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

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ABSTRACT

Yield per plant had significant positive correlation with fruit weight, fruits per plant, number of vines per plant, harvest duration, rind thickness, shelf-life and vine length. Path analysis revealed that fruit weight, fruits per plant, rind thickness, incidence of fruit fly, TSS, days to first fruit harvest, severity of powdery mildew, flesh thickness, severity of downy mildew and shelf-life showed positive direct effect on yield per plant while other characters had negative direct effect. Therefore, it is suggested that fruit weight and number of fruits per plant are the main components of yield and should be given high priority in the selection programme.

Key words: Correction studies, muskmelon, path coefficient analysis

INTRODUCTION

Muskmelon is one of the most important cucurbits grown as a 'Dessert crop' throughout the warmer regions of the world. However, some important parameters *viz.*, resistance against powdery mildew, downy mildew and fruit fly, yield and quality are yet to be improved in this crop. Hence, before aiming an improvement in the crop, it is necessary to have knowledge of association of various components with yield and among them. The knowledge of correlation alone does not reveal the real picture of the dependence of one character on the other. Thus, the understanding of direct and indirect effects of important yield contributing traits is of considerable importance for selecting high yielding genotypes. Some reports are available on correlation and path analysis studies in muskmelon (Singh and Nandpuri, 11; Kalloo *et al.*, 7; Swamy, 14; More *et al.*, 9; Vijay, 15; Kitroongruang, *et al.*, 8., Dhaliwal *et al.*, 3; Somkuwar *et al.*, 13). In continuity of these reports, the present study was made in depth to determine the correlation and path coefficient analysis in a set of 8 parents of muskmelon and their 28 F_1s under semi-arid conditions of Rajasthan.

MATERIALS AND METHODS

Eight parental lines namely MSi, RM-43, MHY-3, Punjab Sunehri, Jobner Local, Hara Madhu, Tonk Local and Durgapura Madhu and 28 F_1s were grown at Horticulture Farm, S.K.N. College of Agriculture, Jobner in a randomized block design with three replications during summer seasons of 2001-02. All the recommended cultural and management practices were followed to raise a healthy crop. Five competitive plants were selected randomnly in each row for recording observations. on parameters namely, vine length (m), number of vines per plant, days to first female flower appearance, days to first fruit harvest, average weight of first three harvested fruit (kg), number of marketable fruits per plant, yield per plant (kg), harvest duration (days), size of seed cavity (cm), rind thickness (cm), flesh thickness (cm), TSS (%), shelf-life (days), severity of downy mildew, severity of powdery mildew and incidence of fruit fly. Correlation coefficient was worked out using the formula given by Singh and Chaudhary (12) and path coefficient as suggested by Dewey and Lu (2).

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RESULTS AND DISCUSSION

The phenotypic and genotypic correlation coefficients between yield per plant and its components are presented in Table 1. It is indicated that the magnitude of genotypic correlation coefficients for most of the character pairs are higher than their respective value of the phenotypic correlation coefficients, which may be ascribed to the low effect of environment on the character expression.

The results indicated that yield per plant had significant positive correlation with vine length, number of vines per plant, fruit weight, fruits per plant, harvest duration, rind thickness and shelf-life. Similar, significant and positive correlation of fruit yield have been earlier reported with number of fruits, fruit weight and vine length (Singh and Nandpuri, 11); with fruit weight and length of main creeper (Chhonkar *et al.*, 1); with number of fruits, fruit weight, number of branches and vine length (Kalloo *et al.*, 7); with number of fruits, fruit weight, vine length and number of primary branches (Swamy, 14); with number of fruits, fruit weight, TSS and flesh thickness (Vijay, 15); with number of fruits (Kitroongruang *et al.*, 8) and with fruit weight, fruits per vine and flesh thickness (Dhaliwal *et al.*, 3).

