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Assessment of variability, heritability, genetic advance and determining correlation for yield and its contributing traits in sponge gourd (*Luffa cylindrica* Roem.) along with path analysis

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Abstract

Sponge gourd is an important cucurbit and its high fruit yield is the main objective of a breeder. Fruit yield is a combination of several characters. Correlation analysis indicates the extent and nature of the relationship of these traits with fruit yield and path analysis explains whether a trait affects the yield directly or indirectly. Association and path analysis were carried out for yield and yield related traits in thirteen sponge gourd lines along with estimation of variability, heritability and genetic advance. Entries were sown in Randomized complete block design at farm area of Vegetable Research Institute, Faisalabad, Pakistan, during 2017-2018. Character studied were length of fruit, fruit weight, fruit diameter, No. of fruits/plant, days to first fruit picking, days to first female flower and yield/plant. No. of fruits per plant depicted highest value of GCV% and PCV% pursued by weight of fruit and yield/plant. Fruit weight anddays to first fruit picking showed the maximum heritability plus genetic advance. No. of fruits/plant, fruit weight and length of fruit were positively and highly significantly associated with fruit yield/plant. Days to first fruit picking exhibited negative and highly significant association with fruit yield per plant and negative relationship of this attribute with fruit yield is desirable. Maximum positive direct effects on yield/plant were exerted by single fruit weight and No. of fruits per plant. Results of correlation and path analysis showed that and No. of fruits/plant and single fruit weight are the major yield contributing traits and must be selected for increasing the fruit yield/plant in sponge gourd.

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Introduction

Sponge gourd is one of the most important members of cucurbitaceae family and locally known as Ghia Tori. Sponge gourd is widely cultivated in tropical countries. The green immature fruits are cooked as vegetable and also used in soups and chutnies. Fully ripe fruits after seed extraction are used for washing dishes and body(Oboh and Aluyor, 2009). Sponge gourd has 94.2 g of water, 1.6 g of protein, 0.1 g of lipid, 3.7 g of carbohydrates and 0.4 g of ash in its 100 g of edible portion. It also contains traces of calcium, iron, phosphorus, beta carotene and folate (Gopalan *et al.,* 1999). It is quite useful in curing asthma, skin diseases and high blood pressure. Its juice is used as a natural remedy for jaundice. Luffa is a monoecious crop it bears male and female flowers on the same plant but at different positions. There is great variation in its growth and fruit characteristics. There is need of identifying stable and better genotypes through screening of germplasm at large scale. Evaluation and utilization of variability is a first and most important step in crop improvement program of any crop.

Yield is a composite trait, hence it is a combination of different attributes and each component of yield has its own share in yield. Therefore, correlation between yield and its components should be assessed. So that more attention could be paid to the traits that have more influence on fruit yield. Correlation studies between yield and its contributing traits help a breeder in planning hybridizing program and evaluate the individual plant in segregating population (Choudhary *et al.*, 2008). Decision based on correlation coefficient may not present a clear picture of interrelation between yield and several others traits for sponge gourd. Path analysis clarifies interrelationship between yield and its attributes in sponge gourd. Path analysis partitions the information got from correlation coefficient into direct and indirect effects of traits on yield (Khule *et al.,* 2011).

In sponge gourd genotypic and phenotypic variations are considerably high which shows the better possible chances of developing high yielding variety. The first step in any crop improvement program is to determine the magnitude of variation present in characters that are of economic interest. The amount and nature of variability present in a crop suggest the best method required to increase the yield of that crop(Zalapa *et al.,* 2006).To carry an effective crop improvement program the current experiment was carried out for gathering information on variability, genetic advance, heritability, correlation and path analysis for various traits in sponge gourd.

Materials and methods

The Present research was conducted at farm area of Vegetable Research Institute, Faisalabad during 2017-2018. Thirteen entries of sponge gourd were sown using randomized complete block design having three replications. Each variety was sown at both sides of three meter wide bed having length of 5m keeping 50cm distance from one plant to another plant. All standard agricultural practices were carried to keep crop healthy. Data were collected for the traits namely length of fruit, average single fruit weight, fruit diameter, fruits/plant, days to first fruit picking, days to appearance of first female flower and fruit yield/ plant. Five plants were selected randomly from each replication to record data for studied traits. Marketable fruits were picked almost after every second day. Digital verniercaliper was used to measure the diameter of marketable fruit.

