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Studies on Genetic Variability, Heritability and Character Association in Okra

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Abstract

The experiment was carried out at vegetable research farm, Department of Horticulture, Allahabad Agriculture Institute. The experimental materials for the present investigation consisted of 25 genotypes of okra. The experiment was laid out in a Randomized Complete Block Design with three replications. Five healthy plants were randomly selected from each plot for recording the sixteen important observations. The wide range of variability was observed among sixteen characters of all genotypes. The (PCV) were generally higher than their respective genotypic coefficient of variance, thus revealing the role of environmental factors. High PCV was reported by (%) disease incidence (77.04), fruit yield plant^{-1} (59.61), number of fruits plant^{-1} (56.15), number of branches plant^{-1} (37.23) and plant height (28.61). High heritability coupled with high genetic advance was observed for (%) disease incidence, fruit yield plant^{-1}, number of fruits plant^{-1}, plant height, number of locules plant^{-1} and fruit length. This indicated that these traits were under the strong influence of additive gene action and hence simple selection based on phenotypic performance of these traits would be more effective. In the present investigation character plant height (0.4464**), days to 50% harvesting (0.3181%), number of fruits plant^{-1} (0.9424**), number of seeds fruit^{-1} (0.2930*), fruit weight (0.2928*) and Vitamin C (0.4665) show positive significant phenotypic correlation with fruit yield plant^{-1}. Positive direct effect number of branches plant^{-1} (0.9365), days to 50% flowering (0.1667), and number of fruits plant^{-1} (0.4650) and fruit length (0.1344) was main cause of their positive association with fruit yield plant at genotypic level.

Keywords: Variability, heritability, correlation and path coefficient, okra

1. Introduction

Okra, (*Abelmoschus esculentus* (L.) Moench.) is a member of the family Malvaceae and an important vegetable crop grown in tropical and subtropical regions of the world due to its wider adaptability, year round cultivation, highly nutritive along with medicinal value, export potential, good portability and bountiful returns. However, the most commonly reported okra is a natural amphidiploids and chromosome number is 2n=120–130. Okra is specially valued for its tender and delicious fruits in different parts of the world. However, to a limited extent, it is canned, dehydrated and processed in frozen form. According to Yadav, (2016) the fruits of okra contains many nutrients in 100 g of edible portion viz., water 88%, carbohydrates 7.7%, protein 2.2%, fat 0.23%, fiber 1.2%, mineral matters 0.7%, calcium 0.09%, phosphorus 0.04%, iron 0.15%, vitamin 'A' 88 IU. Vitamin 'B' 0.07 mg and vitamin 'C' 16 mg. Okra is cooked and consumed in variety of ways. A dry seed of okra contains 13–22% edible oil and 20–24% crude protein (Thamburaj and Singh, 2004). Roasted and ground seeds used as coffee substitute. It has a great potential as foreign exchange earner vegetable and accounts for about 60% of the export of total fresh vegetable excluding onion. Due to high iodine content, the fruits are considered useful for control of goitre. Fruits with its fibrous stalks are used in paper making industries. In spite of large number of varieties available in India only few are promising, this fact draws the attention of plant breeder for its improvements. Genetic variability plays an important role in crop breeding for selecting the elite genotypes for making rapid improvement in yield and other desirable characters as well as is selecting the potential parent for hybridization programmes (Mishra et al., 2015). Heritability is an index for calculating the relative influence of environment on expression of genotypes. It becomes very difficult to judge how much of the variability is heritable and how much is non heritable. This emphasizes to go for the study of extent of variability present in different genotypes. Correlation and path coefficient analysis furnishes information regarding the nature and magnitude of various associations and help the measurement of direct and indirect influence of one variable on the other. Keeping in view the above facts the present work carried out to obtain the following objective to estimate the genetic variability, heritability, genetic advance as percent of mean, correlation and path coefficient analysis between fruit yield and its components traits.

