www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; 9(3): 764-768

www.thepharmajournal.com
Received: 04-01-2020
Accepted: 19-02-2020

Priyanka
PG Student, Department of Horticulture, College of Agriculture, Agriculture University (AU), Jodhpur, Rajasthan, India

Santosh Choudhary
Assistant Professor, Department of Horticulture, College of Agriculture, AU, Jodhpur, Rajasthan, India

SK Moond
Associate Professor and Head, Department of Horticulture, College of Agriculture, AU, Jodhpur, Rajasthan, India

Corresponding Author:
Santosh Choudhary
Assistant Professor, Department of Horticulture, College of Agriculture, AU, Jodhpur, Rajasthan, India

Correlation and path analysis in muskmelon (*Cucumis melo* L.) genotypes

Priyanka, Santosh Choudhary and SK Moond

Abstract
A field experiment was carried out during summer, 2018 at Agricultural Research Station, Mandor, Jodhpur (Rajasthan). The experiment was laid out in Randomized Block Design with 32 genotypes and three replications to estimate the extent of the correlation between yield and other characters and the direct and indirect effect of yield contributing traits through path coefficient analysis. Correlation studies revealed that fruit yield per plant has a strong positive significant association with main vine length at harvest, number of nodes at which first female flower appeared, fruit set, number of marketable fruits per plant, fruit diameter, fruit weight, flesh thickness, cavity width, cavity length, and TSS content both at phenotypic and genotypic levels. In addition, path coefficient analysis of various quantitative characters indicated that cavity width, fruit diameter, number of marketable fruits per plant, number of primary branches, internodal length, fruit length, and fruit weight positively affected fruit yield per plant. In contrast, flesh thickness exhibited the maximum negative direct effect on fruit yield per plant.

Keywords: Genotypic correlation, muskmelon, path coefficient analysis, phenotypic correlation

Introduction

Muskmelon (*Cucumis melo* L.) is one of the important and economic species of fruit vegetables, popularly known as *"Kharbuja"* in India. It is a highly cross-pollinated crop with chromosome numbers of 2n = 2x = 24. Muskmelon was originated in tropical Africa, and India is regarded as its secondary center of origin (Chadha and Lal, 1993) [3]. The muskmelon is grown as a dessert crop for its sweet and musky flavoured fruits, which also have good export potential. In India, muskmelon is cultivated in around 54,000 ha area with 1.14 million tonnes of production (Anonymous, 2018-19) [1]. Despite that, due to the low yield potential and sub-optimal fruit quality of current open-pollinated cultivars, commercial muskmelon cultivation is less remunerative. Hence, further genetic improvement in cultivars for yield and quality is needed. The wide genetic diversity within the available genotypes and cultivars offers ample scope for further improvement through a breeding programme to identify stable and good yielding varieties for farmers. Investigating the relationship between yield and its components will improve the effectiveness of a breeding programme with appropriate selection criteria. Correlation studies are widely used in plant breeding to determine the nature of the association between yield and yield contributing parameters. The correlation coefficient measures the mutual relationship between different plant characters and determines the component characteristics based on genetic improvement in yield. Significant relationships between growth, earliness, and yield-related attributes facilitate selecting high-yielding lines/cultivars and genotypes (Singh, 2001) [11].

However, correlation studies alone cannot indicate interrelationships between heritable characteristics and lead to negative results (Bhatt, 1973) [2]. Moreover, correlation analysis does not show the direct and indirect effects of different yield attributes on yield *per se.* Therefore, path analysis is practiced to partitions the estimated correlation into the direct and indirect effects (Wright, 1921) [13]. The path coefficient analysis measures the direct and indirect effect and separates the correlation coefficients into direct and indirect effects components. Therefore, present study was attempted to study the association between yield and contributing traits of muskmelon by correlation analysis and to determine the direct and indirect effect of various characters on fruit yield.

