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Path Coefficient Analysis Studied in Ridge Gourd (*Luffa acutangula* (L.) Roxb.) Genotypes

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ABSTRACT

Studies on path coefficient analysis carried out in 22 genotypes of Ridge gourd (*Luffa acutangula* (L.) Roxb.) Path coefficient analysis indicated that direct selection on traits showing high positive direct effects *viz*., number of female flowers (0.759 & 3.342), days to first harvest (0.195 & 1.628), number of branches (0.131 & 1.125), average fruit weight (0.754 & 0.956), number of seeds per fruit(0.434 &0.894), rind thickness (0.055 & 0.468), protein content (0.038 & 0.090) and days to male flowering (0.029 & 0.089) with yield at both phenotypic and genotypic levels respectively, influencing the fruit yield of Ridge gourd genotypes.

Keywords : *Path analysis, Ridge gourd, Direct and Indirect effects*

Ridge gourd (*Luffa acutangula* (L.) Roxb.) is one of the most important cucurbitaceous vegetables grown throughout India. It is considered to be the old world species and a native of tropical Africa and South-East Asian region including India. Its chromosome number is 2n=2x=26. Gourds are the important vegetables in the human diet especially in India. Every 100 g of the edible portion of ridge gourd contains 0.5 g of fibre, 0.5 per cent of protein, 0.34 per cent of carbohydrate, 37 mg of carotene, 5.0 mg of vitamin C, 18 mg of calcium and 0.5 mg of Iron (Hazra and Som, 2005). Ridge gourd is estimated to be cultivated in approximately 9.920 hectares and total production is approximately 3.17 lakh tonnes in India (Anonymous, 2017). The cucurbitaceous vegetables being high volume crops offer greater scope to exploit them by developing high yielding varieties and hybrids to bridge the gap between the availability and requirement.The path analysis was used to study the direct and indirect effects on yield. Yield being a complex character, is composed of several components, some of which affect yield directly while others contribute towards it indirectly. Correlation studies provide an opportunity only to study the magnitude and direction of association of yield with its components and also among various components. But it is essential to know the direct and indirect effects of different traits on the dependent variable *i.e.,* yield per plant.In plant breeding it is very difficult to have complete knowledge of all component traits of yield. The residual effect permits precise explanation about the pattern of interaction of other possible components of yield.

MATERIAL AND METHODS

The experiment was carried out in the year 2018 at the college of Horticulture, Venkataramannagudem, Dr YS.R Horticultural University. The experimental material comprised six inbred lines IC 398599 (P_1), IC 308561 (P_2), IC 523892 (P_3), IC 539714 (P_4), Arka Sumeet (P_5), Arka Sujat (P_6) and fifteen hybrids developed in half diallel with standard check (Chitra). These genotypes evaluated in the field with standard check (Chitra) in three seasons *viz*., summer, *kharif* and *rabi* in 2018. The experiment was laid out in Randomised Block Design with three replications at spacing of 1.0 x 1.2 m. The observations were recorded from five randomly selected plants in each genotype per replication. The data of individual plants each progeny were recorded 28 characters on yield per plant (kg).The least significant difference test at 5 per cent level of probability was used to test the differences among mean values. Path coefficient analysis suggested by Wright (1921) and elaborated by Dewey and Lu (1959) was used to calculate the direct and indirect contribution of various traits towards seed yield.

RESULTS AND DISCUSSION

In the present study, path analysis was used to work out the direct and indirect effects of contributing characters on yield per plant in 22 ridge gourd genotypes. Out of the 28 characters studied, only 18 characters have registered significant association with fruit yield for which the path analysis was used to study the direct and indirect effects on yield and are discussed hereunder character wise (Table 1).