2. Materials and Methods

The experiment was carried out at vegetable research farm, Department of Horticulture, Allahabad Agriculture Institute, during the spring summer spell of 2014. The area is situated on the right bank of the river Yamuna. Allahabad has subtropical climate, which prevails in the south east part of Uttar Pradesh with the both extreme in temperature i.e. the winter and summer. The experiment was laid out in a Randomized Complete Block Design with three replications. The experimental materials for the present investigation consisted of 25 genotypes of okra, which were collected from Indian Institute of Vegetable Research, Varanasi (Uttar Pradesh) and NBPGR, Trissur (Kerala). The germplasms are D-1-87-5, OC/1703 IC024137, OC/1712 IC027875, OC/BIC32855, OC/1178 IC128891, OC/1766 IC033304, OC/26 IC33301, VRO-6, Parbhani Kranthi, OC/7776 IC113904, Number-315, VRO-5, CO-1647/IC007952, BO-2, OC-14 IC45806, VRO-3, OC/1858 IC052298-B, OC/1210 IC128092, OC/1836 IC042893, OC/1686 ICO 18540, Larm-1, OC/34 IC333340, Pusa Sawani, Bhindi Vapphy, Selection-10. Five healthy plants were randomly selected from each plot for recording the 16 horticultural important observations such as plant height, number of leaves plant^{-1}, number of branches plant^{-1}, days of 50% flowering, number of fruits plant^{-1}, days to first picking and days to 50% harvesting was recorded manually. The diameter of fruit length (cm) and fruit diameter (cm) was recorded with the use of venire calliper. Weight of the fruit (g) was noted by using weighting balance. YVMV infestation (%) was calculated on the basis of disease incidence and intensity of disease in leaves. Vitamin C (mg 100 g^{-1}), number of ridges, number of locules pod^{-1} and number of seed fruit^{-1} were recorded manually. The analysis of variance, genotypic coefficient of variation (GCV), Phenotypic Coefficient of Variation (PCV) heritability in broad sense (h^2bs), Genetic Advance (GA) and genetic advance as (%) over mean (GAM) for all the characters were calculated following the formulae illustrated by Cochran and Cox, (1957) for ANOVA; Burton, (1952) for genotypic and phenotypic coefficients of variability; Kumar et al. (2003); Korkut et al. (2001) for heritability; Arshad et al. (2009) for genetic advance; Akthar et al. (1992) for genotypic and phenotypic correlations; and Shalini et al. (2000) for path coefficients.

3. Results and Discussion

3.1. Analysis of variance

The present study was carried out the nature of variability in different characters of okra genotypes. Analysis of variance of 16 characters revealed that mean squares due to genotypes were observed for all the traits expect number of all branches plant^{-1}, days to first picking and fruit diameter which shows that sufficient variability existed among the genotypes.

3.2. Range, mean, genetic variability, heritability and genetic advance

The mean, range, genotypic and phenotypic coefficient of variations, heritability and genetic advance as percent of mean for all characters were presented in (Table 1). In present experiment showed that maximum range of variability (244.17–14.71 g) was recorded for fruit yield plant^{-1} followed by plant height (136.60–135.80 cm), (%) of disease incidence (64.67–3.43) number of seed fruit^{-1} (60–43) and days to 50% flowering (49–40). Similar kinds of results were obtained by Singh et al. (2006). Similarly fruit yield plant^{-1} had the highest mean of 107.0 g followed by plant height (92.62 cm) and days to 50% harvesting (64.37) whereas, lowest mean was observed for fruit diameter (2.13 cm) and number of branches plant^{-1} (2.68). The study also indicated invariably, higher values for all the parameters under study for PCV as compared to their respective GCV. Indicating the impact of the environmental factors towards their expression similar results were also reported by Mishra et al. (2015). However, maximum difference between PCV and GCV were observed for characters such as number of branches plant^{-1} (37.23 and 23.55), fruit diameter (11.96 and 3.98) and days to first picking (2.45 and 1.15) representing environmental influence on the expression of these characters was high as compared to other characters. Other characters showed moderate estimates of PCV and GCV. Findings of most of the characters in the present study were supported by Gandhi et al. (2001). The efficiency of selection not only depends on the magnitude of genetic variability but also on the heritability of the characters. The low heritability in broad sense was recorded for days to first picking (22%) and fruit diameter (11%). Whereas, moderate heritability was found for number of branches plant^{-1} (36%), rest of all characters shows high heritability. The high heritability denotes high proportion of genetic effect in the determination of these traits can be selected for improving fruit yield in okra. The genetic advance as percent of mean was highest for percent disease incidence, fruit yield plant^{-1}, number of fruits plant^{-1}. In the present investigation, high heritability coupled with high genetic advance was observed for percent disease incidence, fruit yield plant^{-1}, number of fruits plant^{-1}, plant height, Vitamin ‘C’, number of locules plant^{-1} and fruit length. Similar types of results were shown by Dhall et al. (2000). This indicated that these traits were under the strong influence of additive gene action and hence simple selection based on phenotypic performance of these traits would be more effective. High heritability and low GAM values were observed for days to 50% flowering and days to 50% harvesting .This indicated the influence of non-additive gene action and considerable influence of environment on the expression of these traits. These traits could be exploited through manifestation of dominance and epistatic components through heterosis.