Materials and Methods

A total of 32 genotypes of muskmelon (Table 1) were evaluated in a randomized block design with three replications at Agricultural Research Station, Mandor, Agriculture University, Jodhpur ($26^{0}45''$ N and $73^{0}29''$ E at an altitude of 231 meters amsl) during summer 2018 (March-June). The Seeds of each genotype were grown in a double-row plot of 7.0m in length. Rows were spaced 2.0 m apart, while plants were spaced 0.6 m apart, accommodating 10 plants in a row. All the recommended cultural practices were followed during the experiment. Observations were recorded on a total of 17 quantitative characters. The observations on main vine length; the number of primary branches per vine; internodal length; number of nodes at which the first female flower appeared; percent fruit set; the number of marketable fruit per plant, and days to first fruit harvest were recorded from five randomly selected plants from each plot. The observation related to fruit parameters like fruit diameter; fruit length; fruit weight; fruit yield, rind thickness; flesh thickness; width, and length of the cavity were recorded from the three randomly selected fruits of each genotype from different plants. The total soluble solids (TSS) were determined by Abbe's hand refractometer and shelf-life was determined based on 15% weight loss of fruits at room temperature. Statistical analysis was done on the mean basis across the genotypes. The genotypic and phenotypic correlation coefficients were computed from the phenotypic and genotypic variance and co-variances in accordance with Searle (1961) [10]. Direct and indirect effects were estimated by path coefficient analysis as suggested by Wright (1921) [13] and elaborated by Dewey and Lu (1959) [5].

Table 1: Different genotypes of muskmelon evaluated under the hot arid region

S. No.	Genotype	Source	S. No.	Genotype	Source
1.	GMM-3	GAU, Anand	17.	VRMM-163	IIVR, Varanasi
2.	MHY-5	RARI, Durgapura	18.	VRMM-313	IIVR, Varanasi
3.	MHY-3	RARI, Durgapura	19.	VRMM-205	IIVR, Varanasi
4.	RM-43	RARI, Durgapura	20.	VRMM-158	IIVR, Varanasi
5.	RM-50	RARI, Durgapura	21.	VRMM-194	IIVR, Varanasi
6.	Durgapura Madhu	RARI, Durgapura	22.	VRMM-196	IIVR, Varanasi
7.	Arka Jeet	IIHR, Bengaluru	23.	VRMM307	IIVR, Varanasi
8.	Pusa Madhuras	IARI, New Delhi	24.	VRMM-315	IIVR, Varanasi
9.	Pusa Sharbati	IARI, New Delhi	25.	VRMM-127	IIVR, Varanasi
10.	Punjab Sunehri	PAU, Ludhiana	26.	VRMM-423	IIVR, Varanasi
11.	Hara Madhu	PAU, Ludhiana	27.	VRMM-402	IIVR, Varanasi
12.	KashiMadhu	IIVR, Varanasi	28.	VRMM-153	IIVR, Varanasi
13.	IC-0599709	CIAH, Bikaner	29.	VRMM-106	IIVR, Varanasi
14.	IC-0624304	CIAH, Bikaner	30.	VRMM-207	IIVR, Varanasi
15.	IC-0624305	CIAH, Bikaner	31.	VRMM-201	IIVR, Varanasi
16.	VRMM-11	IIVR, Varanasi	32.	Jodhpur Local	Raymalwara, Osian-Jodhpur

Results and Discussion

Correlation coefficient analysis

A perusal of the correlation coefficient study (Table 2 and 3) revealed that the values of genotypic correlations were higher than phenotypic correlation coefficients in a majority of the cases. The correlations of fruit yield per plant were significantly positive both at genotypic and phenotypic levels with characters *viz.* main vine length at harvest, fruit set, the number of marketable fruits per plant, fruit diameter, fruit weight, flesh thickness, width of cavity, length of cavity, TSS and shelf life indicating that selection of these characters may be helpful in improvement of fruit yield of muskmelon. A similar result was observed by Choudhary *et al.* (2004) [4], Pandey *et al.* (2005) [8], and Reddy *et al.* (2017) [9] in muskmelon. The significant negative correlation of fruit yield per plant with days to first fruit harvest both at genotypic and phenotypic levels was following the earlier results of Reddy *et al.* (2017) [9] in cucumber.

