Estimation of Correlation and Path Coefficient Analysis forQuantitativeCharactersinokra*(Abelmoschusesculentus*L.Moench) Genotypes

Abstract

The purpose of the present study was to evaluate the genetic variability and parameters suchasgenotypiccoefficientofvariation(GCV),phenotypiccoefficientofvariation(PCV),heritability, genetic advance, as well as perform correlation and path analyses on 20 different okragenotypes, including one check variety. The experiment was conducted during the kharif season of2022attheexperimentalfarmoftheDepartmentofGeneticsandPlantBreeding,NainiAgricultural Institute, Sam Higginbottom University of Agriculture, Technologyand Sciences inPrayagraj, Uttar Pradesh. A randomized block design with three replications was employed for thestudy. Thirteen characteristics were observed and recorded, which includes: days to first flowering,days to 50% flowering, length of mature fruit (cm), diameter of fruit (cm), average fruit weight(gm), internodal length (cm), number of nodes on the main stem, number of primary branches,plant height (cm), number of fruits per plant, number of seeds per fruit, seed index (gm), and fruityield per plant (gm). Azad Bhindi-1 exhibited the highest mean performance in terms of fruit yieldper plantamong all the genotypes. The PCV values were consistently higherthan the corresponding GCV values for all traits, indicating the influence of environmental factorson trait expression. Fruit yield per plant and number of primary branches displayed the highestGCVandPCVvalues.Thenumberofprimarybranchesexhibitedbothhighheritabilityandgenetic advance. The correlation analysis revealed a positive and significant association betweennumber of fruits per plant and fruit yield per plant at both the genotypic and phenotypic levels. Thetraits with the highest positive direct effects on fruit yield per plant wereobsereved for averagefruit weight and plant height, as determined through genotypic and phenotypic path analysis. Theseidentifiedtraitscanserveaseffectiveselectioncriteriaforstrategizinganefficientbreedingprogram meto enhancefruityield in okra.

Keywords:okra,phenotypic,genotypic, correlation,heritability.

INTRODUCTION

Okra, scientifically named (*Abelmoschus esculentus* .L Moench) is a member of the Malvaceaefamily and is commonly referred to as Lady's finger or bhindi. It has a somatic chromosomal numberof2n=130.Okraiswidelycultivatedinvariousregionsoftheworld,includingtemperate,subtropical and tropical areas (Verma and Singh, 2020). Okra is primarily a self-pollinated crop,butithasbeenobservedthatinsect-mediatedoutcrossingoccurstosomedegree,rangingfrom4to 19percent(Choudhury and AnothaiChoomsai, 1970).Thisoutcrossingcontributestotheemergenceofsignificantgenetic diversity in the crop. It is a day-neutral plant, cultivated as an annual cropthroughout the year in various regions of the country, primarily for its delectable and tender pods(Balai *et al.*, 2015). The origins of okra are subjected to debate, with proponents suggesting its rootsin South Asia, Ethiopiaand Africa. However, it is believed that okra originated in the Ethiopianregion(DeCandolle, (1883)Loskutov, (2020)

In world, India is the second largest producer of okra after china. In India, major okra growing states are Gujarat,Maharashtra, Uttar Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu, Punjab *etc.* At national levelduring 2020-21, okra was grown in 531 ha area with 6466 tonnes of production with averageproductivity of12.24qt/ha.InthestateofUtterPradesh,itwasgrownin24.19haareawith325.59tonnesofproductionwithaverageproductivityof11.30qt/ha. After being cooked, okra fruits are commonlyutilizedincurriesandsoups.ThesefruitsareabundantinessentialnutrientssuchasvitaminAandC, riboflavin, as well as minerals like calcium, phosphorus, iodine, iron, and potassium. Verma and Singh,(2020).Freshokraishighlynutritious,withacompositionthatincludes86.1percentwater, 0.2 percent fat, 9.7 percent carbohydrates, 2.2 percent protein, 1.0 percent fiber, and 0.8 percent ash(Saifullah and Rabbani(2009). Additionally, it is a rich source of vitamin C (30 mg/100 g), calcium(90mg/100g),and iron(1.5 mg/100g) (Pal *etal*., (1952).