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among different characters in muskmelon.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Vine length	-	0.140	0.165	0.089	0.299*	0..215	0.32**	0.176	-0.122	0.468**	0.109	0.010	0.395**	0.361**	0.269*	-0.387**
2. Vines/ plant	0.176	-	-0.432*	-0.450*	0.505**	0.354**	0.551**	0.706**	-0.369**	0.009	0.330**	0.410**	0.029	-0.207	-0.151	0.016
3. Days to 1st female flower	0.206	-0.530**	-	0.878**	-0.146	-0.115	-0.161	-0.580**	0.496**	0.007	-0.355**	-0.343**	-0.019	0.301*	0.343**	-0.015
4. Days to first fruit harvest	0.096	-0.551**	0.917**	-	-0.268*	-0.144	-0.267*	-0.571**	0.511**	-0.083	-0.285*	-0.272*	-0.081	0.268*	0.365**	-0.015
5. Fruits weight	0.444**	0.729**	-0.167	-0.283*	-	0.215	0.849**	0.545**	-0.293*	0.340**	0.260*	0.040	0.290*	-0.015	0.083	-0.222
6. Fruits/plant	0.339**	0.588**	-0.177	-0.206	0.279*	-	0.692**	0.249*	-0.146	0.187	-0.40	0.358**	0.239*	-0.039	-0.032	-0.165
7. Yield/plant	0.486**	0.823**	-0.207	-0.308**	0.917**	0.633**	-	0.525**	-0.297*	0.348**	0.160	0.206	0.342**	-0.035	0.053	-0.240*
8. Harvest duration	0.235*	0.931**	-0.668**	-0.623**	0.646**	0.430**	0.690**	-	-0.384**	0.109	0.405**	0.388**	0.080	-0.022	0.071	-0.045
9. Size of seed cavity	-0.271*	-0.774**	1.136**	1.165**	-0.730**	-0.534**	-0.811**	-0.887**	-	-0.185	-0.335**	-0.0999	-0.118	0.101	0.130	0.153
10. Rind thickness	0.527**	0.026	0.011	-0.081	0.383**	0.287*	0.426**	0.122	-0.370**	-	0.027	-0.265*	0.874**	0.413**	0.304**	-0.886**
11. Flesh thickness	0.053	1.078**	-0.806**	-0.802**	0.851**	0.333**	0.808**	1.257**	-1.145**	0.031	-	0.172	-0.039	0.001	0.073	0.006
12. TSS	0.003	0.629**	-0.382**	-0.299*	0.011	0.464**	0.189	0.483**	-0.306**	-0.301*	0.340**	-	-0.252*	-0.290*	-0.312**	0.189
13. Shelf-life	0.535**	0.039	-0.011	-0.111	0.359**	0.304**	0.414**	0.148	-0.484**	1.054**	0.148	-0.300*	-	0.360**	0.267*	-0.807**
14. Downy mildew severity	0.402**	-0.251*	0.311**	0.277**	-0.016	-0.072	-0.049	-0.023	0.210	0.438**	-0.014	-0.323**	0.426**	-	0.804**	-0.456**
15. Powdery mildew severity	0.303**	-0.192	0.355**	0.382**	0.101	-0.021	0.081	0.329**	0.319**	0.190	-0.336**	0.290*	0.824**	-	-0.331**	→
16. Fruit fly incidence	-0.443**	0.025	-0.097	-0.022	-0.255*	-0.264*	-0.303**	-0.029	0.189	-0.948**	0.077	0.205	-0.986**	-0.484**	-0.337**	-

*, **Significant at 5% and at 1% levels.

Table 2. Estimates of direct and indirect effects at phenotypic (P) and genotypic (G) levels of various traits with fruit yield/plant (kg).