Among the fruit quality parameters, significant positive association of fruit weight both at phenotypic and genotypic levels with characters *viz.* main vine length, number of nodes at which first female flower appeared, number of marketable fruit per plant, and TSS while, significant negative correlation with days to first fruit harvest are similar to earlier reports of Reddy *et al.* (2017) [9] in muskmelon. Fruit diameter had a significant positive association with internodal length, fruit weight, fruit yield per plant, flesh thickness, and cavity length are similar to the reports of Reddy *et al.* (2017) [9] in muskmelon. The TSS content had a significant positive correlation both at genotypic and phenotypic levels with main vine length at harvest, number of primary branches, number of nodes at which first female flower appeared, number of marketable fruit per plant, fruit weight, and fruit yield per plant while, having a significant negative association with rind thickness. These results are similar to earlier reports of Reddy *et al.* (2017) [9]. The Rind thickness was negatively associated with TSS at a genotypic level similar to earlier reports of Choudhary *et al.* (2004) [4].

The correlation analysis exhibited that the highly significant positive genotypic correlation was found among most traits than the phenotypic correlation. It means there is a strong genotypic association between those traits, but the phenotypic value is almost negligible due to the effect of the environment. These results indicate that the genotypes studied in the experiment are stable and are less affected by the environment.

Table 2: Genotypic correlation coefficient between different characters of muskmelon

Character	MVL	NPB	IL	NNF	FS	NMF	DFH	FD	FL	FW	FYP	RT	FT	WC	LC	TSS	SL
MVL	1.000																
NPB	0.970**	1.000															
IL	0.546**	0.264**	1.000														
NNF	-0.320**	-0.257*	-0.014	1.000													
FS	0.741**	0.461**	0.521**	0.681**	1.000												
NMF	0.840**	0.384**	0.262**	0.805**	0.974**	1.000											

DFH	-0.935**	-0.668**	-0.219*	-0.955**	-0.938**	-0.918**	1.000										
FD	0.346**	-0.057	0.536**	0.595**	0.608**	0.457**	-0.285**	1.000									
FL	0.385**	0.154	0.126	0.448**	0.380**	-0.012	-0.193	0.165	1.000								
FW	0.548**	0.273**	0.032	0.868**	0.904**	0.701**	-0.921**	0.324**	0.374**	1.000							
FYP	0.838**	0.329**	0.281**	0.874**	0.907**	0.830**	-0.995**	0.537**	0.345**	0.936**	1.000						
RT	0.056	0.073	-0.134	-0.299**	-0.775**	-0.461**	0.331**	-0.311**	-0.607**	-0.345**	-0.387**	1.000					
FT	0.754**	0.069	-0.002	0.762**	0.967**	0.761**	-0.945**	0.373**	0.319**	0.647**	0.809**	-0.469**	1.000				
WC	0.495**	0.292**	0.415**	0.928**	0.598**	0.491**	-0.7991**	0.476**	0.221*	0.565**	0.327**	-0.162	0.534**	1.000			
LC	0.267**	0.252*	0.182	0.553**	0.339**	-0.012	-0.444**	-0.013	0.839**	0.387**	0.532**	-0.665**	0.217*	0.332**	1.000		
TSS	0.430**	0.419**	0.210*	0.586**	0.463**	0.613**	-0.570**	0.203*	-0.025	0.500**	0.532**	-0.347**	0.182	0.154	0.178	1.000	
SL	0.453**	0.427**	0.502**	0.273**	0.237*	0.264**	0.108	0.462**	0.268**	-0.008	0.209*	-0.322**	-0.055	0.057	0.059	0.082	1.000