Thecorrelationandpathcoefficientanalysesareessentialtoolsforselectingsuperiorgenotypes and improving various traits. In the field of plant breeding, correlation analysis plays avital role by providing insights into the relationships among yield components. This information aidsintheidentificationand selectionof superiorgenotypesfrom diverse geneticpopulations.

Path coefficient analysis permits the separation of correlation coefficient into direct and indirecteffects. It is basically a standardized partial regression analysis and deals with a closed system ofvariablesthatarelinearlyrelated.Suchinformationprovidesarealisticbasisforallocationofappropriate weightagetovariousyield components.

1.1Objectives

Thecurrent studyaimsto achievethefollowingobjectives:

1. Toassessgeneticvariabilitypresentinokragenotypes.
2. Toestimatesthecorrelationcoefficientforfruityieldanditscontributingtraits.
3. Todeterminedirectandindirecteffecteffectsofyieldcontributingcharactersonfruityield.

2. MATERIALSANDMETHODS

The genetic materialused in this study consisted of 20 different genotypes of okra(*Abelmoschus esculentus* L. Moench). The experiment was conducted at the ExperimentalFarm of the Department of Genetics and Plant Breeding, Naini Agricultural Institute, SamHigginbottom University of Agriculture, Technologyand Sciences, located in Prayagraj,Uttar Pradesh. The genotypes were planted using a randomized blockdesign with threereplications.Therow-to-rowdistancewasmaintainedat30cm,whiletheplant-to-plantdistance was set at 20cm. Data were recorded on thirteen quantitative traits *viz.*,Days to firstflowering, Days to 50% flowering, length of mature fruit(cm), diameter of fruit(cm), averagefruitweight(gm),internodallength(cm),numberofnodesperplant,numberofprimarybranches,plantheight(cm),numberoffruitsperplant,numberofseedsperfruit,seedindex(g), fruit yield per plant(gm) (Table 1). The experimental material under studywere collected from the Indian Institute of Vegetable Research (IIVR) in Varanasi. The studywascarried outduringthe*Kharif*seasonof 2022.

The Panse and Sukhatme (1967) method were used to analyse the variance in all of therecorded data for the characters under consideration. Additionally, the genetic parametersgenotypiccoefficientofvariation(GCV),phenotypiccoefficientofvariation(PCV),heritability in the broad sense, genetic advance as percent of mean and correlation analysiswere carried out by using the statistical methods. The additional components of varianceincludephenotypic variance,genotypic varianceandenvironmentalvariance.

The Softwarecalled“R–Language”wasusedtoperformtheanalysesmentionedabove.

Table1. Details of okra genotypes under study

The details of the experimental material was mentioned belowin table1.

SL.NO	Names of genotypes	SL.NO	Names of genotypes
01	KashiLalima	**11**	AZADBHINDI-2
02	HRB-55	**12**	PUNJAB-8
03	VRO-4	**13**	GO-3
04	SB-6	**14**	HRB-231
05	EMS-8-1	**15**	KASHIPRAGATI
06	IIVR-11	**16**	PUNJAB-7
07	BO-13	**17**	UTTAKALGAURAV
08	AZADBHINDI-1	**18**	NO-55
09	ARKAANAMIKA	**19**	PUNJABSUHAVANI
10	ARKAABHAY	**20**	KASHICHAMAN(check)

Source:IndianInsituteofVegetableResearch,Varanasi,(IIVR).

Table2.AnalysisofVariance(ANOVA)Among20OkraGenotypesfor13QuantitativeTraits

Sl. No.	Source	MeanSumofSquares(MSS)		
		Replications	Treatments	Error
	Degreesoffreedom	**2**	**19**	**38**
1	Daystofirstflowering	2.62	20.56**	1.37
2	Daysto50%flowering	0.82	26.38**	1.55
3	LengthofMaturefruit(cm)	1.94	4.44**	1.56
4	Diameteroffruit(cm)	0.02	0.05**	0.01
5	Inter nodallength(cm)	0.08	0.66**	0.21
6	Numberofprimarybranches	0.02	0.41**	0.01
7	Averagefruitweight(gm)	10.64	16.76**	5
8	Numberoffruitsperplant	1.49	8.53**	0.75
9	Number ofnodes onmainstem	1.99	10.04**	1.00
10	Plantheight(cm)	78.63	482.75**	28.16
11	Numberofseedsperfruit	48.64	72.49**	16.49
12	Seedindex(gm)	0.001	0.44**	0.18
13	Fruityieldperplant(gm)	1191.84	6364.03**	1192.76