Table 1: Range, mean, variance, co-efficient of variations, heritability, genetic advance and genetic advance as percent of mean for 16 traits in okra

Characters	Range	Mean	Genotypic variance	Phenotypic variance	CV		H^2	GA		GA as percent mean	
					GCV%	PCV%		1%	5%	1%	5%
PH	136.36–135.80	92.62	699.02	702.03	28.54	28.61	100	69.65	54.35	75.20	58.68
NBP	4.33–1.00	2.68	0.40	1.11	23.55	37.23	36	1.00	0.78	37.22	29.12
NLP	28.00–13.33	24.01	8.45	9.73	12.10	12.99	87	7.15	5.58	29.79	23.24
DF	49.00–40.00	44.64	4.40	6.01	4.70	5.49	73	4.74	3.70	10.62	8.28
DFP	50.00–47.00	48.17	0.30	1.39	1.15	2.45	22	0.68	0.53	1.41	1.10
DH	67.00–61.66	64.37	1.48	2.82	1.89	2.61	53	2.33	1.82	3.62	2.82
NFP	28.00–2.66	12.84	50.88	51.99	55.55	56.15	98	18.63	14.54	145.10	113.22
NRF	7.33–5.00	5.30	0.43	0.55	12.37	14.00	78	1.53	1.20	28.86	22.52
NSF	60.00–43.00	52.53	13.73	18.24	7.05	8.13	75	8.48	6.62	16.15	12.60
NLF	7.66–5.00	5.30	0.47	0.52	12.98	13.60	91	1.74	1.35	32.70	25.51
FL	11.56–5.23	8.05	4.21	4.34	23.17	23.53	97	5.33	4.10	60.24	47.00
FD	2.66–1.86	2.13	0.01	0.07	3.98	11.96	11	0.07	0.06	3.51	2.74
FW	10.04–5.50	8.20	1.68	1.95	15.81	17.04	86	3.18	2.48	38.74	30.23
Vit-c	15.91–2.08	13.62	0.75	0.79	6.36	6.52	95	2.23	1.74	16.40	12.80
PDI	64.67–3.43	27.83	451.16	459.75	76.32	77.04	98	55.55	43.34	199.58	155.73
FYP	244.17–14.71	107.00	3953.17	4068.17	58.76	59.61	97	163.63	127.68	152.92	119.32

PH: Plant height (cm); NBP: No. of branches plant^{-1}; NLP: No. of leaves plant^{-1}; DF: Days to 50% flowering; DFP: Days to first picking; DH: Days to 50% harvesting; NFP: No. of fruits Plant^{-1}; NRF: No. of ridges fruit^{-1}; NSF: No. of seeds fruit^{-1}; NLF: No. of locules fruit^{-1}; FL: Fruit length (cm); FD: Fruit diameter (cm); FW: Fruit weight (g); Vit-c: Vitamin-C (mg 100 g^{-1}); FYP: Fruit yield plant^{-1} (g)

3.3. Correlation co-efficient analysis

The genotypic and phenotypic correlation coefficients were worked among sixteen characters for twenty-five okra genotypes and the data is presented in Table 2. It was evident that from the table those values of genotypic correlation coefficient were greater than the values of phenotypic correlation co efficient for most of the characters, which indicated there by a strong inherent association between various traits that were quite influenced by the environment. In the present investigation character plant height (0.4464**), days to 50% harvesting (0.3181%), number of fruits plant^{-1} (0.9424**), number of seeds fruit^{-1} (0.2930*), fruit weight (0.2928*) and Vitamin C (0.4665) show positive significant phenotypic correlation with fruit yield plant^{-1} and days to 50% flowering (-0.2791*) and days to first picking (-0.2393*) shown negative but significant correlation. These kinds of results show similarity with results of Hazra and Basu (2000). Number of branches plant^{-1} (0.219), number of locules fruit^{-1} (0.1136), fruit length (0.1861), fruit diameter (0.1302) and % disease incidence (0.1132) shown positive correlation but non significant. Number of leaves plant^{-1} (-0.1428) and number of ridges fruit^{-1} (-0.118) shown negative and non significant phenotypic correlation.

