in governing these traits. Path coefficient analysis indicated that the characters *viz.* the average weight of fruit exhibited maximum direct effect on yield per plant followed by number of fruits per plant, plant height, fruit length, number of primary branches per plant, fruit width, number of nodes per plant and internodal length. While days to 50% flowering, and fruit yield per plant recorded negative direct effect at both phenotypic and genotypic level. It indicates that selection of desired germplasm for these traits may be worthwhile for improving fruit yield in future breeding programme.

Keywords: Phenotypic, genotypic, path coefficient analysis, okra

Introduction

Okra is an allopolyploid of tentative parentage (proposed parents include *Abelmoschus ficulneus*, *A. tuberculatus* and a reported "diploid" form of okra). The geographical source of okra is disputed, with supporters of South Asian, Ethiopian and West African origins. (Source: Wikipedia)

Okra is a warm-season crop called quiabo in Portuguese, quingombó in Spanish. It is initially from India and was cultivated by the Egyptians in the 12th century AD, and here in the US in the 18th century with the slave trade. It is also very admired in lots of parts of Brazil, among many other countries. Okra is an imperative part of the cuisine in Sothern US. *Frango com quiabo* (chicken with okra) is a Brazilian dish that is specially famous in the state of Minas Gerais, the state of origin of a very high percentage of Brazilians living in the US.

The mucilage in okra acts as a thicken agent in soups, such as gumbo, a popular soap in Cajun cuisines. The Hibiscus like flowers and upright plant give okra an ornamental importance.

Okra (*Abelmoschus esculentus*) or ladies finger is key vegetable of the tropical countries and most popular in India, Nigeria, Pakistan, Cameroon, Iraq and Ghana. While, it is practically not grown in Europe and North America, yet, lot of people in these countries have started love this vegetable because of high-quality amount of vitamin A and folic acid, also carbohydrates, phosphorus and magnesium (www.apeda.gov.in).

Okra [*Abelmoschus esculentus* (L.) Moench] typically denoted as Lady's finger belongs to the Malvaceae family and having a somatic chromosome number 2n=130 and is consider to be an amphidiploid. Okra being an often cross-pollinated crop, an important and widely cultivated, annual crop in both the tropical and sub-tropical provinces of the world.

The species is a perennial, often cultivated as an annual in moderate climates, and often grows to around 2 metres (6.6 ft) tall. As a part of the Malvaceae, it is related to such species as cotton, cocoa, and hibiscus. The leaves are 10-20 cm elongated and broad, palmately lobed with 5-7 lobes. The flowers are 4-8 cm in width, with five white to yellow petals, often with a red or purple spot at the base of each petal. The pollens are spherical with around 188 microns diameter.

It is preeminent germinate with a soil temperature of at least 20 C. The fruit is a capsule up to 18cm elongated with pentagonal cross-section, containing frequent seeds. *Abelmoschus esculentus* is cultivated all over the tropical and warm temperate regions of the world for its fibrous fruits or pods containing round, white seeds. It is along with the most heat- and drought tolerant vegetable species in the world and will stand for soils with heavy clay and intermittent moisture, but frost can injure the pods. In cultivation, the seeds are soaked overnight prior to planting to a depth of 1-2 cm.

Germination occurs between six days (soaked seeds) and three weeks. Seedlings need ample water. The seed pods quickly become fibrous and woody and, to be edible as a vegetable, must be harvested when not fully formed, usually within a week after pollination. Okra is obtainable in two varieties, green and red. Red okra carries the equivalent flavor as the other well-liked green okra and differs only in color. When cooked, the red okra pods go round green.

Their value is important especially in under urbanized and developing countries like India, where malnutrition abounds (Randhawa, 1974 and Masood Khan 2001 *et al*., along with the vegetable crops grown-up in India, okra (*Abelmoschus esculentus* L. Moench belongs to family *Malvaceae* and is an significant crop grown throughout the year. while okra finds its origin in South-Africa, India stands top in area and production.