Vine length at final harvest had negative direct effect (-0.000) and significant positive correlation (0.353**) with yield per plant at phenotypic level. It also had positive indirect effects at phenotypic level *via* days to male flowering (0.002), sex ratio (0.010), days to first harvest (0.018), fruit length (0.068), number of fruits per vine (0.044), average fruit weight (0.480) and number of seeds per fruit (0.055) and protein content (0.014)on yield per plant. At genotypic level also, this trait had negative direct effect (-0.303) and significant positive association (0.407**) with the dependant variable. Further, it also exhibited positive indirect effects at genotypic level *via* days to male flowering (0.010), number of male flowers (0.598), days to first harvest (0.190), number of fruits per vine (0.493), average fruit weight (0.689), number of seeds per fruit (0.129) and protein content (0.041)on yield per plant. Thus, vine length at final harvest showed negative direct effect coupled with positive correlation with yield per plant at phenotypic and genotypic levels.

The trait number of leaves per vine recorded negative direct effect (-0.090) and significant positive association (0.296*) with yield per plant at phenotypic level. This trait also recorded positive indirect effects *via* days to male flowering (0.007), number of female flowers (0.092), sex ratio (0.015), days to first harvest (0.053), fruit length (0.066), number of fruits per vine (0.039), average fruit weight (0.386), number of seeds per fruit (0.026) and protein content (0.014) on yield per plant.At genotypic level also, this trait had negative direct effect (-0.195) and significant positive association (0.303*) with the dependant variable. Further, it also exhibited positive indirect effects at genotypic level *via* days to male flowering (0.028), number of male flowers (0.305), number of female flowers (0.421), days to first harvest (0.455), number of fruits per vine (0.407), average fruit weight (0.501), number of seeds per fruit (0.056) and protein content (0.038).Thus, number of leaves per vine showed negative direct effect coupled with positive correlation with yield per plant at phenotypic and genotypic levels.

At phenotypic level, number of branches per vine exhibited positive direct effect (0.131) and significant positive correlation (0.393**) with the dependant variable, yield per plant. This trait also recorded negative indirect effects through all the component traits except *via* vine length at final harvest (0.000), number of leaves per vine (0.005), days to female flowering (0.030), days to 50% male flowering (0.028), days to 50% female flowering (0.006), number of female flowers (0.391), sex ratio (0.034), average fruit weight (0.065) and seed yield per fruit (0.071) on yield per plant. At genotypic level, this trait showed positive direct effect (1.125) and significant positive correlation (0.416**) with yield per plant. It also recorded negative indirect effects through all the component traits except *via* vine length at final harvest(0.005), number of leaves per vine (0.012), days to female flowering (0.356), days to 50% male flowering (0.208), days to 50% female flowering (0.037), number of male flowers (0.124), number of female flowers (1.788), fruit length (0.014), average fruit weight (0.087) and seed yield per fruit (0.109) on yield per plant.Thus, this trait had positive direct effect and significant positive correlation with yield per plant at both phenotypic and genotypic levels.

Days to male flowering had positive direct effect (0.029) and significant negative correlation (-0.322**) with yield per plant at phenotypic level. It had negative indirect effects for all the component traits except *via* vine length at final harvest(0.000), number of male flowers (0.003), days to first harvest (0.161), fruit length (0.014), number of fruits per vine (0.024), rind thickness (0.013), seed yield per fruit (0.158) and protein content (0.007) on yield per plant.At genotypic level also this trait had positive direct effect (0.089) and significant negative correlation (-0.355**) with the dependant variable. Further, it also exhibited negative indirect effects at genotypic level for all the component traits except *via* sex ratio (0.701), days to first harvest (1.445), number of fruits per vine (0.263), rind thickness (0.121), seed yield per fruit (0.253) and protein content (0.023) on yield per plant.Thus the trait showed significant negative correlation on yield per plant at both genotypic and phenotypic levels coupled with positive direct effect at both phenotypic and genotypic levels.

