

PERFORMANCE OF SUCCESSFUL COMBINATION OF THE FRUITS OF WILD POMEGRANATE (*PUNICA GRANATUM* L.) IN HIMACHAL PRADESH

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Abstract: Wild Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruits which originated in Iran and surrounding areas, and there from spread to other regions. *P. granatum* is a predominant member of family Punicaceae which comprises of only two species. The present study was aimed to document the genetic variability in wild crossed fruits of pomegranate in Himachal Pradesh On the basis of morphological and physicochemical characters, 22 crosses were obtained after hybridization between screened parents in adjoining areas of the campus of Dr. Y.S. Parmar U.H.F. Nauni, Solan, H.P. in 2015-2016. Remarkable variability was observed amongst the genotypes for traits fruit length, diameter and TSS, reducing sugars, total sugar and non reducing sugar. On the basis of the performance, best genotypes will be selected for use in future pomegranate improvement programme.

Keywords: *Punica granatum* L., Variation, Morphological, Physicochemical characters

INTRODUCTION

Wild Pomegranate (*Punica granatum* L.), vern. Daru is one of the oldest known edible wild fruits and is capable of growing in different agro-climatic conditions ranging from the tropical to sub-tropical land (Levin, 2006). The fruit is commercially cultivated in Mediterranean region and in countries like Spain, Morocco, Egypt, Pakistan (Baluchistan), Afghanistan, Iraq, Iran, China, Japan, Russia and India. Of late, this crop is gaining popularity in arid and semi arid regions of India due to its wide adaptability, higher yield, drought hardiness and tolerance to salinity. In terms of farmer's economy, pomegranate is next to grapes in its importance and is cultivated in the districts of Maharashtra, commercially (Kaulgud 2002). Pomegranate has a deep association with the culture of Mediterranean region and Near East where it is a flavoured delicacy and is an important dietary component and greatly appreciated for its medicinal properties (Ed Stover and Mecure 2007). Currently there is a greater interest in pomegranate juice due to its anti-oxidant activities and potential health benefits (Hess-pierce and Kadar 2003).

Pomegranate plant can withstand frost (temperature up to -10 °C) and can grow up to an altitude of 1600 meters above mean sea level (Rana and Dwivedi, 1997). It thrives best under hot and dry summers with cool winters provided irrigation facilities are available. It is a hardy plant and can withstand considerable amount of drought, but does better when water is made available. Trees with best quality fruits are produced in areas with cold winters and hot dry summers. Thus, mid-hills of Himachal Pradesh have congenial climate for pomegranate cultivation as wild pomegranate commonly known as Daru is found growing here. The wild pomegranate resembles in morphological characters with the

cultivated ones and grows in the vast hilly marginal tracts of Himachal Pradesh at an elevation of about 900-1800m above mean sea level (Bist *et al.*, 1994). The fruit is well known of high nutritive and therapeutic value, also used as condiments and its bark and rind is used in medicinal preparation. Its different part is used as antioxidant, antiviral, anticancer, antibacterial, antidiabetic etc. It is imperative to conduct study on the selected trees for genetic characterization and breeding potential to harness genetic values through progeny evaluation and multiplication.

MATERIAL AND METHOD

The present study was aimed to document the genetic variability in wild crossed fruits of pomegranate in Himachal Pradesh was carried out in the Department of Tree Improvement and Genetic Resources, College of Forestry, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. Three sites were selected for study of phenological, morphological and breeding system of wild *Punica granatum* L. The sites selected were Tatool (L1) district Solan and Narag (L2) and Dharo ke Dhar (L3) in district Sirmour (Table-1). From each selected site, five medium sized tree were selected and marked. On each tree five branches were selected and marked with metallic tags and numbered from 1 to 5. The controlled crosses was performed between the selected parental trees and 15 crosses were successful (Table 1a). Fruit samples from successful combinations were taken for assessing physical attributes like fresh weight and rind weight. The total soluble solids was estimated by Atago hand refractometer and values corrected at 20°C with the help of temperature coefficient chart (AOAC, 1998). Titrable acidity, total sugars,

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reducing and non reducing sugar were determined as per Ranganna (2001).

Table 1. Three selected study sites for phenological, morphological, breeding system and pollination mechanism of wild *Punica granatum* L.