The area under okra in India is 511 thousand ha and production is about 6219 thousand MT (IARI Topper 2018-19). Where, the area under okra crop in Maharashtra is 14.43 thousands ha and 148.09 thousands Mt production. The most important okra growing states includes Andhra Pradesh, Assam, Uttar Pradesh, Bihar, Orissa, West Bengal, Maharashtra and Karnataka.

In addition, it is developed in many tropical and subtropical parts of the world. The tender fruits are used as vegetables or in cookery preparations as sliced and dried pieces. It is moreover used for thickening gravies and soups, as of its high mucilage content. The roots and stems of okra are used for cleaning cane juice. Matured fruits and stems including crude fibre are used in paper industry.

It has superior nutritional value, mainly the high content of vitamin C (30 mg/100 g), calcium (90 mg/100g), iron (1.5 mg/100 g) and other minerals like magnesium and potassium, vitamin A and B, carbohydrates and fats.

According to USDA National Nutrient data base, dietary value per 100 g of okra contains carbohydrates (1.5%), protein (2.0 g), total fat (0.1 g), pantothenic acid (0.245 mg), dietary fiber (9%), folates (88mcg), niacin (1.00 mg), pyridoxine (0.215 mg), riboflavin (0.060 mg), vitamin C (21.1 mg), vitamin A (375 IU), vitamin E (0.36 mg), thiamin (0.200 mg), vitamin K (53 mcg), sodium (8 mg), potassium (303 mg), calcium (81 mg), zinc (0.60 mg), copper (0.094 mg), iron (0.80 mg), magnesium (57 mg), phosphorus (63 mg), selenium (0.7 mcg), carotene (225 mcg) and lutein zeaxanthin (516 mcg) (source: USDA National Nutrient data base).

It is a vegetable rich in organic and inorganic nutrients similar to vitamins and mineral salts, including calcium; which are often absent in diet, additional containing 86.1% water, 2.2 % protein, 9.7% carbohydrate, 0.2% fat, 1.0% fiber and 0.8% ash. The fruits of okra, typically called "pod" which have digestible fiber, low calories and fat-free contents and extreme as salads, boiled and fried vegetables further the fruits are use for soups and stews thickening due to its mucilaginous and tender texture nature.

Okra grown all over the India, it poses a wide range of variability and number of different forms existing all over the country. In Maharashtra there are a number of local types and superior varieties & hybrid commercially grown in different parts.

The superior types which are commonly grown are Parbhani Kranti, Pusa Sawani, Pusa Makhmali, Arka Anamika, Akola Bahar etc., while local types are also grown because consumer preference have been modified to certain localities in the region. This suggests that there lies a huge possibility for the improvement of this crop throughout application of knowledge of genetics and plant breeding.

Genetic diversity with parents, which is heritable, is a must for any successful breeding programme. The appropriate choice of the parents in the breeding programme is of principal value. Generally plant breeder selects the parents on the basis of phenotypic divergence, but designed for effective breeding, the genetic diversity is prerequisite for any successful breeding program.

The information of genetic diversity of a species has an importance on the development of crop productivity as well as the maintenance of genetic resources. In recent years additional concentration has given to the genetic analysis of diverse genotypes, which are predominantly attractive for association analysis of quantitative character such as disease resistance or any other individual quality characters.

Materials and Methods

The present investigation was undertaken during *Kharif*, 2019. Total 44 genotypes were grown in randomized block design with two replication at field of section Agricultural Botany, College of Agriculture, Badnapur, Dist.-Jalna (VNMKV, Parbhani, M.S.). The details of material and methods used for this investigation are given below.