3.4. Path co-efficient analysis

Correlation coefficient value does not reveal the real association pattern of the independent various with the dependent. Path coefficient analysis on the other hands an efficient statistical technique specially designed to quantity the interrelationship of different components and their direct and indirect effects a fruit yield. In the present study, correlation coefficient of genotypic level of 16 contributing characters with yield were un fanged in to direct and indirect effects to identify the characters as selection criteria for improvement in fruit yield. The result of this analysis is furnished in Table 3 and 4. Plant height (0.0843), number of leaves plant^{-1} (0.001), days to 50% flowering (0.0365), days to 50% harvesting (0.042), number of fruits plant^{-1} (0.879), number of seeds fruit^{-1} (0.012), number of locules fruit^{-1} (0.0389), fruit weight (0.255), vitamin C (0.018) and % disease incidence (0.093) was main cause of their positive association with fruit yield plant^{-1} at phenotypic level Bhalekar et al. (2005). Negative direct effect number of branches plant^{-1} (-0.0074), days to first picking (-0.0038), number of ridges fruit^{-1} (-0.0212), fruit length (-0.0185) and fruit diameter (0.0013) was main cause of their

Table 2: Phenotypic (P) and Genotypic (G) Correlation coefficient for 16 characters in okra

Sl. No.	PH	NBP	NLP	DF	DFP	DH	NFP	NRF	NSF	NLF	FL	FD	FW	Vit-c	PDI	FYP
1.	P	0.248	0.175	-0.250*	-0.243*	0.36**	0.44**	-0.081	0.15	-0.421**	0.018	-0.103	0.073	0.164	0.434**	0.446**
	G	0.405**	0.186	-0.294*	-0.518**	0.519**	0.445**	0.085	0.179	-0.448**	0.022	-0.352**	0.082	0.167	-0.440**	0.452**
2.		P	0.344	-0.312**	-0.137	0.191	0.073	0.061	-0.133	-0.112	0.119	0.065	0.224	0.092	-0.038	0.121
		G	0.559**	-0.49**	-0.223	0.420**	-0.052	0.093	-0.194	-0.284*	0.199	-0.0635	0.354**	0.208	-0.057	0.051
3.			P	-0.227	-0.051	0.023	-0.116	-0.374**	-0.04	-0.349**	0.057	-0.07	-0.139	0.14	-0.071	-0.142
			G	-0.268*	-0.198	0.021	-0.135	-0.181**	-0.031	-0.396**	0.065	-0.343**	-0.117	0.170	-0.077	-0.155
4.				P	0.227*	-0.011	-0.32**	-0.2169	-0.082	0.221	-0.152	0.003	-0.142	-0.163	0.111	-0.279
				G	0.525**	-0.004	-0.36**	-0.235*	-0.02	0.281*	-0.143	0.489**	-0.160	0.180	0.105	-0.339*
5.					P	-0.030	-0.226	-0.06	-0.161	0.075	-0.030	0.213	-0.144	-0.089	0.125	-0.239*
					G	-0.106	-0.46**	-0.251*	-0.23*	0.263*	-0.018	0.525**	-0.219	-0.268*	0.272*	-0.446*
6.						P	0.265*	-0.049	-0.156	-0.042	0.022	0.063	0.130	-0.022	-0.173	0.318**
						G	0.36**	-0.124	-0.184	-0.042	0.009	0.340**	0.295**	-0.020	-0.24*	0.447*
7.							P	-0.122	0.243	0.085	0.068	0.096	0.033	0.433**	0.025	0.942**
							G	-0.148	0.287	0.083	0.069	0.258*	0.037	0.451**	0.026	0.947**
8.								P	-0.027	0.133	0.184	-0.063	0.175	-0.155	-0.099	-0.111
								G	-0.036	0.179	0.215	-0.174	0.214	-0.174	-0.113	-0.136
9.									P	-0.082	0.625**	0.11	0.172	0.403**	0.26*	0.293*
									G	-0.083	0.73**	0.407**	0.189	0.463**	0.296**	0.345*
10.										P	0.175	0.305**	0.082	-0.14	0.187	0.113
										G	0.184	0.742**	0.093	-0.153	0.204	0.128
11.											P	0.180	0.434	0.212	0.245*	0.186
											G	0.456**	0.472**	0.224	0.204	0.191
12.												P	0.115	0.117	0.121	0.13
												G	0.304**	0.537**	0.465**	0.476**
13.													P	0.091	0.083	0.292*
													G	0.102	0.091	0.309*
14.														P	0.410	0.466**
														G	0.428**	0.494**
15.															P	0.113
															G	0.112
16.																1.000