****1%levelofSignificance.**

3.RESULTSANDDISCUSSION

3.1Analysisofvariance

Table 2 presents the mean sum of squares values for the 13 biometrical traits. The resultsindicate significant differences among the genotypes for all traits. Maximum mean sum ofsquares values were observed for fruit yield per plant and plant height at 1% significance. This suggests that there is a wide range of variation within the genepool, providing ample scope for selecting promising lines with high yield and desirablecomponent traits. Among the 20 okra genotypes evaluated, Azad Bhindi-1 (287.0), GO-3(269.2), and Arka Anamika (237.3) exhibited the highest meanperformance for fruityieldperplant.

Chart 1 :MEAN PERFORMECE OF GENOTYPES WITH RESPECT TO 13 CHARACTERS

Sl.No.	Genotypes	Days tofirstflowering	Days to50% flowering	Length ofmature fruit(cm)	Diameteroffruit(cm)	Internodallength(cm)	No. ofprimarybranches	Averagefruitweight(gm)	Numberoffruitsper	Numberofnodesonmainstem	Plant height(cm)	Number ofseedsperfruit	Seed index(gm)	Fruit yieldperplant(gm)
1	KashiLalima	41.0	43.3	12.5	1.7	5.1	1.4	12.9	8.7	14.5	87.2	49.3	4.6	134.9
2	HRB-55	41.7	43.0	12.5	1.7	4.0	1.6	16.3	10.3	16.9	77.5	49.4	4.9	155.3
3	VRO-4	39.0	42.7	13.9	1.5	4.8	1.5	15.1	9.9	16.3	95.6	53.5	4.8	203.7
4	SB-6	37.7	41.3	13.4	1.9	5.3	1.2	16.1	9.6	14.7	112.2	55.5	5.1	208.0
5	EMS-8-1	40.0	43.7	12.0	1.7	4.1	1.5	17.0	8.5	16.1	75.3	53.3	5.3	160.0
6	IIVR-11	41.0	42.0	13.9	1.6	4.2	2.1	13.8	10.5	16.3	82.7	55.3	4.9	146.2
7	BO-13	41.0	43.3	12.4	1.6	3.5	2.3	17.1	12.7	15.5	71.7	47.1	5.6	218.5
8	AzadBhindi-1	47.7	52.7	13.8	1.8	4.4	1.5	21.4	12.3	20.3	96.4	60.8	5.4	287.0
9	AzadBhindi-2	48.7	51.3	11.0	1.4	4.0	1.5	12.1	9.3	14.2	75.2	52.9	5.2	126.6
10	ArkaAnamika	42.7	44.3	13.4	1.6	4.4	2.3	15.9	11.3	18.6	102.0	46.4	4.9	237.3
11	ArkaAbhay	42.7	45.7	14.3	1.8	4.6	1.2	17.1	10.1	16.6	92.7	50.5	5.6	178.7
12	Punjab-8	40.0	42.7	13.7	1.7	4.3	1.4	15.4	11.6	16.5	83.9	49.7	5.3	184.0
13	GO-3	40.3	42.3	14.9	1.5	4.5	1.4	20.1	13.7	13.8	83.8	45.2	4.8	269.2
14	HRB-231	40.0	42.0	10.8	1.5	4.4	1.8	13.8	9.9	14.0	61.3	47.2	5.1	129.2
15	Punjab-7	40.7	43.7	12.4	1.7	3.5	2.5	17.1	9.9	14.7	68.3	46.1	5.1	181.9
16	UttakalGauravu	40.7	43.3	12.5	1.9	4.0	1.4	18.2	10.4	13.5	72.9	47.3	5.4	187.9
17	NO-55	41.3	43.7	11.6	1.6	4.1	2.0	14.4	9.5	18.7	92.1	59.0	4.7	132.8
18	PunjabSuhavani	42.0	44.7	12.1	1.7	4.7	1.6	19.0	8.7	14.9	85.2	57.7	5.5	153.7
19	KashiPragati	39.3	41.0	15.3	1.7	3.8	1.4	14.0	14.1	17.7	74.4	42.7	4.2	204.5
20	KashiChaman (Check)	40.0	42.7	12.6	1.8	4.5	1.4	16.9	8.1	15.0	97.1	50.3	5.6	139.5
	Mean	41.4	44.0	12.9	1.7	4.3	1.7	16.2	10.5	16.0	84.4	51.0	5.1	181.9
Range	Minimum	37.7	41.0	12.5	1.4	3.5	1.2	12.1	8.1	13.5	61.3	42.7	4.2	126.6
	Maximum	48.7	52.7	12.6	1.9	5.3	2.5	21.4	14.1	20.3	112.2	60.8	5.6	287.0
	SEM	0.7	0.7	0.7	0.1	0.3	0.1	1.3	0.5	0.6	3.1	2.3	0.2	19.9
	CDat 5%	1.9	2.1	2.1	0.2	0.8	0.2	3.7	1.4	1.7	8.8	6.7	0.7	57.1
	CDat 1%	2.6	2.8	2.8	0.2	1.0	0.3	5.0	1.9	2.2	11.8	9.0	0.9	76.5