Materials

Experimental field

The field experiment was conducted on the field of Section of Agricultural Botany, College of Agriculture, Badnapur. Experimental material comprising 44 germplasm lines (Including checks) with wider variability for different characters. Out of 44, 40 genotypes received from NBPGR Akola, 2 from PDKV Akola and 2 from Vegetable Research Station VNMKV, Parbhani. Grown in randomized block design with two replication at field of section Agricultural Botany, College of Agriculture, Badnapur. The genotypes used for study are mentioned in following table 1. Recommended agronomic package of were practices followed as per the requirement of crop. Plant protection measures were taken as per requirement. The details of material given below,

Table 1: List of okra germplasm lines and checks

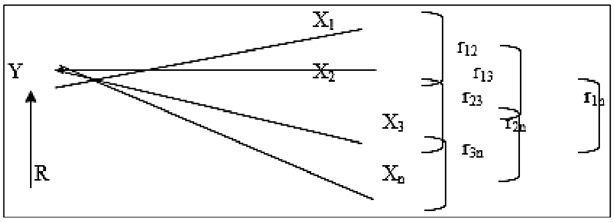
Sr. No.	Genotype	Sr. No.	Genotype	Sr. No.	Genotype
1.	IC 013356	16.	IC 090515	31.	EC 359657
2.	IC 009856	17.	IC 103911	32.	EC 359954
3.	IC 003304	18.	IC 111544	33.	EC 306703
4.	IC 015036	19.	IC 140984	34.	EC 305740
5.	IC 013664	20.	IC 141949	35.	EC 305731
6.	IC 004398	21.	EC 359969	36.	EC 306696
7.	IC 015540	22.	EC 305731	37.	EC 305769
8.	IC 014026	23.	EC 306697	38.	EC 305609
9.	IC 433641	24.	EC 305768	39.	EC 360001
10.	IC 013999	25.	EC 305736	40.	EC 305718
11.	IC 001543	26.	EC 306700	41.	Parbhani Kranti
12.	IC 02934	27.	EC 359995	42.	Parbhani Ok-1
13.	IC 009885	28.	EC 305745	43.	Akola Bahar
14.	IC 014600	29.	EC 305741	44.	PDKV Pragati
15.	IC 090491	30.	EC 359939		

Method of analysis

Path coefficient analysis

To establish a cause and effect relationship the first step used was to partition genotypic and phenotypic correlation coefficient into direct and indirect effects by path analysis as suggested by Dewey and Lu (1959) and developed by Wright (1921) [5].

The second step in path analysis is to prepare path diagram based on cause and effect relationship. In the present study, path diagram was prepared by taking yield as the effect i.e. function of various components like X_1, X_2, X_3 and these component showed following type of association with each other.



In path diagram the yield is the result of X_1, X_2, X_3 ……..Xn and some other undefined factors designated by R. The double arrow lines indicated mutual association as measured by correlation coefficient. The single arrow represents direct influence as measured by path coefficient P_{ij}.

Path coefficients were obtained by solving a set of simultaneous equation of the form as per Dewey and Lu (1959).

$r_{ny} = P_{ny} + r_{n2} P_{2y} + r_{n3}P_{3y} + \ldots\ldots\ldots\ldots\ldots$

Where,

r_{ny} = represents the correlation between one component and yield

P_{ny} = represents path coefficient between that character and yield

r_{n2} = represents correlation between that character and each of the other components in turn.

Matrix A Matrix B

$$\begin{pmatrix} r_{1y} \\ r_{2y} \\ r_{ny} \end{pmatrix} = \begin{pmatrix} r_{11} & r_{12} & r_{13} \ldots\ldots\ldots\ldots r_{1n} \\ r_{21} & r_{22} & r_{23} \ldots\ldots\ldots\ldots r_{2n} \\ r_{n1} & r_{n2} & r_{n3} \ldots\ldots\ldots\ldots 1 \end{pmatrix} \begin{pmatrix} P_{1y} \\ P_{2y} \\ P_{ny} \end{pmatrix}$$

Where,

$r_{12} = r_{21}$ and so on

r_{1y}= Correlation between one component character and seed yield

The 'B' matrix was inverted $[B]^{-1}$ and path coefficients (Pij) were obtained as, i.e.

$Pij = (B)^{-1}.A$

The indirect effects of a particular character through other characters were obtained by multiplication of direct paths and particular correlation between these characters separately.