*Significant at 5% level of significance; **Significant at 1% level of significance MVL- Main vine length at harvest (cm); NPB-Number of primary branches vine-1; IL-Internodal length (cm); NNF-Number of node at which first female flower appeared; FS-Fruit set (%); NMF-Number of marketable fruit plant-1; DFH-Days to first fruit harvest; FD-Fruit diameter (cm); FL-Fruit length (cm); FW-Fruit weight (kg); FYP-Fruit yield (kg $plant^{-1}$), RT-Rind thickness (cm); FT-Flesh thickness (cm); WC- Width of cavity (cm); LC- Length of cavity (cm); TSS- Total Soluble Solids (%); SL- Shelf life (Days)

Table 3: Phenotypic correlation coefficient between different characters of muskmelon

Character	MVL	NPB	IL	NNF	FS	NMF	DFH	FD	FL	FW	FYP	RT	FT	WC	LC	TSS	SL
MVL	1.000																
NPB	0.157	1.000															
IL	0.149	0.140	1.000														
NNF	0.177	0.132	0.242*	1.000													
FS	0.188	0.159	0.022	0.346**	1.000												
NMF	0.349**	-0.003	0.040	0.273**	0.358**	1.000											
DFH	-0.200	-0.172	-0.033	-0.163	-0.319**	-0.371**	1.000										
FD	0.122	-0.042	0.340**	0.278**	0.239*	0.293**	-0.054	1.000									
FL	0.106	0.097	0.033	0.121	0.082	0.024	-0.180	0.138	1.000								
FW	0.231*	0.147	0.034	0.316**	0.361**	0.389**	-0.470**	0.295**	0.246*	1.000							
FYP	0.343**	0.175	0.126	0.366**	0.469**	0.636**	-0.483**	0.427**	0.184	0.793**	1.000						
RT	-0.028	0.024	-0.114	-0.185	-0.048	-0.064	0.072	-0.186	-0.199	-0.179	-0.174	1.000					
FT	0.071	0.077	0.012	0.280**	0.514**	0.237*	-0.290**	0.206*	0.222*	0.379**	0.352**	-0.216*	1.000				
WC	0.099	0.072	0.101	0.201 *	0.117	0.026	-0.253 *	0.009	0.830 **	0.328 **	0.543**	-0.044	0.267 **	1.000			
LC	0.192	-0.149	0.235*	0.438**	0.212*	0.249*	-0.397**	0.368**	0.242*	0.469**	0.207*	-0.256 *	0.169	0.318 **	1.000		
TSS	0.211*	0.231*	0.131	0.309**	0.165	0.372**	-0.300**	0.182	0.002	0.447**	0.431**	-0.201*	0.093	0.164	0.167	1.000	
SL	0.219*	0.214*	0.348**	0.130	0.113	0.184	0.039	0.416**	0.200	-0.005	0.182	-0.182	-0.019	0.048	0.059	0.081	1.000

*Significant at 5% level of significance; **Significant at 1% level of significance MVL- Main vine length at harvest (cm); NPB-Number of primary branches vine-1; IL-Internodal length (cm); NNF-Number of node at which first female flower appeared; FS-Fruit set (%); NMF-Number of marketable fruit plant-1; DFH-Days to first fruit harvest; FD-Fruit diameter (cm); FL-Fruit length (cm); FW-Fruit weight (kg); FYP-Fruit yield (kg $plant^{-1}$), RT-Rind thickness (cm); FT-Flesh thickness (cm); WC- Width of cavity (cm); LC- Length of cavity (cm); TSS- Total Soluble Solids (%); SL- Shelf life (Days)

Path coefficient analysis

The expression of a complex character like fruit yield per plant depends upon the interplay of several component parameters. A better picture of the contribution of each component building up the total genetic architecture of a complex character may be obtained through the analysis of causal schemes. Hence, path coefficient analysis was applied to partition direct and indirect causes of association, which allow a detailed examination of specific forces acting to produce a given correlation and measure the relative importance of each causal character. Furthermore, such a study provides a realistic basis for allocating weightage to each attribute to decide a suitable genetic improvement criterion. In this study, path coefficient analysis was computed at genotypic and phenotypic levels for all the characters.

