Genetic diversity of wild pomegranate (*Punica* granatum L.) distributed in Western Himalayas

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ABSTRACT

Pomegranate (*Punica granatum* L.) is one of the favourite fruits of mankind since time immemorial. Iran is considered to be its primary center of origin. Its wild population is distributed in Transcaucasia and Central Asia, extended up to Western Himalayas of India. The National Research Center on Pomegranate has made an attempt to collect different accessions of wild pomegranate distributed in different parts of Western Himalayas viz. Jammu and Kashmir, Himachal Pradesh and Uttarakhand. The present paper deals with the studies on variations in physico-chemical parameters of 16 accessions of wild pomegranate collected from Himachal Pradesh. Among physico-chemical parameters, fruit weight, calyx length, rind and aril recovery, Total soluble solids (TSS) and acidity varied from 59.33 to 217.00g, 0.78 to 2.45cm, 28.72 to 45.73%, 54.26 to 71.28%, 12.76°brix to 18.86°brix and 1.41 to 5.15%, respectively. High variability (CV) was observed in calyx length (19.66%), fruit weight (16.67%), rind recovery (13.33%), acidity (9.90%) and rind thickness (9.87%). Higher TSS was recorded in IC-318749 (18.89°brix) and IC-318707(18.09°brix). However, acidity was higher in IC-318706 (5.15%).

Keywords: Punica granatum, wild accessions, genetic diversity

INTRODUCTION

Pomegranate (*Punica granatum*) belongs to the family *Punicaceae*. Though the origin of pomegranate is Iran, its wild population is distributed in Transcaucasia and Central Asia, extended up to Western Himalayas of India, especially in J&K, Himachal Pradesh and Uttarakhand at an altitude of 900 to 1800 m above mean sea level [1]. In Himachal Pradesh, wild pomegranate is distributed in some pockets of Solan, Sirmour, Mandi, Shimla, Kullu and Chamba districts but its frequency of distribution in natural habitat is more in Mandi [2]. According to an estimate, India occupies first position in the world with respect to its area (1.13 lakh ha). However, production wise (7.44 lakh tones), it holds second position after Iran.

In fact, genetic diversity of wild pomegranate from Indian Himalayas has been reported by several workers [3-6]. The wild types of central Asia vary widely in fruit size, sweetness, ripening time, juiciness and the proportions of seeds and flesh [7]. The arils of wild pomegranate are rich source of organic acids apart from having appreciable amount of sugars, anthocyanins, phenols, ascorbic acid etc. It also contains good amount of minerals like phosphorus, calcium, potassium and iron [8]. Recently efforts were made to utilize wild pomegranate fruits into value added products [1]. Still there is scope for preparation of value added products from pomegranate fruit (rind and seed) and flowers, etc.

MATERIALS AND METHODS

The wild pomegranate accessions were collected (Fig.1) from different parts of Himachal Pradesh and planted at National Research Centre on Pomegranate (NRCP), Solapur (Maharashtra) during 2007-08. These materials are well established in the field gene bank of NRCP which is located at 17°68'N latitude, 75°91'E longitude and 457 m altitude. The fruit samples of 16 accessions (IC-318754, IC-318705, IC-318723, IC-318728, IC-318790, IC-318703, IC-318753, IC-318779, IC-318706, IC-318762, IC-318744, IC-318766, IC-318749, IC-318707, IC-318718 and IC-318724) of wild pomegranate were harvested at optimum ripening stage from *Mrig* bahar crop (June-July flowering) during 2012-2013 and analysed for physico-chemical properties. Various biometric parameters pertaining to fruit were recorded by standard methods. The total soluble solids (TSS) was measured with the help of Automatic Refractometer. The acidity of fruit juice was determined by titrating a known volume of the sample against standard NaOH solution by using phenolphthalein as an indicator and expressed as per cent citric acid[9].The data on all parameters were analyzed statistically in RBD with 3 replications [10].



Figure 1. Map of Himachal Pradesh (India) from where accessions of wild pomegranates were collected.

RESULTS AND DISCUSSION

All the physicochemical parameters taken in the present investigation showed significant differences among the genotypes (Table 1 and 2). Average fruit weight ranged from 59.33-217g indicating 16.67% co-efficient of variation (CV). The maximum fruit weight was noted in IC-318779 (217.00g) followed by IC-318728 (177.55g) and minimum value was observed in IC-318749 (59.33g). Thakur et al.(2011) [11] evaluated physicochemical properties of wild pomegranates collected from natural habitats of H.P. and found that fruit weight ranged from 53.4g -83.5g in different accessions. But, in our study the fruit weight showed very high variation among different accessions due to following proper cultural practices, variation in genetic constitution of genotypes and availability of congenial agro-climatic conditions. Interestingly, in most of the

Acta Biologica Indica 2014, 3(2):708-711

accessions fruit size was improved and their fruit weight ranged between 134.33 and 217g indicating scope for cultivation in dry arid and semi-arid region of Maharashtra. Further, length, diameter and calyx length of fruits were higher in IC-318728 (7.22cm), IC-318762(6.68cm) and IC-318754 (2.45cm), respectively and their values were minimum in IC-318749 (4.44cm, 4.32cm and 0.78cm). Calyx length showed high CV value (19.66%). Significantly maximum rind recovery was noted in IC-318744 (45.73%) while its minimum value was observed in IC-318753 (28.72%). The rind thickness varied from 0.21-0.29cm in different genotypes but maximum rind thickness (0.29 cm) was recorded in IC-318728, IC-318703, IC-318766 and IC-318749. The CV value of rind thickness was 9.87%. Our findings corroborates with the results of Wani *et al.* (2012) [12] and Mir *et al.* (2007) [13].