	~~**CV**~~	~~**2.8**~~	~~**2.8**~~	~~**9.7**~~	~~**5.7**~~	~~**10.5**~~	~~**6.8**~~	~~**13.8**~~	~~**8.3**~~	**6.3**	**6.3**	**8.0**	**8.3**	**19.0**

Table3.Geneticparametersfor13quantitativetraitsof20okragenotypes

Sl.No.	Characters	GCV	PCV	h^2 (Broad Sense)	Genetic Advance	Gen.Advas %ofMean
1	Days to firstflowering	6.114	6.328	93.3	5.033	12.167
2	Days to 50%flowering	6.543	6.745	94.1	5.749	13.076
3	Length ofMaturefruit(cm)	7.563	9.397	64.8	1.623	12.54
4	Diameter of fruit(cm)	6.817	7.562	81.3	0.21	12.66
5	Internodallength(cm)	8.976	10.845	68.5	0.66	15.306
6	Number ofprimarybranches	22.165	22.508	97	0.742	44.965
7	Average fruitweight(gm)	12.237	14.609	70.2	3.416	21.115
8	Number of fruitsper plant	15.403	16.126	91.2	3.168	30.307
9	Number of nodeson main stem	10.887	11.472	90.1	3.394	21.284
10	Plantheight(cm)	14.592	15.037	94.2	24.608	29.169
11	Number of seedsper fruit	8.479	9.647	77.3	7.823	15.353
12	Seedindex(gm)	5.776	7.508	59.2	0.466	9.153
13	Fruit yield perplant(gm)	22.821	25.316	81.3	77.097	42.377

2.1 GenotypicandPhenotypicvarience

The rangefor Phenotypic Coefficient ofVariation (PCV) varies from (6.328%) in daystofirst flowering to (25.316 %) in case of fruit yield per plant. The PCV estimates in all thecharactersindicatedthatthephenotypicvariabilitywaslow(<10%)fordaystofirstflowering (6.328), days to 50% flowering (6.745), length of mature fruit (9.397), diameter ofthe fruit (7.562), number of seeds per fruit (9.647) and seed index (7.508). The phenotypicvariability was moderate (10-20%) in case of internodal length (10.845), average fruit weight(14.609), number of fruits per plant (16.126), number of nodes on the main stem (11.472) andplant height (15.037). The phenotypic variability was high (>20%) in case of number ofprimarybranches(22.508)andfruityieldperplant(25.316)from(Table3)Asimilardeclarationhas been madebyRana*etal.*, (2020)and Kumari*et al.*, (2017).

Range for Genotypic Coefficient of Variation (GCV) varies from (5.776 %) in seed index to(22.821% in case of fruit yield per plant. The GCV estimates in all the characters indicatedthat the genotypic variability was low (<10%) in days to first flowering (6.114), days to 50%flowering (6.543), length of mature fruit (7.563), diameter of the fruit (6.817), internodallength(8.976),numberofseedsperfruit(8.479)andseedindex(5.776).Genotypicvariability was moderate (10-20%) in case of average fruit weight (12.237), number of fruitsper plant (15.403), number of nodes on the main stem (10.887) and plant height (14.592). Thegenotypic variability was high (>20%) in number of primary branches per plant (22.165) andfruityieldperplant(22.821)from(Table3)Asimilaridentificationwasmadeby(Makhdoomi *et al.*, (2018).