At phenotypic level, the days to first female flowering had negative direct effect (-0.128) and significant negative correlation (-0.264*) with yield per plant. This trait also recorded positive indirect effects for all the component traits except for number of leaves per vine (-0.022), number of branches per vine (-0.031), days to 50% male flowering (-0.071), days to 50% male flowering (-0.023), number of female flowers (-0.290), sex ratio (-0.025), average fruit weight (-0.090) and number of seeds per fruit (-0.194) on yield per plant.The same trait at genotypic level recorded negative direct effect (-1.3856) and significant negative correlation (-0.267*) with yield per plant. This trait also recorded negative indirect effects through the component traits vine length at final harvest(-0.042), number of leaves per vine (-0.050), number of branches per vine (-0.289), days to 50% male flowering (-0.439), days to 50% female flowering (-0.129), number of male flowers (-0.114), number of female flowers (-1.285), fruit length (-0.027), average fruit weight (-0.115) and number of seeds per fruit (-0.403) on yield per plant.Thus, days to female flowering showed negative direct effect coupled with negative correlation with yield per plant at both phenotypic and genotypic levels.

Days to 50 % male flowering had exhibited negative direct effects (-0.091 & -0.501) and significant negative correlation (-0.321**& -0.360**) with yield at both genotypic and phenotypic levels respectively. This trait also recorded negative indirect effects through the component traits like number of leaves per vine (-0.024 & -0.065), number of branches per vine (-0.041 & -0.468), days to female flowering (-0.101 & -1.214), days to 50% female flowering (-0.020 & -0.123), number of female flowers (-0.299 & -1.498), average fruit weight (-0.158 & -0.222) and number of seeds per fruit (-0.203 & -0.469) at both phenotypic and genotypic levels respectively. The indirect negative effects were also observed *via* sex ratio (-0.025) at phenotypic level and number of male flowers (-0.114), fruit length (-0.018) at genotypic level while all other characters exhibited indirect positive effects on yield.Thus, days to 50 % male flowering exhibited negative direct effects on yield and significant negative correlations with yield per plant at both phenotypic and genotypic levels.

Days to 50 % female flowering had exhibited negative direct effects (-0.025 & -0.131) and significant negative correlation (-0.251* & -0.270*) at both genotypic and phenotypic levels respectively. This trait also recorded positive indirect effects through all the component traits except *via* vine length at final harvest(-0.000 & -0.049),number of leaves per vine (-0.025 & -0.058), number of branches per vine (-0.033 & -0.318), days to female flowering (-0.117 & -1.364), days to 50% male flowering (-0.071 & -0.470), number of female flowers (-0.249 & -1.156), average fruit weight (-0.103 & -0.138) and number of seeds per fruit (-0.169 & -0.372) at both phenotypic and genotypic levels respectively. The days to 50 % female flowering was found to influence yield through sex ratio (-0.024) at phenotypic level and through number of male flowers (-0.149) and fruit length (-0.027) at genotypic level.Thus, the trait exhibited negative direct effects and significant negative correlations on yield per plant at both phenotypic and genotypic levels.

Number of male flowers produced on vine had exhibited positive direct effect (0.042) at phenotypic level, negative direct effect (-1.535) at genotypic level and significant negative correlation (-0.347** & -0.349**) at both phenotypic and genotypic levels respectively. This trait recorded positive indirect effects through all the component traitsat both genotypic and phenotypic levels respectively and fruit length (0.023) at only phenotypic level and sex ratio (1.678) at genotypic level.The trait thus had exhibited positive direct effect at phenotypic level, negative direct effect at genotypic level and significant negative correlations with yield per plant at both phenotypic and genotypic levels.

Number of female flowers had exhibited positive direct effects (0.759 & 3.342) and significant positive correlation (0.485**& 0.489**) with yield at both phenotypic and genotypic levels respectively. This trait also recorded negative indirect effects through all the component traits except *via* vine length at final harvest (0.000 & 0.043), number of branches per vine (0.067 & 0.602),days to female flowering (0.049 & 0.532), days to 50% male flowering (0.035 & 0.224), days to 50% female flowering (0.008 & 0.045),average fruit weight (0.096 & 0.123), number of seeds per fruit (0.089 & 0.185) at both genotypic and phenotypic levels respectively and sex ratio (0.063) at phenotypic level while number of male flowers (0.316), fruit length (0.009) at genotypic level.Thus positive direct effects and significant positive correlation were exhibited by this trait on yield per plant at both phenotypic and genotypic levels.

