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Studies on variability in physico-chemical traits and multiplication of *Daru* (wild pomegranate) collections

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ABSTRACT

***Anardana* (wild pomegranate) or 'Daru' is found scattered throughout Doda district of Jammu province. A survey was carried out to identify the elite genotypes among the natural population. The ripe fruits of 12 selected genotypes were analysed for physico-chemical characteristics like fruit weight, length and breadth, seed weight per fruit, rind weight per fruit, juice content, total soluble solids (TSS), acidity, total sugars, reducing sugars, and tannins. Individual fruit weight ranged from 85.64 to 131.60 g with fruit length from 5.52 to 7.42 cm, fruit breadth 5.17 to 5.99 cm, seed weight 34.60 to 56.0 g/fruit and peel weight from 49.04 to 68.0 g/fruit. The chemical characters also showed a wide variation. Total soluble solids varied from 11.0 to 15.5°B, titratable acidity 5.26 to 6.80%, total sugars from 9.32 to 13.86% and tannins from 121.12 to 149.70 mg/100 ml. The stem cuttings of these genotypes were raised for comparing their vegetative multiplication. The survival of cuttings ranged from 25-30%. A wide variation in physico-chemical characters of wild pomegranate genotypes indicated the scope of individual plant selection based on these characters for its genetic improvement.**

Key words: Wild pomegranate, physico-chemical traits, variability, propagation.

INTRODUCTION

Wild pomegranate (*Punica granatum* L.) also known as *Daru* is one of the minor fruits of great economic importance in the sub-mountain tracts of the outer Himalayan region upto an elevation of 1,800 m asl. It grows in wild state on the hill slopes of Jammu & Kashmir as a large evergreen shrub, 4 to 6 m high and flowers during 1st week of April to 2nd week of May. The fruits are round, oblate and obovate in shape varying from 3.5 to 5.0 cm and have thick or thin skin with pale yellow to crimson colour on maturity (Mahajan *et al*., 6). The fruit ripen towards the middle of October and are handpicked. Its fruits are filled with angular hard seeds covered with a juicy, pink or yellowish-white sweet astringent acid pulp. The wild pomegranate eco-types found in Central Asia show a wide range of variation in fruit size, sweetness, time of ripening, juiciness and proportion of seed to flesh or rind (Adsule and Patel, 2). The seeds along with the juice sac are separated from the rind and dried in open sun till they dry enough for safe storage. The drying process normally takes 10-15 days when the colour turns reddish-brown. The sun-dried seeds with pulp constitute the condiment '*anardana*' which is extensively used as an acidulant in curries, chutneys, culinary preparations and improves mouth feel and digestion (Kingsly *et al*., 5). Dried arils are good source of vitamins and minerals (Singh and Kingsly, 10). It is also used in *Ayurvedic* medicines, tanning and colouring industries. Sharma and Sharma (9) revealed that distinct variations were obtained in chemical characters of wild pomegranate.

The propagation of wild pomegranate by seed is easy and seedling plantations appear hardier, drought resistant due to deep tap root system but seed propagation brings genetic variability and leads to low yield and poor quality of fruits. Propagation through hardwood cutting is best and less expensive method of its propagation (Upadhyay and Badyal, 11). The present investigation was undertaken, to find out the variations in physico-chemical traits and multiplications of some wild pomegranate genotypes identified from Doda region of Jammu, J&K.

MATERIALS AND METHODS

A survey was carried out in the Doda district of Jammu region during the flowering season for two years to identify the elite wild pomegranate genotypes from the natural plantation. The areas surveyed were Assar, Malhori, Khellani and Kaurapani. The selected genotypes were WP-1 to WP-3 from Assar; WP-4 to WP-6 from Malhori; WP-7 to WP-9 from Khellani and WP-10 to WP-12 from Kaurapani. The experiment was laid out in a randomized block design with three replications. For recording of observations, 20 mature fruits were randomly selected and collected from each genotype for physico-chemical & pomological parameters and propagational studies. The data on

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physical parameters like fruit weight, length, breadth, seed weight per fruit and rind weight per fruit were recorded. Processing parameters like juice (%), seed (%), rind thickness, fresh and dried weight of 100 seeds and chemical parameters like TSS (^{0}B), acidity (%), reducing sugars (%), total sugars (%) and tannins as tannic acid (mg/100 ml of juice) were also estimated. TSS was recorded by placing a drop of juice on the platform and viewing through a hand refractometer. Titratable acidity was determined by AOAC (1) method. Total sugars, reducing sugars and tannins were estimated as per the method of Ranganna (8).

