

Original Research Article

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Correlation between Different Morphological Traits of Pomegranate (*Punica granatum*)

Shaili Kumari*, M.R. Dinesh, B.N.S. Murthy, K.M. Shankaran,
D.C. Lakshmana Reddy, K.S. Shivashankara, Kanupriya and K.K. Upreti

Division of Fruit Crops, ICAR-IIHR, Hesaraghatta, Bengaluru, 560089, Karnataka, India

*Corresponding author:

ABSTRACT

Keywords

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Pomegranate is quite popular among consumer for its striking, sweet acidic taste and refreshing arils. Pomegranate is one of the ancient fruit crops which were originated in Iran. Total 151 pomegranate genotypes along with their hybrid parents (Bhagwa, DF, Nana) combinely 154 used for morphological characterization. Total 13 morphological parameters were used for characterization and Analysis of Variance, mean comparison and simple correlations were analysed. Significance differences ($P \leq 0.05$) were found among all the genotypes of pomegranate. Highest critical differences at 5% were 13.21 (Fruit weight), 11.98 (Aril %), 2.552Thorn {No/Shoot length (m)} recorded and lowest in leaf blade width 0.143, 0.145 in leaf blade length, 0.456 in fruit length and 0.48 in seed hardness respectively. Plant growth parameters, leaf parameters and fruit parameters are significantly correlated to each other. Fruit weight and seed hardness was negatively correlated to each other ($r = -0.42$). Those fruit have larger size and weight have less seed hardness. Fruit characteristics are negatively correlated with leaf characteristics ($r = -0.22$). The largest the leaf size smallest the fruit size.

Introduction

Pomegranate is quite popular among consumer for its striking, sweet acidic taste and refreshing arils. Pomegranate is one of the ancient fruit crops which were originated in Iran. Now a day its demand is growing for the processing purpose (Pruthi and saxena, 1984). It can produce fruit in Tropical, subtropical and temperate conditions. Pomegranate can produce fruit up to 1800 msl (Sharma and Sharma 1990). Pomegranate is classified under often cross pollinated crop but still have

narrow genetic base, only two species existing under Punicaceae family *Punica granatum* and *Punica protopunica*. So far a very less number of varieties were developed through systematic hybridization. Earlier reported chromosome number of cultivated species *Punica granatum* was $2n=2x=16, 18$ (Singh, 2004). Shieldi *et al.*, (2005) observed chromosome number in his study was $2n=2x=16$. Universely pomegranate has gained commercial importance for their physico chemical characteristics. Pomegranate fruit colour varies from yellow (Ganesh) to red

(Bhagwa) and average fruit weight was about 250-300g (Patil *et al.*, 2013). Aril colour varies from white to dark red. Ovate, oval and round fruit shape was observed in pomegranate. Aril taste varies from sweet (Bhagwa) to sour insipid (Daru, Nana) (Saxena *et al.*, 1987). TSS recorded in Ganesh, Arakta and kesar was 14.5 °B, 13 °B, 14 °B with 0.57, 0.59, and 0.59 per cent acidity, 10.4, 10.2 and 9.65 % total sugars, 8.40, 8.00 and 7.3 % reducing sugars, 2.00, 2.20 and 2.35 % non-reducing sugars (Patil *et al.*, 2005). Jagtap *et al.*, (1992) analysed 29 pomegranate cultivars for their growth and fruit characters and classify the genotypes into the following growth habit (spreading, erect, semi-spreading), foliage nature (Deciduous, semi-deciduous, evergreen). He observed that growth habit of tree based on height to spread ratio. Thakur *et al.*, (2010) used twenty pomegranate cultivars from Iran for their biochemical traits and antioxidant activity. The experiment reported that significant differences among the cultivars. Ercisli *et al.*, (2011) evaluated pomegranate fruit physical characteristics to recognise that which parameters are related to size. Fruit parameters, like fruit volume and weight, aril weight and number, pericarp weight, seed weight, and juice/pulp content, were assessed in a sample of fruits of variable sizes of 'Wonderful' pomegranate. Results showed that fruit volume, fruit weight, and total aril weight were correlating each other. Any one of these characteristics can be considered as an indicator of fruit size. Among them arils numbers per fruit was highly correlated with fruit size.

