Correlation and Path Coefficient Studies in Pomegranate (*Punica granatum* L.) Germplasm

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Twenty four genotypes were taken in a randomized block design with three replications to estimate the correlation and path analysis among ten characters. The correlation studies revealed that the characters viz., weight of 100 arils, juice content, total soluble solids, total sugars and ascorbic acid content showed highly significant positive correlation with the average fruit weight and among themselves both at phenotypic and genotypic levels. The path coefficient analysis at genotypic level revealed that the total sugars had the maximum positive direct effect, while juice content showed the minimum positive indirect effect via seed content on average fruit weight. Whereas, the maximum negative direct effect on average fruit weight was noted for the seed content.

Key Words: Pomegranate, Correlation, Path analysis

Pomegranate (*Punica granatum* L.) is valued for its refreshing juice with nutritional and medicinal properties. Its fruits also have excellent keeping quality with pleasant flavour and attractive colour. The aril is the edible portion, containing about 50 to 55 per cent juice content, which is rich source of sugars, ascorbic acid and several minerals (Prasad and Mali, 2000). For successful hybridization programme with efficient utilization of the resources and the knowledge of association of different characters is the most useful requisite (Desai *et al.*, 1992).

The character association and path coefficient analysis helps in indirect selection for the required trait. However, reports on evaluation of pomegranate germplasm are quite frequent in literature, yet an attempt has been made in the present study to know the correlation coefficient and path analysis for average fruit weight and other characters.

Materials and Methods

The experimental material comprised of twenty four genotypes, which were evaluated in a randomized block design with three replications maintaining a spacing of 5 m x 5 m during 1999-2000 and 2000-2001 at the experimental orchard of the Division of Fruit and Horticultural Technology, Indian Agricultural Research Institute, New Delhi. Observations were recorded on three randomly selected plants for ten characters viz., average fruit weight, seed content, weight of 100 arils, weight of 100 seeds, juice content, total soluble solids, acidity, total sugars, ascorbic acid and tannin contents. The mean values were used to compute the analysis of variance and covariance as prescribed by Panse and Sukhatme (2000). The correlation coefficient analysis among different characters was computed as method suggested by Al-Jibouri *et al.* (1958), while path analysis was worked out as per model given by Dewey and Lu (1959).

Results and Discussion

The phenotypic and genotypic correlation coefficients among average fruit weight and other characters are presented in Table 1. All the traits showed highly significant correlations, both positive and negative with average fruit weight and among themselves. Furthermore, the genotypic associations were higher in magnitude than the corresponding association at phenotypic level (Pandey and Bist, 1998). The genotypic correlation chiefly results from linkage, pleiotropic actions of genes and effect of selection. They acted either individually or jointly. It is therefore, necessary to have precise information to choose appropriate average fruit weight and quality contributing characters in pomegranate improvement programmes.

The genotypic correlations were further partitioned into direct and indirect effects to establish the cause and effect relationship among average fruit weight and its component characters. The results of path analysis at genotypic level are presented in Table 2. The genotypic path coefficient analysis indicated that the total sugars had the maximum positive direct effect on the average fruit weight followed by ascorbic acid content. Whereas, juice content and weight of 100 arils via seed content exhibited positive indirect effect on the average fruit weight. Thus, significant positive correlations were also observed for these characters with average fruit weight. Therefore, these traits deserve top most consideration

Table 1. Estimates of phenotypic (p) and genotypic (g) correlation coefficient for fruit weight and quality characters in pomegranate genotypes