2.2 Heritability

The heritability for all13 characters was estimated. The heritability inbroad sense (h^2)ranged from 59.2% in the case of seed index to 97% in case of number of primary branches.The magnitude of heritability was found to be moderate (30-60%) for seed index (59.2). Highheritability (>60%) was found for days to firstflowering (93.3), days to 50% flowering(94.1), length of mature fruit (64.8), diameter of the fruit (81.3), internodal length (68.5),number of primary branches (97), average fruit weight (70.2), number of fruits per plant(91.2),numberofnodesonthemainstem(90.1),plantheight(94.2),numberofseedsperfruit(77.3)andfruityieldperplant(81.3)Suchsimilarobservationswerereportedby Vani*et al.*,(2021) and Alam*et al.*, (2020).

2.3 GeneticadvanceandGeneticadvanceaspercentofMean

The expected genetic advance for different characters ranged from 0.21 in the case ofdiameter of fruit to 77.097 in case of fruit yield per plant. Lowest to moderate values ofexpected genetic advance (<20) were found in the days tofirst flowering (5.033), days to50% flowering (5.749), number of primary branches (0.742), length of mature fruit (1.623),diameter of the fruit (0.21), inter nodal length (0.66), average fruit weight (3.416), number offruits per plant (3.168), number of nodes on the main stem (3.394), number of seeds per fruit(7.823) and seed index (0.466). High genetic advance was obtained for plant height (24.608)andfruityieldperplant(77.097)similar findingswereobservedin (Kumari *etal*., (2017).

Theexpectedgeneticadvanceaspercentofmeanfordifferentcharactersrangedfrom(9.153%) in the case of seed index to (44.965 %) as in the case of number of primarybranches.The values were lowest (<50%) for all the characters; daysto first flowering(12.67), daysto50% flowering (13.076), length of mature fruit (12.54), diameter of the fruit(12.66), inter nodal length (15.306), average fruit weight (21.115), number of fruits per plant(30.307), number of nodes on the main stem (21.284), number of seeds per fruit (15.353),seedindex(9.153), plantheight (29.169) andfruit yield perplant (42.377). The results indicating the characters are predominantly regulated by additive gene action. As a result of accumulation of more additive genes leading to future improvement, simple selection would be effective of these traits based on phenotypic expression.

Table4:Estimationof correlation coefficientforphenotypic(PC)andgenotypic(GC)levelsamongdifferentcharactersin okragenotypes.

Traits		DFF	DTFPF	LMF	DOF	INL	NOPB	AFW	NFPP	NNMS	PH	NSPF	SI	FYPP
DFF	**PC**	1.00	0.9523**	-0.2187	-0.1862	-0.179	0.0389	0.0908	0.0296	0.3002**	-0.027	0.3442**	0.2727*	0.0818
	GC	1.00	0.9816**	-0.2805*	-0.2068*	-0.2212*	0.0448	0.0684	0.0407	0.3388**	-0.0217	0.3642**	0.4449**	0.0998
DTFPF	**PC**		1.000	-0.1968	-0.0444	-0.077	-0.0713	0.2232*	-0.0314	0.318**	0.083	0.4617**	0.3664**	0.1817
	GC		1.000	-0.2331*	-0.0838	-0.0721	-0.0718	0.2384*	-0.0478	0.3403**	0.0886	0.5145**	0.5446**	0.2111*
LMF	**PC**			1.000	0.2036*	0.1753	-0.3015**	0.2952**	0.644**	0.3119**	0.3735**	-0.209*	-0.3192**	0.651**
	GC			1.000	0.228*	0.286*	-0.4071**	0.3127**	0.8787**	0.4464**	0.4641**	-0.3652**	-0.6808**	0.7994**
DOF	**PC**				1.000	0.1078	-0.3138**	0.4894**	-0.0657	0.067	0.2722*	0.1174	0.3618**	0.2092*
	GC				1.000	0.1163	-0.3313**	0.5664**	-0.1296	0.0828	0.284*	0.1628	0.5656**	0.1814
INL	**PC**					1.000	-0.5733**	-0.025	-0.3495**	-0.0922	0.6962**	0.3457**	-0.0681	0.0051
	GC					1.000	-0.669**	-0.018	-0.4514**	-0.1654	0.7827**	0.5306**	-0.0066	-0.0711
NOPB	**PC**						1.000	-0.0779	0.1079	0.1507	-0.3167**	-0.1389	-0.0202	-0.0042
	GC						1.000	-0.087	0.1165	0.1557	-0.3289**	-0.1706	-0.0779	0.0117
AFW	**PC**							1.000	0.2619*	0.1235	0.1719	0.142	0.4637**	0.6709**
	GC							1.000	0.3321**	0.1678	0.2038*	0.1945	0.8573**	0.7944**
NFPP	**PC**								1.000	0.2999*	-0.1322	-0.414**	-0.2943*	0.728**
	GC								1.000	0.3236**	-0.1488	-0.4743**	-0.367**	0.7878**
NNMS	**PC**									1.000	0.3803**	0.3681**	-0.1804	0.3487**
	GC									1.000	0.3776**	0.4505**	-0.2462*	0.4113**
PH	**PC**										1.000	0.4653**	0.0092	0.3131**
	GC										1.000	0.5382**	0.0122	0.3228**
NSPF	**PC**											1.000	0.2506*	-0.1039
	GC											1.000	0.4113**	-0.0877
SI	**PC**												1.000	-0.0013
	GC												1.000	-0.0189
FYPP	**PC**													1.000
	GC													1.000