Table 3: Phenotypic direct (Diagonal) and indirect effect of different traits contributing to yield in okra (Phenotype level)

Sl. No.	PH	NBP	NLP	DF	DFP	DH	NFP	NRF	NSF	NLF	FL	FD	FW	Vit-c	PDI	FYP
1.	0.0843	0.0210	0.0148	-0.0212	-0.205	0.0309	0.0373	-0.0069	0.0127	-0.0355	0.0016	-0.0087	0.0062	0.0139	-0.0366	0.4464
2.	-0.0019	-0.0074	-0.0026	0.0023	0.001	-0.0014	-0.0005	-0.0005	0.001	0.0008	-0.0009	-0.0005	-0.0017	-0.0007	0.0003	0.1219
3.	0.0002	0.0003	0.001	-0.0002	-0.0001	0.000	-0.0001	-0.0004	0.000	-0.0004	0.0001	-0.0001	-0.0001	0.0001	-0.0001	-0.1428
4.	-0.0092	-0.0114	-0.0083	0.0365	0.0083	-0.0004	-0.0117	-0.0079	-0.003	0.0081	-0.0056	0.0001	-0.0052	-0.006	0.0041	-0.2791
5.	0.0009	0.0005	0.0002	-0.0009	-0.0038	0.0001	0.0009	0.0002	0.0006	-0.0003	0.0001	-0.0008	0.0006	0.0003	-0.0005	-0.2393
6.	0.0154	0.008	0.001	-0.0005	-0.0013	0.0420	0.0111	-0.0021	-0.0066	-0.0018	0.001	0.0027	0.0055	-0.0009	-0.0073	0.3181
7.	0.3086	0.0649	-0.1.2	-0.2813	-0.1986	0.233	0.8791	-0.1073	0.2143	0.0752	0.0598	0.0846	0.0291	0.3811	0.0228	0.9424
8.	0.0017	-0.0013	0.0079	0.0046	0.0013	0.011	0.0026	-0.0212	0.0006	-0.0028	-0.0039	0.0013	-0.0037	0.0033	0.0021	-0.1118
9.	0.0019	-0.0017	-0.0005	-0.001	-0.002	-0.002	0.0031	-0.0003	0.0126	-0.001	0.0079	0.0014	0.0022	0.0051	0.0033	0.293
10.	-0.0164	-0.0044	-0.0136	0.0086	0.0029	-0.0016	0.0033	0.0052	-0.0032	0.0389	0.0068	0.0119	0.0032	-0.0054	0.0073	0.1136
11.	-0.0003	-0.0022	-0.0011	0.0028	0.0006	-0.0004	-0.0013	-0.0034	-0.0155	-0.0032	-0.0185	-0.0033	-0.008	-0.0039	-0.0045	0.1861
12.	0.0001	-0.0001	0.0001	0.00	-0.0003	-0.0001	-0.0001	0.0001	-0.0001	-0.0004	-0.0002	-0.0013	-0.0001	-0.0002	-0.0002	0.1302
13.	0.0187	0.0575	-0.0357	-0.0364	-0.0368	0.033	0.0085	0.0448	0.0440	0.021	0.1111	0.0295	0.2555	0.0233	0.0214	0.2928
14.	0.0030	0.0017	0.0025	-0.003	-0.0016	-0.0004	0.0078	-0.0028	0.0073	-0.0025	0.0039	0.0021	0.0016	0.0181	0.0074	0.4665
15.	-0.0407	-0.0036	0.0066	0.0105	0.0117	-0.0162	0.0024	-0.0093	0.0244	0.0176	0.023	0.0114	0.0078	0.0384	0.0937	0.1132

R square=0.9699; Residual effect=0.1735

Table 4: Genotypic direct (diagonal) and indirect effect of different traits contributing to yield in okra (Genotype level)