Statistical analysis

Analysis of variance was computed by using software named Statistix 8.1. Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, genetic advance, correlation coefficients and path coefficient analysis were computed following the methods devised by Al-Jibouri *et al.* (1958) and Dewey & Lu (1959).

Results

Results obtained from analysis of variance demonstrated that thirteen genotypes of sponge gourd used in this study were highly significantly different from one another for the all the considered

traits (Table 1).

Variability, heritability, genetic advance

Data from Table 2 pictured out that genotypic coefficient of variation (GCV) was lower than the phenotypic coefficient of variation (PCV). No. of fruits per plant (21.05%) showed highest GCV followed by fruit weight (20.79%) and fruit yield/plant (20.19 %).No. of fruits/plant (27.85%) showed highest PCV value followed by average weight of single fruit (21.38%) and marketable fruit yield/plant (20.97%). Days to first fruit picking (94.69%), average single fruit weight (94.49 %) and fruit yield/plant (92.62%) expressed high values of heritability as well as high genetic advance.

Table 1. Analysis of variance for yield and yield related traits in sponge gourd.

Variables	D.f	Fruit Length	Fruit weight	Fruit diameter	No. of fruits/plant	Days to first fruit picking	Days to first female flower	Yield/plant
Replication	2	1.609	8.10	1.495	36.409	2.026	1.872	3.218
Treatment	12	22.09**	406.13**	11.80**	28.15**	101.47**	38.43**	37.67**
Error	24	0.75	7.74	1.26	5.63	1.85	1.37	0.97

* and ** significant and highly significant at p = 0.05 and 0.01, respectively.

Correlation analysis

Genotypic and phenotypic correlation coefficients are given in Table 3. Correlation analysis depicted that genotypic correlation coefficients values were greater than those of phenotypic correlation coefficients. Fruit length was highly significantly and positively associated with fruit weight, No. of fruits/plant and fruit yield/plant and is negatively no significantly correlated with fruit diameter. It is negatively and highly significantly correlated at genotypic level and negatively and significantly associated at phenotypic level with days to first fruit picking and days to appear of first female flower. Fruit weight revealed positive highly signficant association with fruit yield/plant and non-significant correlation with fruit diameter and No. of fruits/palnt.

Table 2. Genotypic and phenotypic coefficients of variation, heritability and genetic advance of various characters of sponge gourd genotypes.

Traits	GCV (%)	PCV (%)	h^2 (%)	GA
Fruit Length	16.387	17.234	90.410	5.224
Fruit weight	20.788	21.385	94.492	23.076
Fruit diameter	10.175	11.861	73.591	3.313
No. of fruits/plant	21.051	27.849	57.135	4.266
Days to first fruit picking	9.746	10.015	94.698	11.552
Days to first female flower	6.990	7.368	90.006	6.869
Yield/plant	20.187	20.976	92.620	6.934

GCV= Genotypic coefficient of variation PCV=phenotypic coefficient of variation h^2= heritability GA=genetic advance.

It exhibited negative highly significant association with days to first fruit picking and negative non-significant association with days to first female flower. Fruit dia is no significantly correlated with all the traits. No. of fruits/plant significantly but negatively linked with days to first fruit picking and days to first female flower and has positive significant associated with yield/plant. Association of days to first fruit picking with days to first female flower was significant and positive. It was highly significantly and negatively associated with yield/plant. Days to first female is negatively and no significantly

correlated with marketable fruit yield/plant. Fruit yield per plant depicted positive highly significant correlation with fruit length (0.721, 0.647), fruit weight (0.520, 0.502) and fruits/plant (0.798, 0.641) both at genotypic and phenotypic level.

