Applied Biological Research 14 (2): 211-214, 2012 **Short Communication**

VARIATION IN SOME PROMISING SELECTIONS OF WILD POMEGRANATE (*Punica granatum* L.) IN CENTRAL KASHMIR

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ABSTRACT

The present study was aimed to document the genetic variability in wild genotypes of pomegranate in central Kashmir. On the basis of morphological and physicochemical characters, 33 genotypes were identified during intensive survey in districts Srinagar, Ganderbal and Budgam in 2009-2010. Remarkable variability was observed amongst the genotypes for traits like plant height, plant spread, yield, fruit length, diameter and weight, total aril weight, rind thickness, TSS, juice content, acidity, ascorbic acid, reducing sugars, total sugar and anthocyanin contents. On the basis of yield and quality, 7 best genotypes were selected for use in future pomegranate improvement programme.

Keywords: Genotype evaluation, Kashmir, pomegranate, selection, variability

INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruits which originated in Persia 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 other species, *P. protopunica*, is endemic of the Island of Socotra (Mereure, 2007). In Persia pomegranate grows both as wild and cultivated varieties/ accessions (Al-Said *et al*., 2009; Narzary *et al.*, 2009). However, in Mediterranean basin only cultivated varieties have been reported (Jbir *et al*., 2008; Durgac *et al*., 2008). Different parts of this tree (leaves, fruits and bark skin) have traditionally been used for medicinal and other properties. These beneficial effects may be related to its high antioxidant activity owing to the presence of a variety of biologically active compounds (Halvorsen *et al.*, 2002). The edible part of fruit contains considerable amount of acids, sugar, vitamins, polysaccharides, polyphenols and minerals (Kulkarni *et al.*, 2004). Studies to determine whether wide variability exists in the antioxidant activity and other physicochemical properties among different pomegranate cultivars allow the fruit breeders to select and breed genotypes with higher content of antioxidants. The present investigation was aimed to study variation within vegetative and physicochemical attributes of pomegranate of central Kashmir.

MATERIALS AND METHODS

Survey for pomegranate variability was conducted in 3 districts of central Kashmir during 2009-2010. Based on interviews with locals and the data obtained from the Directorate of Horticulture, Kashmir, 153 trees were initially labeled from districts Srinagar, Ganderbal and Budgam. The trees showing heavy anar butterfly infestation or cracking symptoms or low fruit weight were excluded. Ultimately, 33

genotypes (17 from Srinagar, 7 from Ganderbal and 9 from Budgam) were selected and each individual trees assigned separate accession number (SKAU-Pg-Sr-001 to SKAU-Pg-Sr-17 for Srinagar, SKAU-Pg-Gb-001 to SKAU-Pg-Gb-007 for Ganderbal and SKAU-Pg-Bd-001 to SKAU-Pg-Bd-009 for Budgam accessions. Each accession was evaluated for various morpho-logical parameters as per the standard procedures. Height of each plant was measured from ground level to the top of main branch or leader; whereas plant spread was measured in terms of the extent of canopy in two different directions i.e. north-south and east-west. Tree yield efficiency was estimated as per Westwood and Robert (1970). Fruit samples from selected trees were taken randomly for assessing physical attributes like weight, size, rind thickness, rind proportion, aril texture, aril colour, aril weight and juice content. The total soluble solids was estimated by Atago hand refractometer and values corrected at 20^{o}C with the help of temperature coefficient chart (AOAC, 1998). Titrable acidity, vitamin C, reducing sugar, total sugars and anthocyanin contents were determined as per Ranganna (2001). Sensory evaluation for general appearance, fruit shape, fruit rind colour, fruit size and aril colour was carried by a panel of 10 semi-trained judges by using pomegranate descriptor and attributes rated on 4-point scale. The data was analyzed using R-software as per Gomez and Gomez (1985).