Character		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Correlation with yield
1. Vine length	P	-0.010	-0.001	-0.002	0.001	0.221	0.116	-0.002	0.002	0.013	-0.001	0.000	0.007	-0.008	0.010	-0.020	0.325**
	G	-0.062	-0.018	0.000	0.002	0.386	0.146	-0.002	0.000	0.114	0.001	0.000	0.002	0.004	0.005	-0.092	0.484**
2. Vines/ plant	P	-0.001	-0.004	0.006	-0.006	0.373	0.190	-0.009	0.006	0.000	-0.004	-0.001	0.000	0.005	-0.006	0.001	0.551**
	G	-0.001	-0.102	0.000	-0.010	0.632	0.254	-0.009	0.001	0.006	0.011	0.051	0.000	-0.002	-0.003	0.005	0.823**
3. Days to first female flower	P	-0.002	0.002	-0.013	0.011	-0.108	-0.062	0.007	-0.008	0.000	0.004	0.001	0.000	-0.007	0.013	-0.004	-0.166
	G	-0.013	0.054	-0.001	0.017	-0.145	-0.076	0.006	-0.001	0.002	-0.008	-0.031	0.000	0.003	0.005	-0.020	-0.207
4. Days to first fruit harvest	P	-0.001	0.002	-0.011	0.012	-0.198	-0.077	0.007	-0.009	-0.002	0.004	0.001	-0.001	-0.006	0.013	-0.001	-0.267*
	G	-0.006	0.056	-0.001	0.019	-0.245	-0.089	0.006	-0.001	-0.018	-0.008	-0.024	0.000	0.003	0.006	-0.005	-0.308**
5. Fruit weight	P	-0.003	-0.002	0.002	-0.003	0.739	0.116	-0.007	0.005	0.010	-0.003	0.000	0.005	0.002	0.003	-0.011	0.849**
	G	-0.028	-0.074	0.000	-0.005	0.868	0.120	-0.006	0.001	0.083	0.008	0.001	0.001	0.000	0.002	-0.053	0.917**
6. Fruits/plant	P	-0.002	-0.001	0.001	-0.002	0.159	0.537	-0.003	0.002	0.005	0.000	-0.001	0.004	0.001	-0.001	-0.008	0.692**
	G	-0.021	-0.060	0.000	-0.004	0.242	0.432	-0.004	0.001	0.062	0.003	0.038	0.001	-0.001	0.000	-0.055	0.633**
7. Harvest duration	P	-0.002	-0.003	0.007	-0.007	0.402	0.133	-0.013	0.007	0.003	-0.005	-0.001	0.001	0.000	0.003	-0.002	0.525**
	G	-0.015	-0.095	0.000	-0.012	0.560	0.186	-0.009	0.001	0.026	0.012	0.039	0.001	0.000	0.001	-0.006	0.690**
8. Size of seed cavity	P	0.001	0.001	-0.006	0.006	-0.217	-0.079	0.005	-0.017	-0.005	0.004	0.000	-0.002	-0.002	0.005	0.008	-0.297*
	G	0.017	0.079	-0.001	0.022	-0.633	-0.231	0.003	-0.001	-0.080	-0.011	-0.025	-0.002	0.002	0.005	0.039	-0.811**
9. Rind thickness	P	-0.005	0.000	0.000	-0.001	0.251	0.100	-0.001	0.003	0.028	0.000	0.001	0.015	-0.009	-0.011	-0.045	0.348**
	G	-0.033	-0.003	0.000	-0.003	0.332	0.124	-0.001	0.000	0.216	0.000	-0.024	0.004	0.004	0.005	-0.198	0.426**
10. Flesh thickness	P	-0.001	-0.001	0.005	-0.005	0.192	-0.022	-0.005	0.006	0.001	-0.012	0.000	-0.001	0.000	0.003	0.000	0.160
	G	-0.003	-0.110	0.001	-0.015	0.739	0.144	-0.012	0.001	0.007	0.010	0.028	0.001	0.000	0.003	0.016	0.808**
11. TSS(%)	P	0.000	-0.002	0.004	-0.003	0.029	0.192	-0.005	0.002	-0.008	-0.002	-0.002	-0.004	0.007	-0.011	0.010	0.206
	G	0.000	-0.064	0.000	-0.006	0.009	0.200	-0.005	0.000	-0.065	0.003	0.081	-0.001	-0.003	-0.005	0.043	0.189
12. Shelf-life	P	-0.004	0.000	0.000	-0.001	0.214	0.128	-0.001	0.002	0.025	0.000	0.001	0.017	-0.008	0.010	-0.041	0.342**
	G	-0.033	0.004	0.000	-0.0002	0.312	0.131	-0.001	0.001	0.228	0.001	-0.024	0.004	0.004	0.004	-0.206	0.414**
13. Downy mildew severity	P	-0.004	0.001	-0.004	0.004	-0.011	-0.021	0.000	-0.002	0.012	0.000	0.001	0.006	-0.023	0.029	-0.023	-0.035
	G	-0.025	0.026	0.000	0.005	-0.014	-0.031	0.000	0.000	0.095	0.000	-0.026	0.002	0.009	0.012	-0.101	-0.049
14. Powdery mildew severity	P	-0.003	0.001	-0.004	0.005	0.061	-0.017	-0.001	-0.002	0.009	-0.001	0.001	0.005	-0.018	0.037	-0.017	0.053
	G	-0.019	0.020	0.000	0.007	0.087	-0.009	-0.001	0.000	0.069	0.002	-0.027	0.001	0.008	0.015	-0.070	0.081
15. Fruit fly incidence	P	0.004	0.000	0.001	0.000	0.164	-0.088	0.001	-0.003	-0.025	0.000	0.000	-0.014	0.010	-0.012	0.051	-0.240*
	G	0.028	-0.003	0.000	0.000	-0.222	-0.114	0.000	0.000	-0.205	0.001	0.017	-0.004	-0.004	-0.005	0.209	-0.303**