Indirect effects = $r_{ij} \times p_{iy}$

Where,

i = 1 to 9

j = 1 to 9

$P_{iy} = P_{1y}, P_{2y}, \ldots\ldots\ldots\ldots\ldots\ldots\ldots, P_{ny}$

Path coefficient (P_{ij}), correlation coefficient (r_{ij}) and residual factors (R) were diagrammatically presented. The residual factor i.e. variation in yield unaccounted for by these associations was calculated with the following formula:

Residual factor (R) = $(1-R^2)$

Where,

$R^2 = P_{1y}\, r_{1y} + P_{2y}\, r_{2y} + \ldots\ldots\ldots\ldots\ldots\ldots + P_{ny}r_{ny}$

$P_{1y}, P_{2y}, \ldots\ldots\ldots\ldots\ldots, P_{ny}$ = Direct path values

r_{1y}, r_{2y}, r_{ny} = Correlation coefficient.

Review of Literature

Thulasiram *et al.* (2017) [5] evaluated thirty genotypes belonging to okra (*Abelmoschus esculentus*) were utilized, to work out the correlation and path coefficient. The genotypic and phenotypic correlation indicated that yield per plant was significantly associated with plant height, number of leaves per plant, number of lobes per leaves, number of primary branches per plant, number of nodes per plant and number of fruits per plant. Results obtained for path coefficient analysis at genotypic level revealed that the character plant height showed positive direct effect on yield per plant.

Pithiya *et al.* (2017) [3] evaluated twenty-eight germplasm lines of okra (*Abelmoschus esculentus* (L.) Moench) in a randomized block design with three replications. Correlation and path coefficient analysis were carried out to study the character association and contribution, respectively; the genotypes were evaluated for the seventeen characters. Plant height and 100-seed weight showed positive and significant correlation with yield per hectare. Stem diameter showed negative and significant correlation with number of leaves per plant, fruit length and plant height with 100-seed weight and seed yield per plant. Path coefficient analysis on various yield contributing characters revealed that number of fruits per plant, number of seeds per fruit, plant height, fruit length, 100-seed weight and number of branches showed direct positive effect towards yield.

Mohammad *et al.* (2017) [2] evaluated twenty-three genotypes of okra in completely randomized block design with three replications for correlation and path coefficient analysis 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. 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.

Mishra *et al.* (2018) [1] studied on direct and indirect effects of thirteen different quantitative characters of okra had revealed the presence of very high direct positive effect of days to first flowering on yield per plant. The traits *viz.*, plant height, nodes per plant, fruit weight, number of fruits per plant, nodes at which first flower appeared and duration of fruiting were identified as the important yield determinants through path co-efficient analysis and these traits could be relied upon for selection of high yielding genotypes in okra. The indirect effect of days to first flowering, duration of fruiting, fruit weight, nodes per plant and plant height were also found to be positive, indicating their importance in exercising selection.

Result & Discussion

Phenotypic and Genotypic path coefficient analysis

To find out the direct and indirect contribution from each of the character towards fruit yield per plant, path coefficient analysis was carried out. The phenotypic and genotypic correlation coefficients being more important are only partitioned to direct and indirect effects which are presented in Table 3 (A) and 3 (B). Phenotypic and genotypic path diagrams are given in figure 6 and 7, respectively.

Direct effect

Among all the components, fruit weight exhibited the highest direct effect (p=0.6766) on fruit yield followed by number of fruit per plant (p=0.3193), plant height (p=0.2547), fruit length (p=0.1970), number of primary branches per plant (p=0.1605), fruit width (p=0.1123), number of nodes per plant (p=0.0465), internodal length (p=0.0319), while days to 50% flowering (p=-0.1790) recorded negative direct effect at phenotypic level.

At genotypic level fruit weight exhibited the highest direct effect (g=0.7000) on fruit yield followed by number of fruit per plant (g=0.3176), plant height (g=0.2713), fruit length (g=0.1942), number of primary branches per plant (g=0.1918), fruit width (g=0.1089), number of nodes per plant (g=0.0550) and internodal length (g=0.0251), while days to 50% flowering (g=-0.2123) recorded negative direct effect at genotypic level.