RESULTS AND DISCUSSION

Pomegranate accessions varied significantly in most of their vegetative characters (Table 1) with plant height varying from 2.34 m (SKAU-Pg-Sr-001) to 4.78 m (SKAU-Pg-Sr-012). Plant spread was more in SKAU-Pg-Pb-002 and less in SKAU-Pg-Bd-005. Suckering capacity showed coefficient of variation of 55.5 whereas fruit number plant^{-1} had variation coefficient of 37.8. Fruit yield was high in SKAU-Pg-Sr-012 (59.0 kg). The yield efficiency had coefficient of variation 61.2. Highest leaf area was in SKAU-Pg-Bd-004 (14.0 cm^2) and lowest in SKAU-Pg-Sr-011 (7.48 cm^2). Similar variation in plant height, plant spread, leaf area and yield has been reported in pomegranate by Sharma and Bhist (2005).

The fruit length was more in SKAU-Pg-Sr-001 (9.24 cm) and less in SKAU-Pg-Bd-006 (5.06 cm). Fruit diameter and weight showed coefficient of variation of 10.18 and 31.8, respectively. Fruit volume ranged from 122.4 to 499.0 cm^3. Total aril weight and number exhibited a coefficient of variation of 32.87 and 28.77, respectively. Maximum weight aril^{-1} was in SKAU-Pg-Sr-001 (0.33 g) and minimum in SKAU-Pg-Bd-001 (0.18 g). Rind thickness varied from 1.50 to 3.64 mm, whereas rind weight varied from 44.75 to 217.75 g. Rind proportion was highest in SKAU-Pg-Sr-001 (65.1%) and lowest in SKAU -Pg-Gb-005 (27.76%). The fruit weight was between 150 and 568 g. Al-Maiman and Ahmad (2002) and Ozkan (2005) support our findings. Cracking ranged from 6.3 to 31.4. The anar butterfly incidence ranged from 9.4% in SKAU-Pg-Sr-017 to 38.6% in SKAU-Pg-Sr-013. Similar variation in fruit length, diameter, weight and volume, total aril weight, aril number fruit^{-1}, weight aril^{-1} and rind thickness, weight and proportion was recorded in pomegranate by Mir *et al.* (2007). Cracking may be attributed to weather conditions during fruit development, especially high temperature and moisture stress in soil (Singh, 2004). Further, they reported similar cracking in Jodhpur Red which supports our findings. The variation in anar butterfly incidence in genotypes may be attributed to dissimilar biological behaviour of cultivars and inherent capacity of each accession to tolerate the incidence.

The accessions exhibited significant variation in their chemical attributes (Table 3). TSS varied from 11.5 to 16.0% with maximum juice content of 62.37% in SKAU-Pg-Sr-017. Acidity varied from 0.30 to 0.57% with highest TSS/acid ratio (53.34) in SKAU-Pg-Sr-017. Ascorbic acid content showed variation coefficient of 22.45. Reducing sugars ranged from 6.0 to 10.1% while non-reducing sugars ranged from 0.66 to 3.06%. Total sugar content was high in SKAU-Pg-Sr-012 and low in SKAU-Pg-Sr-013. Anthocyanin content varied from 9.14 mg to 19.30 mg 100 g^{-1}. Similar variation in TSS has been reported by Shulman *et al.* (1984). The results of juice content reports are in agreement with Prasad *et al.* (2000). Ascorbic acid and reducing and total sugar values correspond to those of Akbarpaur *et al*. (2009). Similar variation in anthocyanin content has been reported by Mir *et al.* (2007).The extent and

Table 1: Vegetative, yield, fruit and sensory characteristics of various pomegranate genotypes