1%levelofsignificance **5%levelofsignificance**

DFF: Days to first flowering**, DTFPF:** Days to 50% flowering**, LMF:** Length of mature Fruit(cm**), DOF:** Diameter of fruit(cm), **INL:** Internodal length (CM), **NOPB:** Number of primarybranches, **AFW:** Average fruit weight(gm**), NFPP:** Number of fruits per plant, **NNMS:** Number of nodes on main stem**, PH:** Plant height, **NSPF:** Number of seeds per fruits**, SI:** Seed index,**FYPP:**Yieldperplant(gm).

3. Correlationcoefficient

For assessing the relationship betweendifferenttraits, a study ofcorrelation coefficientsfacilitates the identification of certain traits in plants that could potentially be focused on forgeneticyieldimprovement.Inordertoincreaseyield,itisimportanttolookintotheexistence of these features to understand how they are connected. The correlation coefficientreveals the degree to which two attributes are related to one another as well as if it is possibletosimultaneouslyimproveboth traits.

3.1 PhenotypicCorrelationCoefficient

PhenotypicCorrelationcoefficientanalysisrevealedthatfruityieldperplantexhibitedpositive and significant correlation with number of fruits per plant (0.728**), average fruit weight (0.6709**), length of mature fruit (0.651**), number of nodes on the main stem (0.3487**), plant height (0.3131**), and diameter of fruit (0.2092*). However, positive non-significant associations were observed with days to 50% flowering (0.1817), days to first flowering (0.0818), and internodal length (0.0051). On the other hand, there were negative non-significant associations with seed index (-0.0013), number of primary branches (-0.0042), and number of seeds per fruit (-0.1039) from (Table 4) such similar observations have been made by (Rai *et al.*, (2022) and(Neeraja*et al.*, (2022).

3.2 GenotypicCorrelationCoefficient

GenotypicCorrelationcoefficientanalysisrevealedthatfruityieldperplantexhibitedpositive and significant correlation with lengthof mature fruit(0.7994**), average fruitweight (0.7994**), number of fruits per plant (0.7878**), number of nodes on main stem(0.4113**) and plant height (0.3228**). Fruit yield per plant exhibited positive and non-significant correlation with days to first flowering (0.0998), diameter of fruit (0.1814) andnumber of primary branches (0.0117). Fruityield per plant exhibited negative and non-significant correlation with number of seeds per fruit (-0.0877), internodal length (-0.0711)andseedindex(-0.0189)from(Table5)Suchsimilarobservationshavebeenmadeby(Ashraf*et al.*, (2020)[2]and (Rathava*et al.*, (2019)[13].

Table5: Direct andIndirectEffectofTwelveCharacters withFruitYield perPlantatPhenotypic(PC) andGenotypic(GC) levelsinokragenotypes.