For plant propagation studies, one-year-old mature hardwood shoots measuring 30-45 cm were taken from the selected trees. Twenty five stem cuttings (0.75 - 1.0 cm) from each genotype were taken in three replications. These cuttings after treatment with 0.2% carbendazim for one minute were planted in the plots having sand, soil and compost in 1:1:1 proportion. The plots were regularly watered and data on percent survival, plant height, number of shoots and number and length of roots were recorded at the end of the growing season. The data was statistically analysed as per the method of Gomez and Gomez (4).

RESULTS AND DISCUSSION

The analysis of variance of 12 *daru* or *anardana* genotypes identified in this investigation revealed a significant difference in fruit physico-chemical parameters (Tables 1 & 2). The maximum fruit weight (131.60 g) was recorded by WP-3 followed by WP-1 (130.24 g). The minimum fruit weight of 84.64 g was observed in WP-5. The maximum fruit length (7.42 cm) was recorded in WP-3 and the minimum fruit length (5.48 cm) was recorded in WP-8. The maximum fruit breadth (5.99 cm) was recorded in WP-1, which varied non-significantly with WP-3 and the minimum (5.17 cm) was recorded in WP-5. The maximum seed weight per fruit (65.62 g) was recorded in WP-3, while it was minimum (34.60 g) in WP-5. Similarly, rind weight per fruit was highest in WP-3 (75.80 g) and lowest in WP-7 (46.46 g).

The processing characteristics also showed a significant variation in the genotypes (Table 1). The juice content of *anardana* ranged from 50.60 to 45.20%. WP-3 recorded maximum juice content of 50.60%, which varied non-significantly with by WP-1 (49.80%) and WP-11 (49.06%). Singh and Kingsly (10) also recorded juice content of 40.0% in wild pomegranate. Maximum seed content was recorded in WP-3 (50.60%), while it was minimum in WP-8 (38.82%). Fresh weight of 100 seeds was maximum in WP-3 (14.24 g) followed by WP-9 (14.06 g) and WP-1 (14.01 g), whereas it was minimum in WP-5 (12.90 g). Rind thickness was maximum in WP-3 (3.67 mm) followed by WP-8 (3.56 mm). A minimum rind thickness of (3.18 mm) was recorded in WP-5.

Total soluble solids (TSS) content of *anardana* genotypes varied from 11.0 to 15.5°B (Table 2). The maximum TSS (15.5°B) was recorded in WP-3 followed by WP-1 (15.3°B), while it was minimum in WP-12 (11.0°B). Bist and Sharma (3) also recorded TSS in the range of 10.30 to 12.80°B in wild pomegranate.

Table 1. Physical characters of different wild pomegranate collections.

Collec. No.	Fruit wt. (g)	Fruit length (cm)	Fruit breadth (cm)	Seed weight/ fruit (g)	Rind weight/ fruit (g)	Juice (%)	Seed (%)	Fresh weight of 100 seeds (g)	Dried weight of 100 seeds (g)
WP-1	130.24	7.36	5.99	59.38	70.69	49.80	45.59	14.01	3.99
WP-2	112.20	5.77	5.72	46.23	61.90	46.20	41.20	13.28	3.76
WP-3	131.60	7.42	5.97	65.62	75.80	50.60	49.86	14.24	4.18
WP-4	98.40	5.52	5.24	43.97	55.58	45.90	44.69	13.68	3.82
WP-5	85.64	5.48	5.17	34.60	49.04	45.20	40.40	12.90	3.67
WP-6	104.60	5.58	5.43	46.30	59.41	48.60	44.26	13.00	3.68
WP-7	90.04	5.49	5.46	36.01	46.46	46.60	40.00	13.26	3.72
WP-8	96.92	5.46	5.75	37.62	55.84	47.24	38.82	13.42	3.84
WP-9	128.46	7.26	5.82	53.69	69.19	48.60	41.80	14.06	4.02
WP-10	109.60	5.64	5.52	46.91	61.68	47.60	42.80	13.52	3.78
WP-11	117.90	6.03	5.86	54.92	59.41	49.06	46.58	13.72	3.88
WP-12	124.20	7.14	5.85	56.88	67.91	47.80	45.80	13.89	3.92
$CD_{0.05}$	2.23	0.22	0.14	1.38	1.19	2.06	0.47	0.66	NS

Table 2. Chemical characters of different wild pomegranate collections.