Sex ratio had exhibited negative direct effect (-0.086) at phenotypic level, positive direct effect (2.076) at genotypic level and significant negative correlation with yield (-0.530**& -0.534**) at both phenotypic and genotypic levels respectively. Further, this trait also had negative indirect effects through the component traits like number of branches per vine (-0.052 & -0.463), days to female flowering (-0.038 & -0.414), days to 50% male flowering (-0.026 & -0.170), days to 50% female flowering (-0.007 & -0.039), number of female flowers (-0.552 & -2.430), average fruit weight (-0.213 & -0.271), number of seeds per fruit (-0.133 & -0.275) at both genotypic and phenotypic levels respectively and fruit length (-0.006) at phenotypic level and number of male flowers (-1.241) at genotypic level.Thus, the trait exhibited negative direct effect at phenotypic level, positive direct effect at genotypic level and significant negative correlations with yield per plant at both phenotypic and genotypic levels.

Days to first harvest had exhibited positive direct effects (0.195 & 1.628) and significant negative correlation (-0.269*& -0.273*) with yield at both phenotypic and genotypic levels respectively. Further, this trait also had positive indirect effects through all the component traits except *via* number of leaves per vine (-0.024 & -0.054), number of branches per vine (-0.034 &-0.318), days to female flowering (-0.124 & -1.362), days to 50% male flowering (-0.075 & -0.453), days to 50% female flowering (-0.023 & -0.132), number of female flowers (-0.235 & -1.052), average fruit weight (-0.139 & -0.178) and number of seeds per fruit (-0.180 & -0.375) at both phenotypic and genotypic levels respectively and sex ratio (-0.021) at phenotypic level while vine length at final harvest (-0.035), number of male flowers (-0.084), fruit length (-0.027) at genotypic level.This trait exhibited positive direct effects and significant negative correlations with yield per plant at both phenotypic and genotypic levels.

Fruit length had exhibited positive direct effect (0.091) at phenotypic level, negative direct effect (-0.085) at genotypic level and significant positive correlation (0.347** & 0.348**) at both phenotypic and genotypic levels respectively. This trait also recorded negative indirect effects through all the component traits except *via* days to male flowering (0.004 & 0.016), days to first harvest (0.062 & 0.521), number of fruits per vine (0.057 & 0.582), average fruit weight (0.489 & 0.621), number of seeds per fruit (0.012 & 0.025) and protein content (0.018 & 0.047) at both phenotypic and genotypic levels respectively and sex ratio (0.006) at phenotypic level and number of male flowers (0.416) at genotypic level.Thus, fruit length exhibited positive direct effect at phenotypic level and negative direct effect at genotypic level and significant positive correlations with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, number of fruits per vine had negative direct effect (-0.236) and positive significant correlation (0.575**) with yield per plant. This trait also recorded negative indirect effects through all the component traits except *via* vine length at final harvest (0.000), number of leaves per vine (0.014),number of branches per vine (0.053), days to female flowering (0.020), days to 50% male flowering (0.010), days to 50% female flowering (0.002), number of female flowers (0.328), sex ratio (0.026) and number of seeds per fruit (0.026) on yield per plant.At genotypic level, number of fruits per vine had negative direct effect (-2.381) and positive significant correlation (0.571**) with yield per plant. This trait also recorded negative indirect effects through all the component traits except *via* vine length at final harvest (0.062), number of leaves per vine (0.033),number of branches per vine (0.484), days to female flowering (0.218), days to 50% male flowering (0.064), days to 50% female flowering (0.014), number of male flowers (0.021), number of female flowers (1.455), fruit length (0.020) and number of seeds per fruit (0.055) on yield per plant.Thus, number of fruits per vine exhibited negative direct effects and significant positive correlations with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, average fruit weight had positive direct effect (0.754) and positive significant correlation (0.578**) with yield per plant. This trait recorded positive indirect effects through all the component traits on yield per plant at phenotypic level.At genotypic level, average fruit weight had positive direct effect (0.956) and positive significant correlation (0.585**) with yield per plant. This trait also recorded positive indirect effects through the component traits such asnumber of branches per vine (0.102), days to female flowering (0.167), days to