Residual effects : Phyenotypic = 0.0056, Genotypic = 0.0015. The diagnonals are the directs effects and the remaining indirect effects.

*, **Significant at 5% and 1% levels.

Among other attributes, the vine length showed positive and significant correlation with fruit weight, yield per plant, rind thickness, shelf-life and severity of downy and powdery mildew incidence. Days to first female flower exhibited significant positive correlation with days to first fruit harvest, size of seed cavity, severity of downy mildew and severity of powdery mildew and significant negative with vines per plant, harvest duration, flesh thickness and TSS. Fruit weight showed significant positive association with vine length, vines per plant, yield per plant, harvest duration, rind thickness, flesh thickness and shelf-life. Earlier, Vijay (15) reported positive correlation of fruit weight with flesh thickness, vine length, TSS and days to flowering.

Number of fruits per plant showed significant positive correlation with vines per plant, yield per plant, harvest duration, TSS and shelf-life. Similar, findings of positive correlation between fruits per vine and TSS was reported by Dhaliwal *et al.* (3). Harvest duration exhibited significant positive association with vines per plant, fruit weight, fruits per plant, yield per plant, flesh thickness and TSS.

The severity of downy mildew and powdery mildew had significant and positive correlation with vine length, days to first female flower, days to first fruit harvest, rind thickness and shelf-life. Similarly, the positive association of downy mildew and powdery mildew with days to first picking as observed in the present study was also reported by Dhiman *et al.* (4). Severity of downy mildew and powdery mildew was found to be significantly and negatively correlated with TSS and incidence of fruit fly. Similar correlation of powdery mildew with TSS has also been reported by Gill (5) in muskmelon genotypes.

The incidence of fruit fly showed highly significant and negative association with rind thickness means low infestation of fruit fly on the parents and F_1s having hard rind. The role of rind thickness in muskmelon was also reported by and Pareek and Kavadia (10). They reported that though egg lying was there but no losses to the fruits. This may be probably attributed to the thickness and hardening of the rind in due course of time, which might have prevented to pierce the hard rind of the fruits, development of maggots and their easy exit. This study reflects that the correlation is influenced greatly by the kind and extent of diversity in the genetic stocks of muskmelon.

The path coefficient analysis (Table 2) revealed that the characters like fruit weight, number of fruits per plant, rind thickness, flesh thickness, shelf-life, which had positive correlation with fruit yield per plant also exerted positive and direct effects on fruit yield per plant at genotypic level. This confirmed the role of above characters in determining the fruit yield and therefore, are valuable in constructing the selection criteria. The other characters that had direct positive effect on yield per plant are rind thickness, TSS, severity of downy mildew, severity of powdery mildew and incidence of fruit fly. However, the characters like vine length, number of vines per plant, days to first female flower, harvest duration and size of seed cavity had negative indirect effect on fruit yield per plant. Earlier, positive direct effect on fruit yield has been reported by Kalloo *et al.* (6) for number of fruits per plant and fruit weight; More *et al.* (9) for flesh thickness; Vijay (15) for number of fruits per plant, fruit weight, flesh thickness and incidence of fruit fly and Somkuwar *et al.* (13) for fruit weight and number of fruits per plant. Vijay (15) reported negative direct effect for TSS, vine length, days to flowering and maturity. Thus most of these studies support the present findings.

The residual effect at genotypic level was very low, which indicated that in this experiment adequate variables have been included. Though, at phenotypic level it has high value, which was mainly due to the effect of environment.

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