Path coefficient was analysed out by taking fruit yield per plant as the dependent variable to partition the correlation coefficients into direct and indirect effects to determine the contribution of different characters towards the fruit yield (Table 4). The direct and indirect effects of various characters on fruit yield indicated an agreement between the direction and magnitude of the direct effect of various characters and correlation with fruit yield per plant. Thus, a significant improvement in fruit yield can be anticipated by selecting the component characters with high positive direct effects at genotypic and phenotypic levels on fruit yield per plant. The characters *viz.*; the number of primary branches per vine, internodal length, number of marketable fruit per plant, fruit diameter, fruit length, fruit weight, and width of cavity had a positive direct effect at both genotypic and phenotypic levels on fruit yield per plant. Fruit weight, cavity width, and fruit length positively affected fruit yield per plant. However, it had a negative correlation both at genotypic and phenotypic levels due to indirect negative effect through vine length, number of primary branches per vine, internodal length, number of marketable fruit per plant, fruit diameter, fruit weight, rind thickness width of cavity and TSS. These results are in agreement with earlier studies on muskmelon by Reddy *et al.* (2017) [9] for flesh thickness, Karadi *et al.* (2017) [6] for cavity width, Mehta *et al.* (2009) [7] for main vine length at the phenotypic level, Tomar *et al.* (2008) [12] for the number of marketable fruits $plant^{-1}$. Genotypic and phenotypic residual effects observed were 0.594, 0.427, respectively. The low residual values show that the characters selected in the present experiment were appropriate.

Out of 17 characters studied in path coefficient analysis, four characters *viz.*, number of marketable fruit per plant, fruit length, number of primary branches per vine, and internodal length showed maximum direct and indirect effect compared to other characters on fruit yield per plant. Therefore, in the muskmelon improvement programme direct selection for these characters will be helpful.

Table 4: Path coefficient analysis showing direct (diagonal bold) and indirect effect at phenotypic level (P) and genotypic level (G) of different characters on fruit yield $plant^{-1}$