Traits		DFF	DTFPF	LMF	DOF	INL	NOPB	AFW	NFPP	NNMS	PH	NSPF	SI	FYPP
DFF	**PC**	**-0.6191**	-0.5896	0.1354	0.1153	0.1108	-0.0241	-0.0562	-0.0183	-0.1859	0.0168	-0.2131	-0.1689	0.0818
	GC	**0.1068**	0.1048	-0.03	-0.0221	-0.0236	0.0048	0.0073	0.0043	0.0362	-0.0023	0.0389	0.0475	0.0998
DTFPF	**PC**	0.7312	**0.7678**	-0.1511	-0.0341	-0.0591	-0.0547	0.1714	-0.0241	0.2442	0.0637	0.3545	0.2813	0.1817
	GC	-0.1619	**-0.165**	0.0384	0.0138	0.0119	0.0118	-0.0393	0.0079	-0.0561	-0.0146	-0.0849	-0.0898	0.2111*
LMF	**PC**	-0.0015	-0.0014	**0.007**	0.0014	0.0012	-0.0021	0.0021	0.0045	0.0022	0.0026	-0.0015	-0.0022	0.651**
	GC	-0.0207	-0.0172	**0.0739**	0.0168	0.0211	-0.0301	0.0231	0.0649	0.033	0.0343	-0.027	-0.0503	0.7994**
DOF	**PC**	0.0146	0.0035	-0.016	**-0.0784**	-0.0085	0.0246	-0.0384	0.0052	-0.0053	-0.0213	-0.0092	-0.0284	0.2092*
	GC	0.1182	0.0479	-0.1303	**-0.5714**	-0.0665	0.1893	-0.3236	0.0741	-0.0473	-0.1623	-0.093	-0.3232	0.1814
INL	**PC**	-0.0215	-0.0092	0.0211	0.013	**0.1201**	-0.0688	-0.003	-0.042	-0.0111	0.0836	0.0415	-0.0082	0.0051
	GC	0.1109	0.0362	-0.1434	-0.0583	**-0.5014**	0.3355	0.009	0.2264	0.083	-0.3925	-0.2661	0.0033	-0.0711
NOPB	**PC**	0.0088	-0.0162	-0.0685	-0.0713	-0.1303	**0.2273**	-0.0177	0.0245	0.0343	-0.072	-0.0316	-0.0046	-0.0042
	GC	-0.0053	0.0086	0.0485	0.0395	0.0797	**-0.1192**	0.0104	-0.0139	-0.0186	0.0392	0.0203	0.0093	0.0117
AFW	**PC**	0.0183	0.045	0.0596	0.0988	-0.005	-0.0157	**0.2018**	0.0528	0.0249	0.0347	0.0287	0.0936	0.6709**
	GC	0.0365	0.1272	0.1669	0.3022	-0.0096	-0.0464	**0.5336**	0.1772	0.0895	0.1088	0.1038	0.4575	0.7944**
NFPP	**PC**	0.0125	-0.0133	0.2723	-0.0278	-0.1478	0.0456	0.1107	**0.4228**	0.1268	-0.0559	-0.175	-0.1244	0.728**
	GC	-0.018	0.0211	-0.3874	0.0571	0.199	-0.0514	-0.1464	**-0.4409**	-0.1427	0.0656	0.2091	0.1618	0.7878**
NNMS	**PC**	-0.0048	-0.0051	-0.005	-0.0011	0.0015	-0.0024	-0.002	-0.0048	**-0.0159**	-0.0061	-0.0059	0.0029	0.3487**
	GC	0.0456	0.0458	0.0601	0.0111	-0.0223	0.021	0.0226	0.0436	**0.1346**	0.0508	0.0606	-0.0331	0.4113**
PH	**PC**	-0.0079	0.0243	0.1093	0.0797	0.2038	-0.0927	0.0503	-0.0387	0.1113	**0.2927**	0.1362	0.0027	0.3131**
	GC	-0.0145	0.0592	0.3105	0.19	0.5236	-0.2201	0.1363	-0.0996	0.2526	**0.669**	0.36	0.0082	0.3228**
NSPF	**PC**	-0.0769	-0.1031	0.0467	-0.0262	-0.0772	0.031	-0.0317	0.0925	-0.0822	-0.104	**-0.2234**	-0.056	-0.1039
	GC	-0.1547	-0.2185	0.1551	-0.0691	-0.2254	0.0725	-0.0826	0.2015	-0.1914	-0.2286	**-0.4248**	-0.1747	-0.0877
SI	**PC**	-0.0002	-0.0003	0.0003	-0.0003	0.0001	0.00001	-0.0004	0.0003	0.0002	0.00001	-0.0002	**-0.0009**	-0.0013
	GC	-0.0192	-0.0235	0.0293	-0.0244	0.0003	0.0034	-0.0369	0.0158	0.0106	-0.0005	-0.0177	**-0.0431**	-0.0189

