



## Studies on physical and chemical characteristics of pomegranate cultivars in Kashmir valley

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### ABSTRACT

Ten pomegranate (*Punica granatum* L.) cultivars, namely, Kabuli Kandhari, Chawla, Ganesh, Mridula, Jyoti, G-137, Dholka, Bedana, Kandhari and Local Check were evaluated for different physical and chemical characteristics of fruit at the Central Institute of Temperate Horticulture, Srinagar, during 2004. Fruit weight, diameter and volume was significantly higher in cv. Bedana compared to the rest of the cultivars. Cultivar Kandhari recorded significantly less rind thickness when compared to other cultivars. Cultivar Chawla exhibited less cracking per cent followed by Kandhari. Total soluble solids and total sugars were highest in cv. Kandhari whereas less acidity was recorded in cvs. Ganesh and G-137% acidity was lowest in cv. G-137 (0.41) and highest in cv. Bedana (0.81). Highest ascorbic acid content was found in cv. Kabuli Kandhari. The highest anthocyanin content was observed in cv. Ganesh and lowest in cv. Chawla. Juice content was found to be maximum in Bedana. The lowest anar butterfly attack was observed in cv. Bedana. The data revealed overall superior performance of cv. Bedana and Kandhari with regard to physical and chemical characteristics and these can be recommended for commercial cultivation in the Karewa belt of Kashmir valley.

**Key words:** Pomegranate, physical and chemical characteristics of fruit

### INTRODUCTION

Pomegranate (*Punica granatum* L.) fruit deserves special attention of consumers interested in nutritional food with excellent taste. Dietary supplementation with pomegranate is believed to relate with cancer prevention (Afaq *et al.*, 2003). The tree is deciduous in low winter-temperature areas but, in tropical and subtropical areas, it is evergreen or partially deciduous. High-quality fruits can be produced where there are cool winters and hot, dry summers. It enjoys reputation for its healthy, dietetic and medicinal properties. The fruit is now gaining importance in temperate regions due to its hardy nature and capacity to tolerate drought, frost and alkaline conditions. In spite of the economic importance of pomegranate, information on its physico-chemical composition is under temperate conditions meagre and, therefore, the present investigation was undertaken to evaluate important cultivars for their physical and chemical characteristics under the temperate conditions of Kashmir Valley.

### MATERIAL AND METHODS

The investigation was conducted at the Central

Institute of Temperate Horticulture, Srinagar, in 2004. Ten pomegranate cultivars of five years age having uniform vigour were evaluated in a randomized block design replicated thrice. Five plants per replication in each cultivar were taken randomly for recording data. The plants were raised under uniform cultural practices. Fruits were harvested when most of them were red in colour and were transferred to the laboratory to sort for size and uniformity of shape. Fruit shape, colour and general appearance was recorded on a hedonic scale. The chemical constituents of the edible portion were estimated as per methods detailed in A.O.A.C. (1984). The TSS of fruit juice was estimated with a hand-refractometer. Anthocyanin content was estimated as per Ranganna (1986).

### RESULTS AND DISCUSSION

Most of the physical characters studied showed significant difference among cultivars (Table 1). Cultivar Bedana had the maximum fruit weight, diameter and volume (232.12g, 7.68 cm and 237.62 cm<sup>3</sup>, respectively), whereas, lowest values in these parameters were recorded in cv. Ganesh. Local check recorded an average 188.12 g of fruit

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**Table 1. Physical characteristics of different pomegranate cultivars**