Indirect effect

1. Days to 50% flowering

Days to 50% flowering had shows negative phenotypic and genotypic correlation (p=-0.1520; g=-0.1795) with fruit yield per plant. It exhibited positive indirect effects through fruit length (p=0.0181; g=0.0244) followed by number of fruits per plant (p=0.0141; g=0.0168), internodal length (p=0.0027; g=0.0053), and negative indirect effect through plant height (p=-0.0005;g=-0.0053), number of primary branches (p=-0.0071; g=-0.0067), fruit weight (p= -0.0099; g=-0.0130), number of nodes per plant (p=-0.0140; g=-0.0189) and fruit width (p=-0.0393; g=-0.0495) at both phenotypic and genotypic level. Thus these indirect causal factors are to be considered during selection process for improving seed yield per plant.

2. Number of primary branches per plant

Number of primary branches had positive phenotypic and genotypic correlation (p=0.1951; g=0.2228) with fruits yield per plant. It exhibited positive indirect effects through fruit width (p=0.0361; g=0.0455) followed by internodal length (p=0.0155; g=0.0211), number of fruits per plant (p=0.0155; g=0.0198), fruit weight (p=0.0110; g=0.0133), days to 50% flowering (p=0.0063; g=0.0060) and negative indirect effect through plant height (p=-0.0365; g=-0.0451), number of nodes per plant (p=-0.0150; g=-0.0182) followed by fruit length (p=-0.0013; g=-0.0033) at both phenotypic and genotypic level in the decreasing order of their magnitude.

3. Fruit length

Fruit length showed positive direct phenotypic and genotypic correlation (p=0.1139; g=0.1124) with fruit yield per plant. It has positive indirect effect *via* number of fruits per plant (p=0.0090;g=0.0087), fruit weight (p=0.0052;g=0.0044) and negative indirect effect through number of primary branches per plant (p=-0.0016;g=-0.0034), number of nodes per plant (p=-0.0156;g=-0.0149), days to 50% flowering (p=-0.0194;g=-0.0224), internodal length (p=-0.0443;g=-0.0453), plant height (p=-0.0563;g=-0.0554) and fruit width (p=-0.0851;g=-0.0848).

4. Fruit width

Fruit width had positive phenotypic and genotypic correlation (p=0.2197; g=0.2316) with fruit yield per plant. It showed positive indirect effects at both phenotypic and genotypic level through fruit weight (p=0.0385; g=0.0377), number of primary branches per plant (p=0.0252; g=0.0258), days to 50% flowering (p=0.0247; g=0.0254), number of nodes per plant (p=0.0196;g=0.0193), plant height (p=0.0112;g=0.0109) and It showed negative indirect effects at phenotypic and genotypic level through internodal length (p=-0.0078; g=-0.0079), number of fruit per plant (p=-0.0238; g=- 0.0227), and fruit length (p=-0.0485; g=-0.0475).

5. Fruit weight

Fruit weight had positive phenotypic and genotypic correlation (p=0.5316; g=0.5500) with fruit yield per plant. It showed positive indirect effects through fruit width (p=0.2319;g=0.2435), number of primary branches per plant (p=0.0464;g=0.0487), days to 50% flowering (p=0.0372;g=0.0428), fruit length (p=0.0178;g=0.0178). It showed negative indirect effect through number of nodes per plant (p=-0.0615; g=-0.0638), plant height (p=-0.0763;g=-0.0792), Internodal length (p=-0.1328;g=-0.1395) and number of fruits per plant (p=-0.3193; g=-0.3358) at both phenotypic and genotypic level.

6. Number of fruits per plant

Number of fruits per plant had positive phenotypic and genotypic correlation (p=0.1066; g=0.1060) with fruit yield per plant. It displayed positive indirect effect through plant height (p=0.1052;g=0.1063), number of nodes per plant (p=0.0705;g=0.0730), number of primary branches per plant (p=0.0308;g=0.0328), fruit length (p=0.0147;g=0.0143). It showed negative indirect effect through internodal length (p=-0.0244; g=-0.0244), days to 50% flowering (p=-0.0252;g=-0.0252), fruit width (p=-0.0675;g=-0.0662) and fruit weight (p=-0.1507; g=-0.1523) at both phenotypic and genotypic level.