Path analysis

Path analysis was carried out to find out direct and indirect effects of seven studied yield attributes of sponge gourd on marketable fruit yield/plant (Table 4).In present study the maximum positive direct effects on fruit yield per plant were exerted by No. of marketable fruits per plant (1.422) followed by fruit weight (1.223). Length of fruit (-0.590) and fruit diameter (-0.337) recorded negative direct effects on average fruit yield per plant. Days to first fruit picking (-0.99) and first female flower (-0.046) had negative direct effects on yield. Fruit length affected yield indirectly through fruit weight, fruit dia, No. of fruits/plant and days to first female flower. Fruit weight recorded positive indirect effects on yield through number of fruits/plants and days to first female flowering. Fruit diameter influenced the yield indirectly through fruit length, fruit weight and days to first female flowering. No. of fruits per plant exhibited positive indirect effects through fruit weight, fruit diameter and days to first female flowering. The indirect effects of days to first fruit picking were through fruit length and fruit diameter. Days to first female flowering affected the yield indirectly through fruit diameter, days to first fruit picking and fruit length.

Table 3. Genotypic (rg) and phenotypic (rp) correlation coefficients between different characters in sponge gourd.

Traits		Fruit Length	Fruit weight	Fruit diameter	No. of fruits/plant	Days to first fruit picking	Days to first female flower	Yield/plant
Fruit Length	Rg	1						
	rp	1						
Fruit weight	Rg	0.483**	1					
	rp	0.445**	1					
Fruit diameter	Rg	-0.150NS	0.094NS	1				
	rp	-0.105NS	0.106NS	1				
No. of fruits/plant	Rg	0.749**	0.280NS	-0.001NS	1			
	rp	0.532**	0.181NS	0.026NS	1			
Days to first fruit picking	Rg	-0.414**	-0.789**	-0.165NS	-0.552**	1		
	rp	-0.378*	-0.732**	-0.111NS	-0.394**	1		
Days to first female flower	Rg	-0.398**	-0.048NS	-0.091NS	-0.541**	0.384*	1	
	rp	-0.359*	-0.064NS	-0.076NS	-0.429**	0.343*	1	
Yield/plant	Rg	0.721**	0.520**	-0.295NS	0.798**	-0.468**	-0.225NS	1
	rp	0.647**	0.502**	-0.218NS	0.641**	-0.432**	-0.211NS	1

* and ** significant and highly significant at p = 0.05 and 0.01, respectively.

Discussion

Variability, heritability, genetic advance

Analysis of variance showed that sponge gourd genotypes used in this study were highly significantly different from one another for all the studied traits. Genotypic coefficient of variation (GCV) was lower than the phenotypic coefficient of variation (PCV) indicating that environment has crucial part in the outlook of traits under study. Kumar *et al.*(2013) found similar results in sponge gourd. No. of fruits per plant showed highest GCV value followed by fruit weight and fruit yield/plant.Khan *et al.*(2009) andKumar *et al.*(2013) reported similar results in sponge gourd. High GCV value emphasized on the existence of wide variability in these characters and thus showing that there is wide scope of improvement through selection. High heritability and genetic advance values of days to first fruit picking, average

single fruit weight and fruit yield/plant showed that the expression of these components of yield are governed by additive gene action and theses are reliable traits for effective selection (Idahosa *et al.,* 2010; Kumar *et al*., 2013).

Correlation analysis

One yield attribute influences the other yield related attribute, therefore, interrelation among yield components need to be assessed (Doku, 1970).Genotypic correlation coefficients values were greater than those of phenotypic correlation coefficients that described the strong inherent association among studied traits. These findings are in confirmation with the findings of Rao *et al.* (2000), Prasanna *et al.* (2002) and Karuppaiah *et al.* (2005) in ridge gourd and Kumar *et al.* (2013)and Amar *et al.* (2017) in sponge gourd. Fruit length was highly significantly and positively associated with fruit weight, No. of fruits/plant and fruit yield/plant suggesting that varieties having more fruit length will have more fruit weight and fruit yield (Saha *et al*., 1992). Fruit length had negative and highly significant correlation at genotypic level with days to first fruit picking and days to appear of first female flower showing that early varieties will have greater fruit length. Fruit weight was positively and highly significantly correlated with fruit yield/plant. Khan *et al.* (2009) also reported increase in fruit yield/plant with increase of fruit weight in pointed gourd. Negative highly significant association of fruit weight with days to first fruit picking and negative non-significant association with days to first female flower Fruit dia was non-significantly correlated with all the traits. Results showed that those varieties have more fruit yield/plant that have more No. of fruits/plant and are early flower and fruit bearing.