Phenotypicpathcorrelation(1level ofsignificance,*5levelofsignificance,Residualeffect=0.1722).Genotypicpathcorrelation**1%levelofsignificance, *5%levelofsignificance,Residualeffect=SQRT(1-1.2853).**

DFF: Days to first flowering**, DTFPF:** Days to 50% flowering**, LMF:** Length of mature Fruit(cm**), DOF:** Diameter of fruit(cm), **INL:** Internodal length (CM), NOPB**:** Number of primary branches, **AFW:** Averagefruitweight(gm**), NFPP:**Numberoffruitsperplant,**NNMS:**Numberofnodeson main stem**, PH:**Plantheight,**NSPF:**Numberofseedsperfruits**, SI:**Seed index, **FYPP:**Yield perplant(gm).

4. PathcoefficientAnalysis

Throughpath-coefficientanalysis,thephenotypicandgenotypiccorrelationcoefficientsofall the individual parameters assessed with fruit yield have been separated into direct andindirecteffects.Fruityieldisdirectly orindirectly affectedby numerousfactorsatthegenotypic and phenotypic levels. The findings indicate the direct as well as indirect effects ofnumerous variables on plant fruit yield. Path coefficient analyses revealed that direct andindirect impacts at the genotypic level were somewhat greater than direct and indirect effectsatthephenotypic level. The analysis serve as an outline for selection and assist in identifying the yield contributing features that impact yield in crop.

4.1 PhenotypicPathCoefficientAnalysis

The phenotypic path coefficient analysis indicated that several traits had a positive directeffect on fruit yield per plant. The traits with the highest positive direct effects were observedfordaysto50%flowering(0.7678),numberoffruitsperplant(0.4228),plantheight(0.2927) , number of primary branches (0.2273), average fruit weight (0.2018), internodallength (0.1201) and length of mature fruit (0.007). On the other hand, days to first flowering(-0.619, number of seeds per fruit (-0.2234), diameter of fruit (-0.0784), number of nodes onthe main stem (-0.0159), and seed index (-0.0009) exhibited negative direct effects on fruityield per plant in (table5). Similar findings were obsereved by (Kumari*et al.,* (2017) [7],(Makhdoomi*et al.*,2018)[9].

4.2 GenotypicPathCoefficientAnalysis

The genotypic path coefficient analysis revealed positive direct effects on fruit yield per plantfor several traits. Plant height had the highest positive direct effect (0.669), followed byaverage fruit weight (0.5336), number of nodes on the main stem (0.1346), days to firstflowering (0.1068), and length of mature fruit (0.0739). On the other hand, the maximumnegative direct effect on fruit yield per plant was observed from diameter of fruit (-0.5714),followedbyinternodallength(-0.5014),numberoffruitsperplant(-0.4409),numberofseeds per fruit (0.4248), seed index (-0.0431), days to 50% flowering (-0.165) and number ofprimarybranches (-0.4409).Similarfindingswere observed in(Neeraja *etal.*, (2022)[10]

4.CONCLUSION

Genotypes namely, Azad bhindi-1, GO-3, BO-13 had high fruit yield. These genotypes couldbeusedfurtherbreedingprogrammesorrecommendedtofarmersforprofitableokracultivation. The results for coefficients of variability for differentcharacters suggestedthatthe experimental material utilized had a significant amount of variability. Genetic analysisrevealed that estimates of phenotypic coefficients of variability (PCV) were higher thangenotypiccoefficientsofvariability(GCV)whichindicatedtheconsequenceofenvironmental impact on the phenotypic expressions of the characters. The maximum valueswere obtained for fruit yield per plant and number of primary branches. High heritabilitytogetherwithhighgeneticgainwasobtainedfornumberofprimarybranches.Hence,selection of these characters for improvement could be more effective and efficient. Fruityield had a strong, positive and significant association with the number of fruits per plant,average fruit weight, length of mature fruit, number of nodes on main stem and plant height.Therefore, improvement of okra can be practiced with direct selection of these characters.Plant height and average fruit weight had a positive direct effect on fruit yield at both levels,showingtheirsuitabilityfordirect selection.

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