7. Number of nodes per plant

Number of nodes per plant had positive phenotypic and genotypic correlation (p=0.0960; g=0.1034) with fruit yield per plant. It exhibited positive indirect effects through plant height (p=0.0132; g=0.0157) followed by number of fruits per plant (p=0.0103; g=0.0126), fruit width (p=0.0081; g=0.0097), days to 50% flowering (p=0.0036; g=0.0049) and negative indirect effect through fruit length (p=-0.0037; g=-0.0042), fruit weight (p=-0.0042; g=-0.0050) followed by number of primary branches per plant (p=-0.0043; g=-0.0052) and internodal length (p=-0.0097;g=-0.0119) at both phenotypic and genotypic level in the decreasing order of their magnitude.

8. Internodal length

Internodal length had shows negative phenotypic and genotypic correlation (p=-0.1867; g=-0.1966) with fruit yield per plant. It showed positive indirect effect through number of primary branches per plant (p=0.031; g=0.0028) at both phenotypic and genotypic level. It showed negative indirect effect through days to 50% flowering (p=-0.0005; g=-0.0006), plant height and fruit width shows same (p=-0.0022; g=-0.00183), number of fruits per plant (p=-0.0024; g=-0.0019), fruit weight (p=-0.0063; g=-0.0050), number of nodes per plant (p=-0.0066; g=-0.0054) and fruit length (p=-0.0072;g=-0.0058) both at phenotypic and genotypic level.

9. Plant height

Plant height had positive phenotypic and genotypic correlation (p=0.2124; g=0.2213) with fruit yield per plant. It exhibited positive indirect effect through number of fruits per plant (p=0.0839; g= 0.0908), number of nodes per plant (p=0.0721; g=0.0774), fruit width (p=0.0253; g=0.0272), days to 50% flowering (p=0.0007; g=0.0018). It showed negative indirect effect through internodal length (p=-0.0178; g=-0.0192), fruit weight (p=-0.0287; g=-0.0307), number of primary branches per plant (p=-0.0579; g=-0.0638) and fruit length (p=-0.0728; g=-0.0774) at phenotypic and genotypic level.

Table 2(A): Direct and indirect effect of yield and its component characters on fruit yield (g) at phenotypic level in okra

Sr. No.	Characters	Days to 50 % flowering	Number of primary branches/plant	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Number of fruits/plant	Number of nodes/plant	Inter nodal length (cm)	Plant height (cm)	Fruit yield/ plant (g)
1.	Days to 50% flowering	-0.1790	-0.0071	0.0181	-0.0393	-0.0099	0.0141	-0.0140	0.0027	-0.0005	0.1520
2.	No. of Primary branches/plant	0.0063	0.1605	-0.0013	0.0361	0.0110	0.0155	-0.0150	0.0155	-0.0365	0.1951
3.	Fruit Length (cm)	-0.0199	-0.0016	0.1970	-0.0851	0.0052	0.0090	-0.0156	-0.0443	-0.0563	0.1139
4.	Fruit Width(cm)	0.0247	0.0252	-0.0485	0.1123	0.0385	-0.0238	0.0196	-0.0078	0.0112	0.2197
5.	Fruit Weight(g)	0.0372	0.0464	0.0178	0.2319	0.6766	-0.3193	-0.0615	-0.1328	-0.0763	0.5316
6.	Number of fruit per Plant	-0.0252	0.0308	0.0147	-0.0675	-0.1507	0.3193	0.0705	-0.0244	0.1052	0.1066
7.	Number of nodes per plant	0.0036	-0.0043	-0.0037	0.0081	-0.0042	0.0103	0.0465	-0.0097	0.0132	0.0960
8.	Internodal length(cm)	-0.0005	0.0031	-0.0072	-0.0022	-0.0063	-0.0024	-0.0066	0.0319	-0.0022	0.1867
9.	Plant height(cm)	0.0007	-0.0579	-0.0728	0.0253	-0.0287	0.0839	0.0721	-0.0178	0.2547	0.2124

R square = 0.5520 residual effect = 0.6694, Underlined figures indicate direct effect.
*, **indicates significant at 5 and 1% level of significant respectively.