Character		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Vine length	P	0.031	0.005	0.005	0.006	0.006	0.011	-0.006	0.004	0.003	0.007	-0.001	0.002	0.006	0.003	0.007	0.007
	G	-0.372	-0.360	-0.203	-0.275	-0.584	-0.312	0.347	-0.129	-0.143	-0.204	-0.021	-0.280	-0.184	-0.099	-0.160	-0.169
2. No. of primary branches/vine	P	0.006	0.036	0.005	0.005	0.006	0.000	-0.006	-0.002	0.004	0.005	0.001	0.003	0.005	0.003	0.008	0.008
	G	0.896	0.836	0.352	0.616	0.025	0.513	-0.892	-0.076	0.206	0.364	0.098	0.092	0.389	0.337	0.560	0.570
3. Length of internode	P	0.003	0.002	0.017	0.004	0.000	0.001	-0.001	0.006	0.001	0.001	-0.002	0.000	0.004	0.002	0.002	0.006
	G	0.397	0.191	0.726	0.378	0.202	0.190	-0.159	0.389	0.092	0.024	-0.097	-0.002	0.302	0.132	0.153	0.364
4. No. of node at which first female flower appeared	P	-0.007	-0.005	-0.009	-0.039	-0.013	-0.011	0.006	-0.011	-0.005	-0.012	0.007	-0.011	-0.017	-0.008	-0.012	-0.005
	G	0.023	0.014	0.016	0.031	0.021	0.025	-0.030	0.018	0.014	0.027	-0.009	0.024	0.029	0.017	0.018	0.008
5. Fruit set (%)	P	0.027	0.022	0.003	0.049	0.141	0.051	-0.045	0.034	0.012	0.051	-0.007	0.072	0.030	0.017	0.023	0.016
	G	-0.702	-0.008	-0.125	-0.305	-0.447	-0.525	0.643	-0.272	-0.170	-0.404	0.347	-0.432	-0.267	-0.152	-0.207	-0.106
6.Number of marketable fruit/plant	P	0.106	-0.001	0.012	0.083	0.109	0.305	-0.113	0.089	0.007	0.119	-0.020	0.072	0.076	0.008	0.113	0.056
	G	0.805	0.283	0.876	0.691	0.923	0.941	-0.400	0.528	-0.039	0.342	-0.541	0.541	0.644	-0.041	0.848	0.883
7. Days to first fruit harvest	P	0.003	0.003	0.001	0.003	0.005	0.006	-0.016	0.001	0.003	0.007	-0.001	0.005	0.006	0.004	0.005	-0.001
	G	-0.638	-0.456	-0.150	-0.652	-0.982	-0.695	0.683	-0.195	-0.132	-0.766	0.226	-0.714	-0.546	-0.303	-0.389	0.074
8. Fruit diameter	P	0.005	-0.002	0.015	0.012	0.010	0.012	-0.002	0.043	0.006	0.013	-0.008	0.009	0.016	0.000	0.008	0.018
	G	0.071	-0.012	0.110	0.122	0.125	0.094	-0.059	0.206	0.034	0.067	-0.064	0.077	0.098	-0.003	0.042	0.095
9. Fruit length	P	0.008	0.008	0.003	0.010	0.007	0.002	-0.014	0.011	0.079	0.020	-0.016	0.018	0.019	0.066	0.000	0.016
	G	0.250	0.500	0.410	0.853	0.832	-0.038	-0.626	0.534	0.943	0.812	-0.970	1.034	0.717	2.896	-0.082	0.869
10. Fruit weight	P	0.126	0.080	0.018	0.172	0.197	0.212	-0.256	0.161	0.134	0.544	-0.098	0.206	0.255	0.179	0.244	-0.003
	G	0.276	0.137	0.016	0.437	0.455	0.353	-0.565	0.163	0.188	0.503	-0.174	0.326	0.284	0.195	0.252	-0.004
11. Rind thickness	P	0.002	-0.001	0.007	0.011	0.003	0.004	-0.004	0.011	0.012	0.011	-0.060	0.013	0.003	0.015	0.012	0.011
	G	-0.049	-0.065	0.118	0.263	0.681	0.406	-0.291	0.274	0.534	0.304	-0.879	0.413	0.143	0.585	0.306	0.283
12. Flesh thickness	P	-0.005	-0.005	-0.001	-0.019	-0.034	-0.016	0.019	-0.014	-0.015	-0.025	0.014	-0.067	-0.018	-0.011	-0.006	0.001
	G	-0.836	-0.122	0.004	-0.950	-0.714	-0.848	0.852	-0.661	-0.565	-0.848	0.832	-0.773	-0.948	-0.385	-0.322	0.098
13. Width of cavity	P	0.038	0.030	0.046	0.086	0.042	0.049	-0.078	0.073	0.048	0.092	-0.009	0.053	0.197	0.063	0.032	0.009
	G	0.107	0.063	0.090	0.201	0.129	0.106	-0.173	0.103	0.048	0.122	-0.035	0.116	0.216	0.072	0.033	0.012
14. Length of cavity	P	-0.014	-0.010	-0.014	-0.028	-0.016	-0.004	0.035	-0.001	-0.114	-0.045	0.035	-0.023	-0.044	-0.138	-0.023	-0.008
	G	-0.691	-0.653	-0.469	-0.7431	-0.877	0.032	0.950	0.036	-0.912	-0.904	0.722	-0.562	-0.860	-0.589	-0.462	-0.152
15. TSS	P	0.003	0.003	0.002	0.004	0.002	0.005	-0.004	0.003	0.0004	0.006	-0.003	0.001	0.002	0.002	0.014	0.001
	G	-0.451	-0.440	-0.220	-0.614	-0.485	-0.643	0.597	-0.212	0.027	-0.525	0.364	-0.190	-0.161	-0.187	-0.848	-0.086
16. Shelf life	P	0.011	0.011	0.018	0.007	0.006	0.009	0.002	0.021	0.010	0.0003	-0.009	-0.001	0.002	0.003	0.004	0.051
	G	-0.947	-0.979	-0.870	-0.691	-0.599	-0.669	-0.273	-0.870	-0.678	0.021	0.814	0.140	-0.144	-0.149	-0.209	-0.991
17. Fruit yield/plant	P	0.343**	0.175	0.126	0.366**	0.469**	0.636**	-0.483**	0.427**	0.184	0.793**	-0.174	0.352**	0.543**	0.207*	0.431**	0.182
	G	0.838**	0.329**	0.281**	0.874**	0.907**	0.830**	-0.995**	0.537**	0.345**	0.936**	-0.387**	0.809**	0.327**	0.532**	0.532**	0.209*
Partial R^2	P	0.011	0.006	0.002	-0.014	0.066	0.194	0.008	0.018	0.015	0.432	0.010	-0.024	0.107	-0.029	0.006	0.009
	G	-0.311	0.440	0.204	0.027	-0.495	2.772	-0.816	0.110	1.120	0.471	0.341	-1.434	0.154	-0.847	-0.558	-0.530