50% male flowering (0.116), days to 50% female flowering (0.019), number of male flowers (0.554), number of female flowers (0.430), number of fruits per vine (0.715), rind thickness (0.043), number of seeds per fruit (0.216) and protein content (0.047) on yield per plant.Thus, average fruit weight exhibited positive direct effect coupled with positive significant correlation with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, rind thickness had positive direct effect (0.055) and negative significant correlation (-0.285*) with yield per plant. This trait also recorded negative indirect effects through the component traits number of branches per vine (-0.032), days to female flowering (-0.037), days to 50% male flowering (-0.023), days to 50% female flowering (-0.005), number of female flowers (-0.104), sex ratio (-0.013), fruit length (-0.004), average fruit weight (-0.175) and number of seeds per fruit (-0.083) on yield per plant.At genotypic level, average fruit weight had positive direct effect (0.468) and negative significant correlation (-0.293*) with yield per plant. This trait also recorded positive indirect effects through all the component traits except *via* number of branches per vine (-0.293), days to female flowering (-0.421), days to 50% male flowering (-0.134), days to 50% female flowering (-0.033), number of male flowers (-0.204), number of female flowers (-0.484), average fruit weight (-0.226) and number of seeds per fruit (-0.174) per plant.Thus, the trait exhibited positive direct effect coupled with negative significant correlation with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, number of seeds per fruit had positive direct effect (0.434) and significant positive correlation (0.322**) with yield per plant. This trait also recorded negative indirect effects through all the component traits except effects*via* vine length at final harvest(0.000), days to female flowering (0.057), days to 50% male flowering (0.042), days to 50% female flowering (0.010), number of female flowers (0.157), sex ratio (0.026), fruit length (0.002), average fruit weight (0.182) on yield per plant.The same trait at genotypic level recorded positive direct effect (0.894) and significant positive correlation (0.324**) with yield per plant. This trait also recorded negative indirect effects through all the component traits except *via* days to female flowering (0.624), days to 50% male flowering (0.262), days to 50% female flowering (0.054), number of male flowers (0.432), number of female flowers (0.693), average fruit weight (0.231) on yield per plant.Thus, number of seeds per fruit exhibited positive direct effect coupled with positive significant correlation with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, seed yield per fruit had negative direct effect (-0.444) and significant positive correlation (0.335**) with yield per plant. This trait also recorded positive indirect effects through the component traits days to female flowering (0.044), node to female flowering (0.011), days to 50 % male flowering (0.031), days to 50 % female flowering (0.007), number of female flowers (0.258), sex ratio (0.034), fruit length (0.025), average fruit weight (0.222) and number of seeds per fruit (0.331) on yield per plant.The same trait at genotypic level recorded negative direct effect (-0.644) and significant positive correlation (0.337**) with yield per plant. This trait also recorded positive indirect effects through the component traits such as days to female flowering (0.483), node to female flowering (0.086), days to 50 % male flowering (0.196), days to 50 % female flowering (0.042), number of male flowers (0.527), number of female flowers (1.141), average fruit weight (0.281) and number of seeds per fruit (0.681) on yield per plant.Thus, the trait exhibited negative direct effect coupled with positive significant correlation with yield per plant at both phenotypic and genotypic levels.

At phenotypic level, protein content had positive direct effect (0.038) and significant positive correlation (0.277*) with yield per plant. This trait also recorded negative indirect effects through all the component traits except effects *via* days to male flowering (0.005), number of male flowers (0.001), days to first harvest (0.033), fruit length (0.045), number of fruits per vine (0.042), average fruit weight (0.371), rind thickness (0.012) and seed yield per fruit (0.045) on yield per plant.The same trait at genotypic level recorded positive direct effect (0.090) and significant positive correlation (0.297*) with yield per plant. This trait also recorded negative indirect effects through all the component traits except *via* days to male flowering (0.023), sex ratio (0.303), days to first harvest (0.294), number of fruits per vine (0.442), average fruit weight (0.498), rind thickness (0.115) and seed yield per fruit (0.069) on yield per plant.Thus, the trait exhibited positive direct effect coupled with positive significant correlation with yield per plant at both phenotypic and genotypic levels.