Materials and Methods

Total 151 pomegranate genotypes along with their hybrid parents (Bhagwa, DF, Nana) combinely 154 conserved at Division of Fruit crops, IIHR, Bengaluru, were be used for morphological characterization. The details of this genotype are given in Table 1 is used for

characterization. Total 13 morphological parameters were used for characterization; these are as follows plant height, plant spread, growth habit, thorn no/shoot length, Fruit weight (g), Fruit length (cm), Fruit width (cm), Fruit peel thickness(mm), Aril(%), Seed hardness (N/mm), Leaf blade length (cm), Leaf blade width (cm), Petiole length (mm). Analysis of Variance, mean comparison and simple correlations were analysed in SPSS and SAS software (Mehr *et al.*, 2012).

Results and Discussion

Significance differences ($P \leq 0.05$) were found among all the genotypes of pomegranate (Table 2). There was the quite variation in the mean and range of different plant characteristics which enlisted in Table 3. Highest critical differences at 5% were 13.21 (Fruit weight), 11.98 (Aril %), 2.552 Thorn (No/Shoot length (m)) recorded and lowest in leaf blade width 0.143, 0.145 in leaf blade length, 0.456 in fruit length and 0.48 in seed hardness respectively. The result obtained was quite similar to result obtained in the research of (Karimi *et al.*, 2009).

The correlation between each pair of trait was calculated enlisted in Table 3. Vegetative growth parameters like plant height and plant spread was positively correlated with each other. Correlation between plant height and plant spread ($r = +0.23$). Growth habit of plant was determined based on height and spread ration (Jagtap *et al.*, 1992). Thorn (No/shoot length (m)) was one of the important vegetative characteristics of pomegranate and it negatively correlated with plant spread and growth habit ($r = -0.085$) and ($r = -0.20$). Leaf parameter was positively correlated with each other. Leaf length and leaf breadth are significantly correlated with each other ($r = +0.81$) and leaf width and leaf length was positively correlated petiole length ($r = +0.75$) and ($r = +0.88$).

Table.1 Pomegranate genotypes used for morphological characterization

Group of genotypes	Genotypes name
Hybrid (Bhagwa DF x Nana)	9/8,14/20,18/16, 9/14, 15/2,18/20,9/16,15/4,9/7,11/10,15/7,11/8,12/5,15/18,12/6, 12/10,16/3,13/6,12/12,16/4,14/8,13/3,16/5,15/5 13/4,16/10,14/2,13/11,16/20,15/1,13/12,17/6,16/1,13/20,17/13,17/2 14/6,17/18,17/3,14/11,9/6,17/7,14/12,18/1,18/3,14/16,18/4,18/5,14/19,18/10
Mutant (Gamma Irradiated Bhagwa cutting)	1/1,5/6,11/10,1/8,5/13,11/17,1/10,5/19,11/18,1/18, 6/4,12/1,1/19,7/5,12/22/13,7/8,12/5,2/14,7/12,12/7, 2/19, 7/19,13/13,3/2,8/8,13/16,3/6,8/10, 13/19,3/18,8/11,14/2, 4/6,8/18,14/8,4/11,9/7,14/14,4/19,9/10,14/19,5/1 10/9,15/7,5/2,10/13,15/9,5/5,10/18
Wild (Daru type)	318766,318758,318798,318775,318767,318700,318776,318732,318790318787,318701,318703,318784,318708,318762,318741,318708A,318735 318741A,318733,318768,318717,318760,318744,318736,318760,318807318752,318712,318699,318705,318753,318711,318797,318738, 318749318464,318716,318696,318791,318709,318771,318759,318951,318750318559,318697,318875,318758,318754,318713