Character		Average fruit weight	Seed content (%)	Weight of 100 arils (g)	Weight of 100 seeds (g)	Juice content (%)	TSS (° Brix)	Acidity (%)	Total sugars (%)	Ascrobic acid (mg per 100 ml juice)	Tannins (mg per 100 ml juice)
Average fruit weight (g)	p	1.00	-0.935**	0.903**	-0.902**	0.845**	0.624**	-0.733**	0.668**	0.802**	-0.690**
	g	1.00	-0.949**	0.915**	-0.924**	0.913**	0.829**	-0.740**	0.734**	0.888**	-0.695**
Seed content (%)	p		1.00	-0.939**	0.940**	-0.895**	-0.595**	0.697**	-0.608**	-0.807**	0.735**
	g		1.00	-0.959**	0.970**	-0.968**	-0.788**	0.711**	-0.663**	-0.902**	0.745**
Weight of 100 arils (g)	p			1.00	-0.948**	0.901**	0.674**	-0.750**	0.695**	0.816**	-0.771**
	g			1.00	-0.980**	0.984**	0.927**	-0.764**	0.775**	0.920**	-0.786**
Weight of 100 seeds (g)	p				1.00	-0.865**	-0.675**	0.734**	-0.681**	-0.787**	0.796**
	g				1.00	-0.952**	-0.896**	0.756**	-0.759**	-0.896**	0.811**
Juice content (%)	p					1.00	0.642**	-0.748**	0.560**	0.814**	-0.731**
	g					1.00	0.895**	-0.812**	0.658**	0.981**	-0.783**
TSS (° Brix)	p						1.00	-0.683**	0.649**	0.605**	-0.554**
	g						1.00	-0.898**	0.934**	0.902**	-0.728**
Acidity (%)	p							1.00	-0.639**	-0.729**	0.554**
	g							1.00	-0.692**	-0.805**	0.564**
Total sugars (%)	p								1.00	0.542**	-0.514**
	g								1.00	0.643**	-0.565**
Ascorbic acid (mg per 100 ml juice)	p									1.00	-0.632**
	g									1.00	-0.710**
Tannins (mg per 100 ml juice)	p										1.00
	g										1.00

** Significant at 1% level

Table 2. Genotypic path coefficient analysis (direct and indirect effects) for average fruit weight (g) and other characters

Character	Seed content (%)	Weight of 100 arils (g)	Weight of 100 seeds (g)	Juice content (%)	TSS (° Brix)	Acidity (%)	Total sugars (%)	Ascrobic acid (mg per 100 ml juice)	Tannins (mg per 100 ml juice)	Genotypic correlation with average fruit weight (g)
Seed content (%)	**-1.141**	0.776	0.118	-0.181	0.084	0.001	-0.303	-0.278	-0.027	-0.949**
Weight of 100 arils (g)	1.094	**-0.809**	-0.120	0.184	-0.099	-0.001	0.354	0.284	0.028	0.915**
Weight of 100 seeds (g)	-1.106	0.793	**0.122**	-0.178	0.096	0.001	-0.347	-0.276	-0.029	-0.924**
Juice content (%)	1.105	-0.796	-0.116	**0.187**	-0.096	-0.001	0.301	0.302	0.028	0.913**
TSS (° Brix)	0.899	-0.750	-0.109	0.167	**-0.107**	-0.001	0.427	0.278	0.026	0.829**
Acidity (%)	-0.811	0.618	0.092	-0.152	0.096	**0.001**	-0.316	-0.248	-0.020	-0.740**
Total sugars (%)	0.756	-0.627	-0.093	0.123	-0.100	-0.001	**0.457**	0.198	0.020	0.735**
Ascorbic acid (mg per 100 ml juice)	1.029	-0.745	-0.109	0.183	-0.097	-0.001	0.294	**0.308**	0.026	0.888**
Tannins (mg per 100 ml juice)	-0.850	0.637	0.099	-0.146	0.078	0.001	-0.258	-0.219	**-0.036**	-0.695**

Residual effect: 0.0556; Bold letters denote direct effects
** Significant at 1% level

in the selection programmes for the improvement of average fruit weight in pomegranate. These results are in consonance with the findings of Desai *et al.* (1994) and Karale and Desai (2000). As regards the residual effect, it was seen that apart from the variables under study, there could be certain factors influencing the average fruit weight as was evident from the estimates of the residual effect of + 0.0556.

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