Table 1. Path coefficient analysis showing the direct and indirect effect of 28 characters on fruit yield per plant in ridge gourd at phenotypic and genotypic level

Characters	Path coefficient	Vine length(m)	Number ofleaves	Number of branches	Days to male flowering	Days to female flowering	Days to 50% male flowering	Days to 50% female flowering	Number of male flowers	Number of female flowers
Vine length(m) at final harvest	**P**	**-0.000**	-0.000	0.000	0.000	0.000	0.000	-0.000	0.000	0.000
	G	**-0.303**	-0.217	0.005	-0.036	-0.042	-0.040	-0.049	0.118	0.043
Number of leaves per vine	**P**	-0.057	**-0.090**	0.005	-0.023	-0.022	-0.024	-0.025	0.017	-0.011
	G	-0.140	**-0.195**	0.012	-0.062	-0.050	-0.065	-0.058	0.038	-0.024
Number of branches per vine	**P**	-0.009	-0.007	**0.131**	-0.042	-0.031	-0.041	-0.033	-0.009	0.067
	G	-0.021	-0.071	**1.125**	-0.468	-0.289	-0.468	-0.318	-0.091	0.602
Days to male flowering	**P**	0.002	0.007	-0.009	**0.029**	0.022	0.028	0.022	0.002	-0.011
	G	0.010	0.028	-0.037	**0.089**	0.076	0.089	0.082	0.007	-0.038
Days to female flowering	**P**	-0.015	-0.032	0.030	-0.099	**-0.128**	-0.101	-0.117	-0.009	0.049
	G	-0.193	-0.356	0.356	-1.186	**-1.385**	-1.214	-1.364	-0.103	0.532
Days to 50% male flowering	**P**	-0.010	-0.024	0.028	-0.090	-0.071	**-0.091**	-0.071	-0.006	0.035
	G	-0.067	-0.167	0.208	-0.500	-0.439	**-0.501**	-0.470	-0.037	0.224
Days to 50% female flowering	**P**	-0.004	-0.007	0.006	-0.020	-0.023	-0.020	**-0.025**	-0.002	0.008
	G	-0.021	-0.039	0.037	-0.121	-0.129	-0.123	**-0.131**	-0.012	0.045
Number of male flowers	**P**	-0.014	-0.008	-0.003	0.003	0.003	0.002	0.003	**0.042**	-0.008
	G	0.598	0.305	0.124	-0.129	-0.114	-0.114	-0.149	**-1.535**	0.316
Number of female flowers	**P**	-0.103	0.092	0.391	-0.292	-0.290	-0.299	-0.249	-0.156	**0.759**
	G	-0.483	0.421	1.788	-1.445	-1.285	-1.498	-1.156	-0.689	**3.342**
Sex ratio	**P**	0.010	0.015	0.034	-0.025	-0.025	-0.025	-0.024	-0.070	0.063
	G	-0.285	-0.375	-0.854	0.701	0.621	0.706	0.617	1.678	-1.509
Days to first harvest	**P**	0.018	0.053	-0.050	0.161	0.188	0.162	0.180	0.010	-0.060
	G	0.190	0.455	-0.461	1.445	1.600	1.472	1.632	0.089	-0.512
Fruit length(cm)	**P**	0.068	0.066	-0.014	0.014	0.029	0.017	0.027	-0.024	-0.010
	G	-0.072	-0.063	0.014	-0.015	-0.027	-0.018	-0.027	0.023	0.009
Number of fruits per vine	**P**	0.044	0.039	-0.096	0.024	0.036	0.027	0.024	0.003	-0.102
	G	0.493	0.407	-1.024	0.263	0.376	0.306	0.269	0.032	-1.037
Average fruit weight(g)	**P**	0.480	0.386	0.065	-0.169	-0.090	-0.158	-0.103	-0.272	0.096
	G	0.689	0.501	0.087	-0.235	-0.115	-0.222	-0.138	-0.345	0.123
Rind thickness (mm)	**P**	-0.008	-0.003	-0.013	0.013	0.016	0.014	0.012	0.007	-0.007
	G	-0.081	-0.030	-0.122	0.121	0.142	0.125	0.117	0.062	-0.067
Number seeds per fruit	**P**	0.055	0.026	-0.069	-0.202	-0.194	-0.203	-0.169	-0.122	0.089
	G	0.129	0.056	-0.151	-0.460	-0.403	-0.469	-0.372	-0.252	0.185
Seed yield per fruit(g)	**P**	-0.084	-0.066	0.071	0.158	0.154	0.155	0.134	0.152	-0.151
	G	-0.138	-0.098	0.109	0.253	0.225	0.252	0.207	0.221	-0.220
Protein(%)	**P**	0.014	0.014	-0.015	0.007	0.007	0.007	0.005	0.001	-0.004
	G	0.041	0.038	-0.036	0.023	0.017	0.023	0.015	0.003	-0.011
r with yield per plant (kg)	**P**	0.353**	0.296*	0.393**	-0.322**	-0.264*	-0.321**	-0.251*	-0.347**	0.485**
	G	0.407**	0.303*	0.416**	-0.355**	-0.267*	-0.360**	-0.270*	-0.349**	0.489**