Table.2 Evaluation of pomegranate genotypes for their economic traits

Sl. No.	Parameter	Mean	Range		SEm ±	C.D. at 5%
			Minimum	Maximum		
1.	Plant height (m)	3.3(m)	0.535(Nana)	4.74(318760)	0.041	0.115
2.	Plant spread(m)	2.05(m)	0.555(Nana)	3.55(318766)	0.027	0.074
3.	Thorn(No /Shoot length(m)	16	5(12/5)	38(14/11)	0.902	2.552
4.	Fruit weight(g)	98.30	20.05(318701)	362.78(14/12)	4.724	13.21
5.	Fruit length(cm)	5.63	3.4(318735)	8.93(318713)	0.163	0.456
6.	Fruit width(cm)	5.24	3.55(318735)	9.033(318713)	0.171	0.477
7.	Fruit Peel Thickness(mm)	2.35	1.15(18/1)	4.305(14/12)	0.068	1.913
8.	Aril(%)	235	57(318699)	778(15/18)	4.11	11.98
9.	Seed hardness(N/mm)	10.56	4.4(Bhagwa)	19.6(318750)	0.172	0.48
10.	Leaf blade length(cm)	4.48	1.72(Nana)	6.35(318699)	0.052	0.145
11.	Leaf blade width(cm)	1.44	0.65(Nana)	2.43(318699)	0.044	0.143
12.	Petiole length(mm)	4.13	1.52(Nana)	6.46(318699)	0.059	0.164

Table.3 Bivariate correlations among 13 morphological traits in pomegranate genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1												
2	0.233445	1											
3	-0.70729	0.470473	1										
4	0.171299	-0.08588	-0.20009	1									
5	-0.31291	0.204525	0.399311	-0.24291	1								
6	-0.18373	0.275369	0.268283	-0.26272	0.759172	1							
7	-0.09085	0.23381	0.178476	-0.15487	0.775946	0.921073	1						
8	0.147809	0.132153	-0.07131	-0.21486	0.117325	0.135965	0.153535	1					
9	-0.42502	0.173146	0.461153	-0.205	0.859517	0.706724	0.673407	0.07565	1				
10	0.513035	-0.15793	-0.47342	0.574982	-0.42168	-0.52644	-0.33855	-0.17907	-0.46227	1			
11	0.444756	0.096609	-0.30637	0.307651	-0.22729	-0.18499	-0.09474	0.075382	-0.22739	0.453995	1		
12	0.450588	0.1224	-0.29802	0.282228	-0.18895	-0.14684	-0.05433	0.073941	-0.25512	0.389859	0.818924	1	
13	0.473264	0.096588	-0.31885	0.301563	-0.23515	-0.17035	-0.09817	0.08405	-0.19985	0.50321	0.881268	0.753988	1

Plant growth habit (Height/Spread) was positively correlated with each other ($r = +0.67$). Mars (1996) correlated leaf colour with sour and sweet taste of fruit. The cultivars with green and smaller leaves are sourer and sweet cultivars have lighter leaves and larger leaves. Fruit characters like fruit weight, fruit length, fruit breadth and aril (%) are positively correlated to each other. Fruit weight significantly correlated to fruit length and breadth ($r = +0.75$), ($r = +0.77$). Fruit weight was positively correlated with fruit peel thickness ($r = +0.11$). Fruit weight and seed hardness was negatively correlated to each other ($r = -0.42$). Those fruit have larger size and weight have less seed hardness. Fruit characteristics are negatively correlated with leaf characteristics ($r = -0.22$). The largest the leaf size smallest the fruit size. Zamini *et al.*, (2006) studied that fruit quantitative and qualitative characteristic in pomegranate. He observed that number of seed in fruit was negatively correlated to the

fruit weight ($r = -0.72$) and positively correlated with fruit length ($r = +0.74$).

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