Cultivar	Fruit weight	Fruit diameter (g)	Fruit volume (cm)	Specific gravity (cm <sup>3</sup> )	Rind thickness (mm)	Rind weight (g)	Number of seeds fruit <sup>-1</sup>	Aril weight (g)	Cracking (%)	Fruit shape	Fruit colour	General appearance	Anar butterfly incidence (%)
Kabuli	174.36	6.86	169.45	0.985	4.22	71.37	482.09	0.213	19.24	4.00	3.93	3.30	12.49
Kandhari													
Chawla	166.91	6.63	152.74	1.036	4.95	54.62	438.16	0.256	06.32	2.73	3.33	2.84	10.09
Ganesh	110.28	5.76	100.28	0.950	3.10	52.52	275.88	0.210	26.30	3.92	4.00	2.80	08.33
Mridula	143.06	6.36	134.97	0.973	3.24	50.41	426.62	0.216	19.50	3.80	2.46	2.35	12.38
Jyoti	162.36	6.50	144.31	0.986	3.91	57.17	449.14	0.233	25.17	2.40	0.46	1.50	10.25
G-137	189.49	7.09	187.21	0.971	3.41	75.15	423.00	0.270	31.40	1.73	2.40	2.48	08.51
Dholka	216.61	7.38	211.13	0.965	3.58	70.73	468.33	0.316	19.54	3.93	2.60	3.50	09.94
Bedana	232.12	7.68	237.62	0.966	4.13	73.75	546.94	0.289	18.15	4.00	2.73	3.57	08.36
Kandhari	222.88	7.49	220.69	0.956	2.92	69.36	502.99	0.305	16.52	4.00	2.66	3.44	11.26
Local	188.06	7.06	184.59	0.990	4.15	74.45	486.33	0.233	21.20	3.06	1.80	2.50	11.42
Check													
SE d	9.35	0.06	4.13	0.015	0.25	4.73	12.60	0.008	0.78	0.17	0.26	0.17	0.61
CD	19.66	0.11	8.68	0.03	0.54	9.95	26.48	0.017	1.64	0.36	0.55	0.36	1.30
( <i>P</i> =0.05)													
CV (%)	6.34	0.98	2.90	1.94	8.45	8.93	3.43	4.03	4.71	6.40	12.23	7.59	7.36

weight plant<sup>-1</sup> and was significantly superior to five but not cultivars cvs. Bedana, Kandhari, Dholka and G-137. Variation in fruit weight and diameter was in accordance with findings of Bist *et al* (1994). The minor deviation with respect to fruit weight may be due to variations in the form, as, sometimes they are obscurely ridged and many-sided, as reported by Nath and Randhawa (1959). Maximum specific gravity was recorded in cv. Chawla (1.036) followed by Local Check (0.990) and Jyoti (0.986). Lowest specific gravity was exhibited by cv. Ganesh (0.950). Generally, fruit weight, diameter and volume are directly proportional to each other. Increase in fruit size, volume and weight and decrease in specific gravity was also reported by Dhillon and Kumar (2004) and Khodade *et al* (1990). It is obvious from the data that lowest rind-thickness was observed in cv. Kandhari (2.92 mm) which was significantly less compared to rest of the cultivars under test. Higher rind-thickness was recorded in cv. Chawla (4.95 mm). Rind weight is also an important factor in pomegranate as it constitutes the non-edible part of the fruit. The lowest rind-weight was registered in cv. Mridula (50.41 g fruit<sup>-1</sup>), followed by cvs. Chawla and Jyoti. These results are in close conformation with findings of Bist *et al* (1994) and Misra *et al* (1983).

It is evident from the data that cv. Bedana recorded maximum number of seeds/ fruit (546.94), followed by Kandhari (502.99) and Local Check (486.33). The latter two cultivars were statistically at par with each other. The results obtained are in agreement with findings of Misra *et*

*al* (1983). As regards aril-weight, cv. Dholka (0.316 g) was significantly superior to the rest of the cultivars. The least aril-weight was recorded in cv. Ganesh (0.210 g), followed by Kabuli Kandhari (0.213 g) and Mridula (0.216 g). Increase in aril-weight with advancement of maturity in Cv. Kandhari was also observed by Dhillon and Kumar (2004). Maximum cracking was registered in cv. G-137 (31.40%), followed by Ganesh (26.30%) and Jyoti (25.17%). Lowest cracking incidence was observed in cv. Chawla (6.32%). Variability in this trait is attributed to the fact that some fruits may have higher rind-thickness due to which these do not crack easily. Secondly, variation in cracking may be also due to a sudden change in the climate at the time of maturity, besides variable moisture and tolerance of cultivars to cracking (Bankar and Prasad, 1992). The results are also supported by the findings of Shulman *et al* (1984).