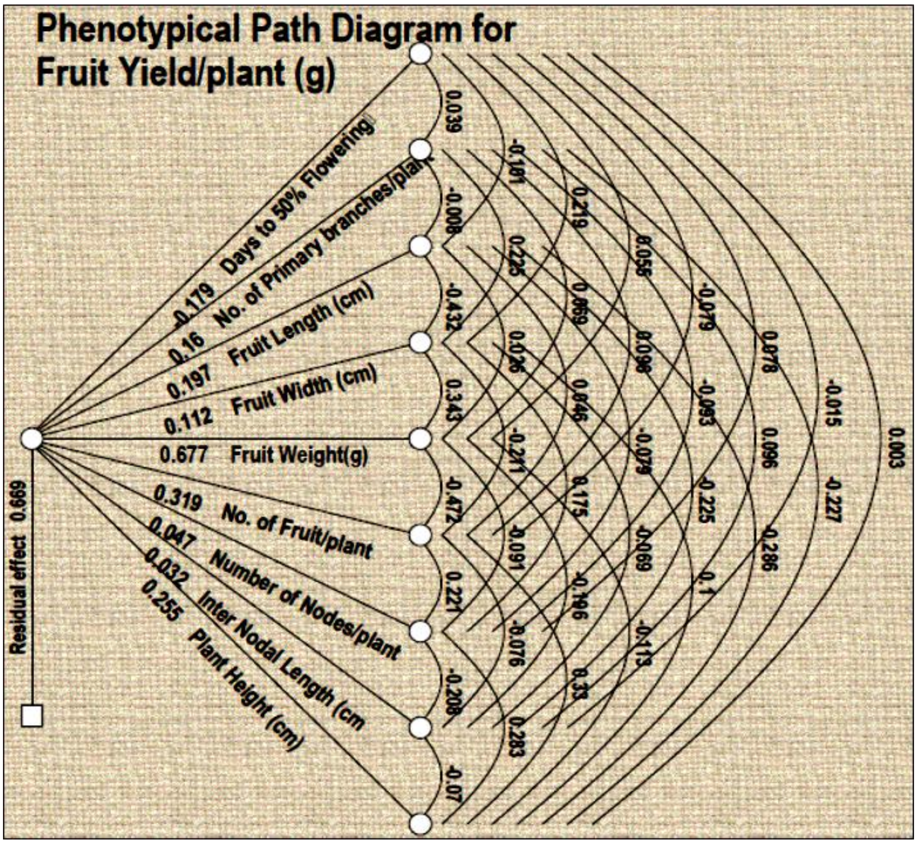


Fig 1: Diagram showing the phenotypic path correlation of yield and its component characters of okra

Table 2(B): Direct and indirect effect of yield and its component characters on fruit yield at genotypic level

Sr. No.	Characters	Days to 50% flowering	Number of primary branches/plant	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Number of fruits/plant	Number of nodes/plant	Inter nodal length (cm)	Plant height (cm)	Fruit yield/ plant (g)
1.	Days to 50% flowering	-0.212	-0.0067	0.0244	-0.0495	-0.0130	0.0168	-0.0189	0.0053	-0.0014	-0.1795
2.	No. of Primary branches/plant	0.0060	0.1918	-0.0033	0.0455	0.0133	0.0198	-0.0182	0.0211	-0.0451	0.2228
3.	Fruit Length (cm)	-0.0224	-0.0034	0.1942	-0.0848	0.0049	0.0087	-0.0149	-0.0453	-0.0554	0.1124
4.	Fruit Width(cm)	0.0254	0.0258	-0.0475	0.1089	0.0377	-0.0227	0.0193	-0.0079	0.0109	0.2316
5.	Fruit Weight(g)	0.0428	0.0487	0.0178	0.2425	0.7000	-0.3358	-0.0638	-0.1395	-0.0792	0.5500
6.	Number of fruit per Plant	-0.0252	0.0328	0.0143	-0.0662	-0.1523	0.3176	0.0730	-0.0244	0.1063	0.1060
7.	Number of nodes per plant	0.0049	-0.0052	-0.0042	0.0097	-0.0050	0.0126	0.0550	-0.0119	0.0157	0.1034
8.	Internodal length (cm)	-0.0006	0.0028	-0.0058	-0.0018	-0.0050	-0.0019	-0.0054	0.0251	-0.0018	-0.1966
9.	Plant height(cm)	0.0018	-0.0638	-0.0774	0.0272	-0.0307	0.0908	0.0774	-0.0192	0.2713	0.2213