Collec. No.	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Tannins (mg/100 ml)
WP-1	15.30	6.58	13.24	11.38	146.40
WP-2	14.00	6.36	13.48	11.29	138.60
WP-3	15.50	6.80	13.86	12.01	149.70
WP-4	14.50	6.42	13.18	11.16	142.40
WP-5	14.05	6.04	12.62	10.41	132.34
WP-6	13.00	5.98	10.68	9.92	134.60
WP-7	12.00	5.84	11.06	9.48	129.40
WP-8	13.00	6.12	12.92	11.06	133.42
WP-9	12.00	5.81	12.28	10.86	126.80
WP-10	14.00	6.04	12.62	11.14	141.30
WP-11	12.50	5.72	10.34	8.72	130.16
WP-12	11.00	5.26	9.32	8.06	121.12
$CD_{0.05}$	0.83	0.18	0.73	0.34	2.59

The maximum titratable acidity (6.80%) was found in WP-3 and minimum was in WP-12 (5.26%). Singh and Kingsly (10) also reported a titratable acidity of 6.68% in wild pomegranate. Reducing sugars was maximum (12.01%) in WP-3 followed by WP-1 (11.38%) and the minimum of 8.06% in WP-12 (Table 2). Pruthi and Saxena (7) also recorded reducing sugars of 12.0% in wild pomegranate. Similarly, highest total sugars was observed in WP-3 (13.86%) and lowest in WP-12 (9.32%). Among the evaluated genotypes, WP-3 showed maximum tannins (149.70 mg/100 ml) followed by WP-1. Lowest tannins were found in WP-12 (121.12 mg/100 ml). Mahajan *et al*. (6) also reported tannin content of 145.0 mg/100 ml of juice in wild pomegranate. Sharma and Sharma (9) also revealed distinct variations in chemical characters of wild pomegranate.

The survival percentage of cuttings ranged from 30.02 to 25.04% (Table 3). Maximum survival (30.02%) was recorded in WP-3 followed by WP-1 (29.26%), whereas, it was minimum in WP-5 (25.04%). Similarly, among the evaluated genotypes WP-3 showed maximum sprout height (58.12 cm), number of shoots (4.02), number of primary roots/plant (4.26)

Table 3. Comparative rooting of hardwood cuttings of different wild pomegranate collections.

Collec. No.	Survival (%)	Sprout height (cm)	No. of shoots	No. of primary roots/ plant	Length of longest root (cm)
WP-1	29.26	57.86	3.92	4.02	36.14
WP-2	27.30	56.28	3.95	3.94	33.65
WP-3	30.02	58.12	4.02	4.26	38.26
WP-4	26.82	54.26	3.72	3.76	33.23
WP-5	25.04	48.26	2.91	2.92	24.15
WP-6	27.01	56.43	3.84	3.84	32.68
WP-7	25.46	49.82	3.66	2.86	28.12
WP-8	26.84	51.68	3.74	3.41	28.54
WP-9	26.37	52.14	3.89	3.32	29.86
WP-10	25.92	49.48	3.72	3.08	27.04
WP-11	26.64	55.21	3.86	3.62	34.68
WP-12	27.16	56.34	3.94	3.86	31.26
$CD_{0.05}$	1.15	1.18	0.11	0.12	0.57

and length of longest root (38.26 cm) followed by WP-1, while these were minimum (48.26 cm, 2.91, 2.92 and 24.15 cm, respectively) in WP-5.

It is thus concluded that wild pomegranate genotypes differed significantly for various fruit characters and propagation abilities. Out of all the 12 genotypes studied, genotype WP-3 proved to be best for different fruit and propagation characters followed by WP-1.

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