Sites	Latitude	Longitude	Code
Tatool	30°86'N	77°14'N	L1
Narag	30°87'N	77°18'N	L2
Dharo ke Dhar	30°85'N	77°20'N	L3

Table 1a. Successful combinations of the selected trees

Sr. No.	Successful Combinations
1.	L1T1 X L1T2
2.	L2T1 X L2T2
3.	L2T1 X L3T3
4.	L2T2 X L1T2
5.	L2T2 X L2T1
6.	L2T2 X L2T3
7.	L2T2 X L2T4
8.	L2T2 X L3T3
9.	L2T3 X L1T1
10.	L2T3 X L1T2
11.	L2T3 X L2T2
12.	L2T3 X L2T4
13.	L2T3 X L3T1
14.	L2T4 X L2T1
15.	L3T5 X L2T3

RESULTS AND DISCUSSION

Pomegranate successful combinations varied significantly in most of their characters (Table 3) with fruit width varying from 28.9 mm (L2T3 X L3T3) to 49 mm (L1T1 X L1T2). Fruit length was more in L2T2 X L1T2 and less in L2T1 X L3T3. The combinations exhibited significant variation in their chemical attributes (Table 3). TSS varied from 12.1 to 17.6% with highest TSS in L1T1 X L1T2. Acidity varied from 4.57 to 6.5% with highest Acidity in

L2T3 X L3T1. Ascorbic acid content showed variation coefficient of 2.81. Reducing sugars ranged from 5.76 to 8.36 % while non-reducing sugars ranged from 2.81 to 4.03%. Total sugar content was high in L1T1 X L1T2 and low in L2T2 X L1T2. Similar variation in TSS has been reported by Shulman *et al.* (1984). Ascorbic acid and reducing and total sugar values correspond to those of Akbarpour *et al.* (2009). The extent and type of variation in vegetative plant and physico-chemical fruit characters is primarily due to genetic difference in trees, which in wild may have arisen due to the influence of different evolutionary factors. These variations may also be contributed by agro-climatic conditions, altitude, and nutritional status of soil, cultural practices and environment. The evaluation suggests that superior strains hold promise in variety breeding programme. Hence, there is an urgent need to collect and preserve valuable wild forms which may act as a source for further improvement of pomegranate.

The extent and type of variation in wild pomegranate genotypes is primarily due to genetic differences in trees which in wild stands have arisen through seeds and are affected by agro-climatic conditions. On the basis of physical and chemical characteristics, 2 combinations selected are L1T1 X L1T2 and L2T2 X L1T2. The evaluation suggests that these strains hold promise in wild pomegranate improvement programme and can be used for clonal mass multiplication of plant with better quality.

Table 2: Some analytical properties of pomegranate

Sr. No.	CROSSES	TOTAL SUGAR (%)	REDUCING SUGAR (%)	NON REDUCING SUGAR (%)	ACIDITY (%)	TSS(°Brix)	ASCORBIC ACID(mg 100 g-1 fruit)	FRUIT WIDTH (mm)	FRUIT LENGTH (mm)
1	L1T1 X L1T2	12.53	8.27	4.02	5.67	17.40	18.55	47.80	47.10
2	L2T1 X L2T2	12.36	8.16	3.99	5.82	17.17	19.38	44.40	46.90
3	L2T1 X L3T3	11.30	7.46	3.66	5.73	15.70	18.87	31.30	31.53
4	L2T2 X L1T2	8.76	5.78	2.83	5.58	12.17	17.86	51.50	52.30
5	L2T2 X L2T1	9.86	6.51	3.20	5.47	13.70	18.06	46.10	49.90
6	L2T2 X L2T3	10.37	6.84	3.34	5.77	14.40	19.38	38.90	39.90
7	L2T2 X L2T4	10.27	6.78	3.33	5.22	14.27	18.93	44.40	48.40
8	L2T2 X L3T3	11.42	7.54	3.68	5.47	15.87	18.04	39.50	39.60
9	L2T3 X L1T1	12.07	7.97	3.89	5.77	16.77	19.11	51.00	46.90

10	L2T3 X L1T2	10.08	6.66	3.23	4.62	14.00	19.71	49.90	51.40
11	L2T3 X L2T2	12.07	7.97	3.91	5.73	16.77	18.56	43.400	46.00
12	L2T3 X L2T4	12.05	7.95	3.91	5.50	16.73	17.65	51.00	51.50
13	L2T3 X L3T1	11.52	7.60	3.73	6.0	16.00	19.06	37.40	43.90
14	L2T4 X L2T1	9.96	6.58	3.21	5.34	13.83	17.92	42.00	41.70
15	L3T5 X L2T3	12.02	7.94	3.87	6.23	16.70	18.25	47.50	41.40
CD		0.19	0.12	0.04	0.34	0.26	0.88	3.81	8.35

Table 3. Fruit and morphological characteristics of various pomegranate genotypes

CHARACTERS	Range		Mean \pm SE	SD	CV (%)
	Minimum	Maximum			
Total Sugar(%)	8.71	12.67	11.11+0.07	0.09	1.01
Reducing Sugar(%)	5.75	8.36	7.34+0.04	0.06	1.01
Non reducing Sugar(%)	2.81	4.03	3.59+0.01	0.02	0.62
Acidity(%)	4.57	6.5	5.60+0.12	0.17	3.63
TSS(^o Brix)	12.1	17.6	15.43+0.09	0.12	1.01
Ascorbic acid (mg 100 g-1 fruit)	17.06	20.09	18.62+0.30	0.43	2.81
Fruit Width(mm)	28.9	49	44.41+1.31	1.86	5.12
Fruit length(mm)	24.1	56	45.23+2.88	4.07	11.02

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