Sl. No.	PH	NBP	NLP	DF	DFP	DH	NFP	NRF	NSF	NLF	FL	FD	FW	Vit-c	PDI	FYP
1.	-0.463	-0.1881	-0.0866	0.1364	0.24	-0.2406	-0.2066	0.0397	-0.0832	0.2077	0.0103	0.1634	0.0381	-0.0775	0.2043	0.4526
2.	0.38	0.9365	0.5236	-0.4618	-0.2092	0.3941	-0.0489	0.0879	-0.1818	-0.2663	0.1863	0.0595	0.3317	0.1949	-0.0534	0.0517
3.	-0.305	-0.9124	-0.6317	0.4383	0.3236	-0.0348	0.2211	0.7858	0.0516	0.6465	-0.1052	0.5607	0.1923	-0.2784	0.1266	-0.1551
4.	-0.0491	-0.0822	-0.0448	0.1667	0.0877	-0.0007	-0.0605	-0.0393	-0.0045	0.047	-0.0239	0.0816	-0.0268	-0.03	0.0176	-0.3392
5.	0.5434	0.2339	0.2077	-0.0559	-0.0474	0.1113	0.4865	0.2634	0.2427	-0.2756	0.0191	-0.5501	0.2293	0.2809	-0.2859	-0.4468
6.	-0.0442	-0.0358	-0.0018	0.0003	0.0090	-0.0857	-0.0310	0.0106	0.0157	0.0036	-0.0008	-0.0290	-0.0252	0.0017	0.021	0.4472
7.	0.2072	-0.0243	-0.063	-0.0168	-0.216	0.1692	0.4650	-0.0689	0.1335	0.0388	0.0323	0.1201	0.0173	0.2097	0.0124	0.9477
8.	0.1199	-0.1314	0.6746	0.33	0.3523	0.1738	0.2.74	-0.4007	0.0505	-0.2512	-0.3014	0.2441	-0.3011	0.2438	0.1592-	-0.1367
9.	-0.1068	0.11155	0.0188	0.016	0.1379	0.1097	-0.1709	0.0215	-05951	0.0495	-0.4386	-0.2428	-0.1126	-0.2760	0.1767	0.3452
10.	0.0174	0.011	0.0154	-0.0109	-0.0102	0.0016	0.0032	-0.007	0.0032	-0.0388	-0.0072	-0.0288	-0.0036	0.006	-0.0079	0.1287
11.	0.0253	0.2257	0.0731	-0.1624	-0.0207	0.0102	0.0789	0.2441	0.0789	0.2097	0.1344	0.5172	0.2363	0.255	0.2985	0.1911
12.	0.0681	0.0123	0.0663	-0.0945	-0.1014	-0.0658	-0.0499	0.0336	-0.0499	-0.1437	-0.0880	-0.1931	-0.0588	-0.1037	-0.0899	0.4763
13.	-0.0358	-0.1544	0.0514	0.07	0.0954	-0.1289	-0.0162	-0.0937	-0.0162	-0.0409	-0.206	-0.1328	-0.4358	-0.0448	-0.0398	0.3094
14.	0.0296	0.0368	0.0302	-0.0319	-0.0475	-0.0036	0.0798	-0.0308	0.0798	-0.0271	0.0398	0.095	0.0182	0.177	0.0759	0.4945
15.	0.066	0.0085	0.0116	-0.0158	-0.0409	0.0369	-0.004	0.017	-0.004	0.0306	-0.0394	-0.0697	-0.0137	-0.0642	-0.1497	0.1120

R square=0.9699; Residual effect=0.1735

negative association with fruit yield plant^{-1} at phenotypic level.

Positive direct effect number of branches plant^{-1} (0.9365), days to 50% flowering (0.1667), and number of fruits plant^{-1} (0.4650), fruit length (0.1344) and vitamin C (0.1770) was main cause of their positive association with fruit yield plant at genotypic level.

4. Conclusion

Large amount of variability existed among the genotypes for selection. The characters like plant height, number of leaves plant^{-1}, number of fruits plant^{-1}, number of ridges fruit^{-1}, number of locules fruit^{-1}, fruit length, fruit weight, percent disease incidence and fruit yield plant^{-1} exhibited high heritability coupled with high genetic advance providing good scope for further improvement in advance generation.

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