Table 4. Direct (diagnol) and indirect effect of different characters on fruit yield/plant.

	Fruit Length	Fruit weight	Fruit diameter	No. of fruits/plant	Days to first fruit picking	Days to first female flower
Fruit Length	-0.5902	0.5901	0.0506	1.0654	-0.4135	0.0183
Fruit weight	-0.2848	1.2227	-0.0318	0.3987	-0.7870	0.0022
Fruit diameter	0.0886	0.1152	-0.3375	-0.0008	-0.1649	0.0042
No. of fruits/plant	-0.4421	0.3427	0.0002	1.4222	-0.5505	0.0249
Days to first fruit picking	0.2445	-0.9642	0.0558	-0.7845	-0.9980	-0.0177
Days to first female flower	0.2348	-0.0585	0.0308	-0.7694	0.3837	-0.0460

In sponge gourd Panwar *et al.* (1977) reported similar findings. Correlation between days to first fruit picking with days to first female flower was significant and positive showing that early flowering varieties will have early fruiting. Negative correlation of days to appearance of first female flower and days to first fruit picking with yield is desirable because as the early varieties give more yield in sponge gourd. In present study among all traits fruit length, fruit weight and fruits/plant depicted positive highly significant correlation with fruit yield per plant both at genotypic and phenotypic level denoting that improvement in these characters will increase the fruit yield per plant. The similar results were given by Choudhary *et al.* (2008) and Hanumegowda *et al.* (2012), in ridge gourd and Kumar *et al.* (2013) and Amar *et al.* (2017) in sponge gourd.

Path analysis

Correlation analysis merely depicts interrelationship without giving information about cause and effects of relationship. Path-coefficient analysis provides a method for portioning the direct and indirect effects and it estimates the relative worth of cause of casual factor that ultimately affect the yield. In present study the maximum positive direct effects on fruit yield per

plant were exerted by No. of marketable fruits per plant followed by fruit weight. Results of path analysis showed that number of fruits/plant and average fruit weight are the most important traits while selecting high yielding plants and contribute most to the yield in sponge gourd.

These findings are in line with those of Shah and Kale (2002), Kumar *et al.* (2013), Janaranjani and Kanthaswamy (2015) and Ananthan and Krishnamoorthy (2017). Length of fruit and fruit diameter recorded negative direct effects on average fruit yield per plant, fruit yield per plant will decrease as length and dia of fruits increases in sponge gourd because increased length and dia may decrease the No. of fruits/plant which is the major yield contributing attribute in sponge gourd in present investigation. This is supported by findings ofAnanthan and Krishnamoorthy (2017). Days to first fruit picking and first female flower had negative direct effects on yield and negative values of these traits contribute positively to fruit yield/plant. The indirect effects of most of the characters were through fruit diameter and days to appearance of first female flower.

Conclusion

It can be concluded that selection would be rewarding for yield/plant, No. of fruits/plant and single fruit weight as they have high values of genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance. Correlation studies showed that for improving yield/plant of sponge gourd such plants should be selected that have more No. of fruits/plant and more weight of single fruit and greater length of fruit. According to path analysis No. of fruits and weight of single fruit had highest positive direct effect on yield. On the whole, fruit weight and No. of fruits/plant are the major yield contributing traits in sponge gourd crop.

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Conflicts of Interest

The authors declare there are no conflicts of interest.

References

Al-Jibouri HA, Miller P, Robinson H. 1958. Genotypic and environmental variances and covariances in an upland cotton cross of interspecific origin. Agronomy Journal **50,** 633-636.