R square = 0.6074 residual effect = 0.6266 Underlined figures indicate direct effect.
*, ** indicates significant at 5 and 1% level of significant respectively

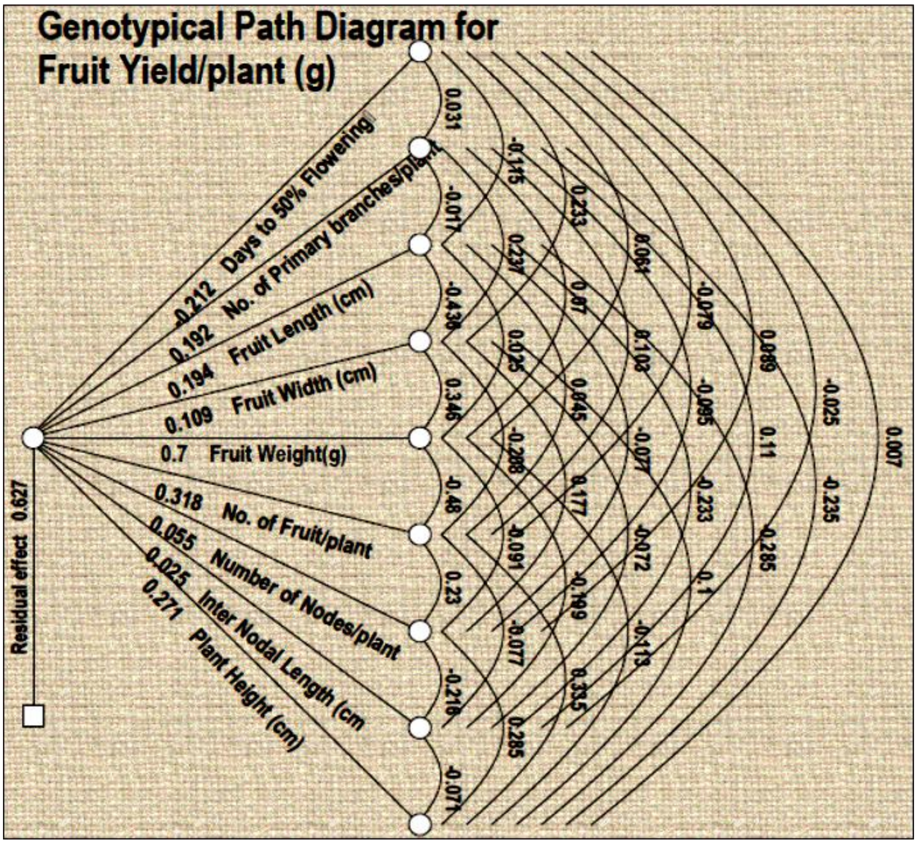


Fig 2: Diagram showing the genotypic path correlation of yield and its component characters of okra

Conclusion

Path coefficient analysis indicated that the characters *viz.* the average weight of fruit exhibited maximum direct effect on yield per plant followed by number of fruits per plant, plant height, fruit length, number of primary branches per plant, fruit width, number of nodes per plant and internodal length. While days to 50% flowering, and fruit yield per plant recorded negative direct effect at both phenotypic and genotypic level. Hence, the selection of genotypes based on these characters as selection criterion would be helpful in improving the fruit yield potential of okra.

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