Residual Effect: Phenotypic level = 0.427; Genotypic level = 0.594 * and ** Significant at 5% and 1% level, respectively

References

1. Anonymous. Directorate of Agriculture and corporation, Ministry of Agriculture and Farmer Welfare, New Delhi 2018-19.
2. Bhatt GM. Significance of path coefficient analysis in determining the nature of character association. Euphytica 1973;22:338-343.
3. Chadha K, Lal T. Improvement of cucurbits. Advances in Horticulture, Eds. Chandha K L and Kalloo G, Malhotra Publishing House, New Delhi 1993;5(1):137-144.
4. Choudhary BR, Fageria MS, Dhaka RS. Correlation and path coefficient analysis in muskmelon (*Cucumis melo* L.). Indian J Hort 2004;61(2):158-162.
5. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J 1959;51:515-518.
6. Karadi SM, Ganiger VM, Bhuvaneshwari G, Hadimani HP, Madalageri MB, Pallavi HM. Path analysis and diversity studies for growth, earliness, yield and quality parameters in wild melon (*Cucumis melo* subsp. agrestis) genotypes. Inter. J Curr. Micro. & App. Sci 2017;6(12):1612-1618.
7. Mehta R, Singh D, Bhalala MK. Correlation and path analysis in muskmelon. Indian J Hort 2009;66(3):396-399.
8. Pandey S, Rai M, Singh B. Genetic variability and character association in muskmelon (*Cucumis melo* L.). Indian J Pl. Gen. Res 2005;18(2):212-216.
9. Reddy KPB, Begum H, Sunil N, Reddy T. Correlation and path coefficient analysis in muskmelon (*Cucumis melo* L.). Inter. J Cur. Micro. & App. Sci 2017;6(6):2261-2276.
10. Searle SR. Phenotypic, genetic and environmental correlations. Inter. Biometric Soc 1961;17(3):474-480.
11. Singh SP. Broadening the genetic base of common bean cultivars. Crop Sci 2001;41:1659-1675.
12. Tomar RS, Kulkarni GU, Kakade OK, Patel AD, Acharya RR. Genetic divergence in muskmelon (*Cucumis melo*L.). Asian J Hort 2008;3(1):103-105.
13. Wright S. Correlation and causation. J Agric. Res 1921;20:557-585.