Amar N, Singh V, Yadav G, Vimlesh K. 2017. Determining relationships between different horticultural and yield traits in sponge gourd (*Luffa cylindrica* Roem.) genotypes with path coefficient analysis. Journal of Pharmacognosy and Phytochemistry **6,** 342-345.

Ananthan M, Krishnamoorthy V. 2017. Genetic variability, correlation and path analysis in ridge gourd (*Luffa acutangula* (Roxb) L.). International Journal of Current Microbiological and Applied Science **6,** 3022-3026.

Choudhary BR, Pandey S, Bhardwaj DR, Yadav DS, Rai M. 2008. Component analysis for qualitative traits in ridge gourd (*Luffa acutangula* (Roxb.) L.). Vegetable Science **3,** 144–7.

Dewey DR, Lu K. 1959. A correlation and path-coefficient analysis of components of crested wheat grass seed production. Agronomy journal **5,** 515-518.

Doku E. 1970. Variability in local and exotic varieties of cowpea (*Vigna unguiculata* L. Walp.) in Ghana. Ghana Journal of Agricultural Science **3,** 139-143.

Gopalan C, Sastri V, Balasubramanium S, Rao B, Dosthale Y, Pant K. 1999. Nutritive value of Indian foods. National Institute of Nutrition, Hyderabad: Indian Council of Medical Research Technological Bulletin.

Hanumegowda K, Shirol A, Mulge R, Shantappa T, Prasad K. 2012. Correlation co-efficient studies in ridge gourd [*Luffa acutangula* (L.) Roxb.]. Karnataka Journal of Agricultural Sciences

25, 160-162.

Idahosa D, Alika J, Omoregie A. 2010. Genetic variability, heritability and expected genetic advance as indices for yield and yield components selection in cowpea (*Vigna unguiculata* (L) Walp). Academia arena **2,** 22-26.

Janaranjani K, Kanthaswamy V. 2015. Correlation Studies and path analysis in Bottle gourd. Journal of Horticulture **2,** 1-4.

Karuppaiah P, Kavitha R, Kumar PS. 2005. Correlation and path analysis in ridge gourd (*Luffa acutangula* L.). Crop Research-hisar **29,** 490-494.

Khan A, Kabir M, Alam M. 2009. Variability, correlation and path analysis of yield and yield components of pointed gourd. Journal of Agriculture & Rural Development **7**, 93-98.

Khule A, Tikka S, Jadhav D, Kajale D. 2011. Correlation and path coefficient analysis in sponge gourd [*Luffa cylindrica* (Linn.) M. Roem.]. International Journal of Plant Sciences (Muzaffarnagar) **6,** 277-279.

Kumar R, Ameta K, Dubey R, Pareek S. 2013. Genetic variability, correlation and path analysis in sponge gourd (*Luffa cylindrica* Roem.). African Journal of Biotechnology **12,** 539-543.

Oboh I, Aluyor E. 2009. Luffa cylindrica-an emerging cash crop. African Journal of Agricultural Research **4,** 684-688.

Panwar J, Singh H, Prasad K, Srivastava J. 1977. Genetic variability and heritability studies in sponge Gourd. Haryana Journal of Horticultural Scienes **6,** 170-179.

Prasanna SC, Krishnappa KS, Reddy NS. 2002. Correlation and path coefficient analysis studies in ridge gourd. Current Research **31,** 150–2.

Rao B, Rao P, Reddy B. 2000. Correlation and path analysis in the segregating population of ridge gourd [*Luffa acutangula* (Roxb.) L.]. Crop Research (Hisar), **20,** 338-342.

Saha R, Mitra B, Hossain A, Jamaluddin M, Mosiul Hoque A. 1992. Genetic variability, character association and path coefficient analysis in pumpkin (*Cucurbita moschata* L.). Bangladesh Horticulture **20,** 59-62.

Shah S, Kale P. 2002. Yield componenet association analysis in ridge gourd. Journal of Maharashtra Agricultural Universities (India) **27,** 197-198.

Zalapa JE, Staub J, McCreight J. 2006. Generation means analysis of plant architectural traits and fruit yield in melon. Plant Breeding **125,** 482-487.