Table 1. continued

Characters	Path coefficient	Sex ratio	Days to first harvest	Fruit length(cm)	Number of fruits per vine	Average fruit weight(g)	Rind thickness	Number of seeds per fruit	Seed yield per fruit(g)	Protein(%)
Vine length(m) at final harvest	**P** **G**	0.000 0.041	0.000 -0.035	-0.000 -0.257	0.000 0.062	-0.000 -0.218	0.000 0.052	0.000 -0.043	-0.000 -0.065	-0.000 -0.140
Number of leaves per vine	**P** **G**	0.015 0.035	-0.024 -0.054	-0.065 -0.144	0.014 0.033	-0.046 -0.102	0.006 0.012	-0.005 -0.012	-0.013 -0.029	-0.034 -0.083
Number of branches per vine	**P** **G**	-0.052 -0.463	-0.034 -0.318	-0.021 -0.188	0.053 0.484	0.011 0.102	-0.032 -0.293	-0.021 -0.190	-0.021 -0.191	-0.051 -0.458
Days to male flowering	**P** **G**	0.008 0.030	0.023 0.079	0.004 0.016	-0.002 -0.009	-0.006 -0.022	0.007 0.023	-0.013 -0.046	-0.010 -0.035	0.005 0.023
Days to female flowering	**P** **G**	-0.038 -0.414	-0.124 -1.362	-0.041 -0.445	0.020 0.218	0.015 0.167	-0.037 -0.421	0.057 0.624	0.044 0.483	-0.024 -0.273
Days to 50% male flowering	**P** **G**	-0.026 -0.170	-0.075 -0.453	-0.017 -0.107	0.010 0.064	0.019 0.116	-0.023 -0.134	0.042 0.262	0.031 0.196	-0.017 -0.130
Days to 50% female flowering	**P** **G**	-0.007 -0.039	-0.023 -0.132	-0.007 -0.042	0.002 0.014	0.003 0.019	-0.005 -0.033	0.010 0.054	0.007 0.042	-0.003 -0.023
Number of male flowers	**P** **G**	0.034 -1.241	0.002 -0.084	-0.011 0.416	-0.000 0.021	-0.015 0.554	0.005 -0.204	-0.011 0.432	-0.014 0.527	0.001 -0.066
Number of female flowers	**P** **G**	-0.552 -2.430	-0.235 -1.052	-0.086 -0.383	0.328 1.455	0.097 0.430	-0.104 -0.484	0.157 0.693	0.258 1.141	-0.093 -0.435
Sex ratio	**P** **G**	**-0.086** **2.076**	-0.021 0.510	0.006 -0.148	0.026 -0.643	0.024 -0.589	-0.013 0.333	0.026 -0.640	0.034 -0.822	-0.012 0.303
Days to first harvest	**P** **G**	0.047 0.400	**0.195** **1.628**	0.062 0.521	-0.020 -0.175	-0.036 -0.304	0.060 0.520	-0.081 -0.683	-0.054 -0.459	0.033 0.294
Fruit length(cm)	**P** **G**	-0.006 0.006	0.029 -0.027	**0.091** **-0.085**	-0.022 0.020	0.059 -0.055	-0.004 0.004	0.002 -0.002	0.025 -0.023	0.045 -0.044
Number of fruits per vine	**P** **G**	0.072 0.738	0.024 0.257	0.057 0.582	**-0.236** **-2.381**	0.070 0.715	0.012 0.131	-0.014 -0.148	-0.013 -0.134	0.042 0.442
Average fruit weight(g)	**P** **G**	-0.213 -0.271	-0.139 -0.178	0.489 0.621	-0.225 -0.287	**0.754** **0.956**	-0.175 -0.226	0.182 0.231	0.222 0.281	0.371 0.498
Rind thickness (mm)	**P** **G**	0.008 0.075	0.017 0.149	-0.002 -0.023	-0.003 -0.025	-0.012 -0.110	**0.055** **0.468**	-0.010 -0.091	-0.007 -0.063	0.012 0.115
Number of seeds per fruit	**P** **G**	-0.133 -0.275	-0.180 -0.375	0.012 0.025	0.026 0.055	0.105 0.216	-0.083 -0.174	**0.434** **0.894**	0.331 0.681	-0.070 -0.154
Seed yield per fruit(g)	**P** **G**	0.175 0.255	0.124 0.182	-0.122 -0.177	-0.024 -0.036	-0.130 -0.189	0.058 0.087	-0.338 -0.491	**-0.444** **-0.644**	0.045 0.069
Protein(%)	**P** **G**	0.005 0.013	0.006 0.016	0.018 0.047	-0.006 -0.016	0.019 0.047	0.008 0.022	-0.006 -0.015	-0.003 -0.009	**0.038** **0.090**
r with yield per plant (kg)	P G	-0.530** -0.534**	-0.269* -0.273*	0.347** 0.348**	0.575** 0.571**	0.578** 0.585**	-0.285* -0.293*	0.322** 0.324**	0.335** 0.337**	0.277* 0.297*