Analysis of variance (ANOVA) revealed that highest scoring index for fruit shape in cvs. Bedana and Kandhari (4.00 points each), followed by Dholka (3.93 points) and Ganesh (3.92 points). The lowest scoring index was noticed in cv. G-137 (1.73 points). The highest fruit colour value was recorded in cv. Kandhari (4.00 points), followed by Bedana and Kabuli Kandhari. These cultivars were, however, statistically at par but significantly superior to rest of the cultivars. Regarding the general appearance of the fruit, highest scoring index was observed in cv. Bedana (3.57), followed by cvs. Dholka (3.50) and Kandhari (3.44). Lowest scoring index was observed in cv. Jyoti (1.50)

**Table 2. Chemical composition of different pomegranate cultivars**

Cultivar	Total soluble solids (%)	Total sugars (%)	Acidity (%)	TSS/ Acid ratio	Ascorbic acid (mg 100 <sup>-1</sup> ml)	Anthocyanin (mg 100 <sup>-1</sup> g)	Juice content (%)
Kabuli	15.46	8.16	0.64	24.20	13.26	19.37	45.88
Kandhari							
Chawla	13.56	7.81	0.45	30.79	09.40	10.34	49.72
Ganesh	14.42	8.19	0.43	33.84	12.94	20.30	41.71
Mridula	15.61	8.56	0.76	20.58	13.10	15.35	46.13
Jyoti	14.03	8.50	0.44	32.03	12.15	11.24	47.42
G-137	15.49	8.33	0.41	38.12	11.31	13.21	50.39
Dholka	15.55	8.38	0.52	30.13	10.65	14.42	50.55
Bedana	15.77	9.62	0.81	19.48	13.36	16.27	50.83
Kandhari	15.74	9.75	0.57	27.69	10.33	18.34	49.80
Local Check	13.85	8.05	0.47	29.70	9.76	14.18	48.92
SE d	0.28	0.19	0.021	2.13	0.74	1.13	1.07
CD ( <i>P</i> =0.05))	0.60	0.40	0.04	4.48	1.56	2.38	2.25
CV (%)	2.35	2.74	4.73	9.11	7.86	9.09	2.73

which was inferior to even Local Check (2.50). The findings revealed that cvs. Bedana, Dholka, Kandhari, Kabuli Kandhari and Chawla were best with regard to these traits. As far as anar butterfly incidence is concerned, it was higher in cv. Kabuli kandhari (12.49%) and lower in cv. Ganesh (8.33%). This difference in anar butterfly incidence in the cultivars may be due to variable biological behavior of the cultivars and their inherent capacity to tolerate the incidence.

The TSS of the juice in different cultivars ranged from 13.56 (cv. Chawla) to 15.77<sup>0</sup> Brix (cv. Bedana). However, cvs. Bedana, Kandhari, Mridula, Dholka and Kabuli Kandhari were statistically at par. The findings are in conformity with that reported by Parmar and Kakushal (1982) and Bist *et al* (1994). The highest total sugars were registered in cv. Kandhari (9.75%), followed by cvs. Bedana (9.62%) and Mridula (8.56%). The lowest sugar content was recorded in cv. Chawla (7.81%). Results obtained in the present study are in accordance with findings of Malhotra *et al* (1983) and Jagtap *et al* (1992). Fruit acidity ranged from 0.41 (cv. G-137) to 0.81% (cv. Bedana). Intervarietal differences were highly significant. Increase in TSS and decrease in acidity during fruit development was in accordance with findings of Kumar and Purohit (1989).

The total soluble solids/ acid ratio ranged from 19.48 (cv. Bedana) to 38.12 (cv. G-137). The cultivar G-137 was significantly superior to the rest of the cultivars. As far as ascorbic acid is concerned, cv. Bedana, at par with cvs. Kabuli Kandhari and Mridula, recorded the highest ascorbic acid content of 13.36, 13.26 and 13.10 mg/ 100ml, respectively compared to the rest of the cultivars. Lower ascorbic acid content was observed in cv. Chawla (9.40 mg/ 100 ml). The variation in ascorbic acid

content has also been reported by Malhotra *et al* (1983) and Jagtap *et al* (1992) in pomegranate. Cultivar Ganesh registered the highest anthocyanin content (20.30 mg/ 100 g), followed by cv. Kabuli Kandhari (19.37 mg/ 100g) and cv. Kandhari (18.34 mg/ 100 g), whereas, the lowest anthocyanin content was recorded in cv. Chawla (10.34 mg/ 100g). The variation in anthocyanin content among cultivars is attributed to genetic make up of the plant. Significant varietal difference was also reported by Legua *et al* (2000). The juice percentage was significantly higher in cv. Bedana (50.83%), Dholka and G-137 compared to the other cultivars. Siddappa (1943) also reported that cultivars differed in their juice content due to differences in their genetic constitution. From the present study it can be concluded that cvs. Kandhari, Bedana and Dholka are superior in physico-chemical characteristics and may be recommend for commercial cultivation under Srinagar conditions and can be used for further improvement of the crop.

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