Characters	Range		Mean ±SE	SD	CV (%)
	Minimum	Maximum			
Vegetative and yield characteristics					
Plant height (m)	2.34	4.78	3.55±0.12	0.69	19.44
Plant spread (m)	1.23	2.65	1.69±0.07	0.39	23.07
Suckering capacity	4.00	42.00	18.15±1.76	10.08	55.54
Number of fruits tree^{-1}	47.00	245.00	157.50±10.4	59.60	37.84
Yield (kg tree^{-1})	7.20	59.02	35.04±2.62	15.06	42.98
Yield efficiency (kg cm^{-2})	0.20	2.21	0.85±0.09	0.52	61.18
Leaf area (cm^2)	7.48	14.04	10.49±0.26	1.49	14.20
Physical characteristics of fruit					
Fruit length (cm)	5.06	9.24	6.83±0.15	0.85	12.44
Fruit diameter (cm)	6.16	9.84	7.56±0.13	0.77	10.18
Fruit weight (g)	120.30	463.70	225.00±12.5	71.60	31.82
Fruit volume (cm^3)	122.40	499.00	234.20±13.5	77.50	33.09
Total aril weight (g)	58.00	250.00	133.25±7.63	43.80	32.87
Number of arils fruit^{-1}	245.00	792.00	514.00±25.8	147.90	28.77
Weight (g aril^{-1})	0.18	0.33	0.26±0.01	0.04	15.38
Rind thickness (mm)	1.50	3.64	2.45±0.10	0.55	22.45
Rind weight (g)	44.75	217.75	91.68±6.48	37.22	40.59
Rind proportion (%)	27.76	65.11	41.16±1.45	8.33	20.24
Chemical characteristics of fruit					
TSS (^{o}Brix)	11.50	16.00	13.87±0.24	1.39	10.02
Juice content (%)	25.59	62.37	43.05±1.63	9.34	21.70
Acidity (%)	0.30	0.57	0.41±0.01	0.07	17.07
TSS/acid ratio	20.17	53.34	35.43±1.28	7.37	20.80
Ascorbic acid content (mg 100 g^{-1} fruit)	7.96	20.68	14.70±0.57	3.30	22.45
Reducing sugar (%)	6.00	10.12	7.91±0.20	1.12	14.16
Total sugar (%)	7.24	12.92	9.35±0.22	1.29	13.79
Non-reducing sugar (%)	0.66	3.06	1.45±0.09	0.50	34.48
Anthocyanin content (mg 100 g^{-1} fruit)	9.14	19.30	13.60±0.60	3.46	25.44
Sensory evaluation					
General appearance	1.14	4.00	2.63±0.13	0.73	27.76
Fruit shape	2.00	3.77	2.83±0.09	0.53	18.73
Fruit rind colour	1.00	3.52	2.37±0.12	0.71	29.96
Fruit size	1.00	3.50	1.41±0.12	0.68	48.23
Aril colour	1.50	4.00	3.01±0.14	0.82	27.24
Cracking (%)	6.31	31.40	13.91±1.20	6.91	49.68
Anar butterfly incidence (%)	9.42	38.62	22.20±1.24	7.10	31.98

*Scale followed for general appearance: very attractive (4), attractive (3), less attractive (2) and least attractive (1); fruit shape: round (4), round oblong (3), round flat (2) and elliptic (1); rind colour: primrose rose (4), scarlet (3), scarlet with tinges (2) and lemon yellow (1); fruit size: extra-large >750 g (4), large 500-750 g (3), medium 250-500 g (2) and small <250 g (1); arial colour: Red (4), pink (3), pinkish white (2) and white (1)

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.

Scoring index of pomegranate accessions for general appearance ranged from 1.1 to 4.0 points whereas for fruit shape the scores ranged from 2.0 to 3.77. Highest scoring index for fruit rind colour

was seen in SKAU-Pg-Sr-014 and lowest in SKAU-Pg-Sr-015. For fruit size, scoring index was high in SKAU-Pg-Sr-001 and for aril colour it ranged from 1.5 to 4.0 points. 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. The variation observed is in tune with Mir *et al.* (2007). On the basis of yield and quality, 7 accessions selected are SKAU-Pg-Sr-012, SKAU-Pg-Sr-015, SKAU-Pg-Sr-017, SKAU-Pg-Gb-003, SKAU-Pg-Gb-006, SKAU -Pg-Bd-003, SKAU-Pg-Bd-008. The evaluation suggests that these strains hold promise in pomegranate improvement programme and can be used for clonal mass multiplication of plant with better yield efficiency and quality.

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