Residual Effect = 0.0925 (p), - 0.0290 (g) P = Phenotypic and G = Genotypic Correlation Coefficient Diagonal bold values are direct effects

Path coefficient analysis of different characters contributing towards fruit yield per plant showed that number of female flowers had highest positive direct effect followed by days to first harvest, number of branches, average fruit weight, number of seeds per fruit, rind thickness, protein content and days to male flowering.The results are in accordance with those reported by Shweta *et al*.(2018) for days to harvest in cucumber, Prasanna *et al*. (2002), Choudhary *et al*. (2008), Narasannavar *et al*. (2014) and Varalakshmi *et al*. (2015) for number of branches in ridge gourd, Choudhary *et al*. (2008), Robbani and Hoque (2012), Dubey *et al*. (2013), Choudhary *et al*. (2014), Varalakshmi *et al*. (2015) and Ananthan for average fruit weight in ridge gourd. Similar effects of average fruit weight on fruit yield were also reported in sponge gourd (Yadav *et al*., 2017), pumpkin (Akter *et al*., 2013) and cucumber (Shweta *et al*., 2018). Khule *et al*. (2011) reported positive direct of seed yield in sponge gourd while Akter *et al*. (2013) observed positive effects of days to male flowering on fruit yield of pumpkin and these observations support the findings of this investigation.

As a whole, it can be inferred that direct selection on traits showing high positive direct effects and it was concluded that the selection of genotypes to improve fruit yield per plant, should be imposed primarily for *viz*., number of female flowers, days to first harvest, number of branches, average fruit weight, number of seeds per fruit, rind thickness, protein content, days to male flowering and sex ratio is beneficial.

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