Germplasm	Fruit	Fruit	Fruit	Calyx	Rind	Rind
1	weight	length	diameter	length	recovery	thickness
	(g)	(cm)	(cm)	(cm)	(%)	(cm)
IC-318754	167.11	6.63	6.30	2.45	34.64	0.27
IC-318705	167.33	6.85	6.39	1.25	41.04	0.28
IC-318723	150.88	6.88	5.89	1.21	31.43	0.25
IC-318728	177.55	7.22	6.46	1.31	30.70	0.29
IC-318790	135.55	6.8	6.60	1.32	30.90	0.25
IC-318703	161.66	6.45	6.67	1.07	30.36	0.29
IC-318753	141.44	6.68	6.05	1.23	28.72	0.21
IC-318779	217.00	6.63	6.38	1.66	31.85	0.27
IC-318706	134.33	5.93	5.46	0.98	35.90	0.26
IC-318762	163.11	6.60	6.68	1.14	34.04	0.26
IC-318744	79.66	5.17	4.76	0.91	45.73	0.26
IC-318766	60.00	5.21	4.44	1.34	45.47	0.29
IC-318749	59.33	4.44	4.32	0.78	42.84	0.29
IC-318707	142.11	5.54	5.06	1.45	29.27	0.26
IC-318718	149.33	6.59	6.11	1.83	35.65	0.24
IC-318724	155.99	6.33	5.96	1.51	41.53	0.28
CD at 5%	39.43	0.90	0.74	0.44	7.94	0.04

Table 1. Physico-chemical evaluation of wild germplasm.

Hundred aril weight, aril recovery, aril size (length and width), TSS and acidity were also differed significantly among the genotypes (Table 2). IC-318728 had moderately bold arils (32.66g/100 arils) as compared to other accessions. However, maximum aril recovery was observed in IC-318753 (71.28%) followed by IC-318707, IC-318703, IC-318728, IC-318790, IC-318723, IC-318779, IC-318762, IC-318754, IC-318718 and IC-318706. In most of the accessions, aril recovery ranged between 64.35 and 71.28% while IC-318744 recorded very low aril recovery (54.35%). The aril length and width ranged from 1.03-1.53cm and 0.58-0.77cm indicating low variation in this trait among different genotypes. IC-318707(18.09°brix). These two accessions could be exploited for preparation of pomegranate raisin due to their high sugar content. Similarly, the titrable acidity was maximum in IC-318706(5.15%), and minimum in IC-318724 (1.41%) indicated high degree of variation (9.90% CV). The accessions like IC-318706, IC-318744, IC-318703, IC-318749 and IC-318790 have acidity more than 4% could be useful for preparation of *Anardana* and other value added products. Similar results were reported) in different wild pomegranate accessions including H.P. collections by Thakur *et al.* (2011) [11], Rawat, *et al.* (2012) [14] and Thakur *et al.* (2013) [1].

Germplasm	100 aril	Aril	Aril	Aril	TSS (°brix)	Acidity (%)
	weight (g)	recovery	length	width (cm)		
		(%)	(cm)			
IC-318754	30.11	65.35	1.48	0.74	16.25	3.10
IC-318705	29.66	58.96	1.48	0.69	14.64	3.52
IC-318723	27.33	68.57	1.42	0.68	16.37	3.65
IC-318728	32.66	69.29	1.14	0.77	12.76	3.23
IC-318790	28.33	69.09	1.53	0.68	16.82	4.19
IC-318703	28.55	69.64	1.51	0.65	17.06	4.51
IC-318753	29.33	71.28	1.42	0.70	15.43	2.99
IC-318779	28.33	68.15	1.37	0.64	17.92	3.23
IC-318706	28.44	64.10	1.18	0.69	16.28	5.15
IC-318762	28.11	65.95	1.05	0.67	13.46	3.53
IC-318744	27.66	54.26	1.05	0.65	16.79	4.83
IC-318766	24.22	54.53	1.06	0.65	16.60	3.03
IC-318749	25.88	57.16	1.03	0.68	18.86	4.32
IC-318707	28.33	70.73	1.04	0.69	18.09	2.85
IC-318718	27.33	64.35	1.05	0.66	17.24	2.46
IC-318724	30.00	58.47	1.04	0.58	14.81	1.41
CD at 5%	1.88	7.94	0.17	0.09	1.37	0.58

Table 2. Physico-chemical evaluation of wild germplasm.

Acknowledgments: The authors are highly thankful to the Head, NBPGR Regional Station, Shimla for supply of wild pomegranate accessions collected from different parts of Himachal Pradesh.

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