

Phytochemical Changes during Ripening in Pomegranate (*Punica Granatum* L.) Varieties

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Abstract: This study evaluated the biochemical and phytochemical changes in pomegranate varieties (Ganesh, Bhagawa and Mridula) during ripening. Total chlorophylls and carotenoid content were maximum in mature fruits of variety Bhagawa while polyphenol content was more in ripened fruit of Mridula. An accumulation of ascorbic acid is higher in ripened fruit of variety Mridula. The soluble protein content was more in both mature and immature fruit of variety Bhagawa. The free amino acid content was increased in ripened fruits of variety Mridula. Nitrogen % is more in mature and ripened fruits of variety Bhagawa. Phosphorus content was more in immature fruits of variety Ganesh and mature fruits of variety Bhagawa. In Ganesh variety, Potassium and Magnesium content was more during ripening. In all the three varieties, Calcium content was increased during ripening. Iron content was more in immature and mature fruits of variety Mridula and Ganesh, respectively. Copper content was more in ripened fruits of variety Mridula. Carbohydrate % was increased during ripening in all the three varieties. Crude fiber content was more in mature fruits of variety Ganesh.

Keywords: Phytochemical changes. (*Punica granatum* L.) Ganesh, Bhagawa, Mridula var

I. INTRODUCTION

Pomegranate (*Punica granatum* L.) of the family Lythraceae is native from Iran to the Himalayas. In northern India, cultivated and naturalized over the whole Mediterranean region since ancient times. There is growing interest in this fruit not only because it is pleasant to eat, but also because it is a functional product of great benefit in the human diet, as it contains several groups of substances that are useful in disease prevention. Because of market demand, it has become increasingly important to characterize the different varieties and clones to obtain high quality product with economical interest. The current study evaluates the biochemical and phytochemical changes during ripening in pomegranate cultivar viz. Ganesh, Bhagawa and Mridula.

Ganesh

Ganesh is one of the important varieties of pomegranate. This fruit crop is commercial grown in Maharashtra. It is light yellow to red in colour. Seeds are soft and pinkish in colour.

Bhagawa

The 'Bhagawa' variety of pomegranate presently under commercial cultivation known by different names viz. 'Shendari', 'Asthagandha', 'Mastani', 'Jay Maharashtra' and 'Red Diana' in various districts of Maharashtra such as Solapur, Nashik, Sangli, Satara, Ahmednagar, Pune and Dhule district. This variety has been recommended for its cultivation by the Mahatma Phule Agriculture University, Rahuri. It has no incidence of cracking of fruits which is observed in other varieties viz. Ganesh, G-137 and Mridula which ranges from 10 to 15%. There is no fruit drop observed in case of severe water shortage situations.

Mridula

This variety has all the characters of the Ganesh variety except the arils are dark red in colour. The colour of the arils in 'Ambe' bahar and 'Mrig' bahar is dark red in colour while it is pink during the 'Hasta' bahar. The average fruit weight is 252 - 300 grams.



Figure Showing fruit size of Ganesh, Bhagawa and Mridula

II. MATERIAL AND METHODS

Punica granatum L. (var. Ganesh, Bhagawa and Mridula) fruit material was selected for comparative study of biochemical analysis. Fruit material was selected in three categories such as immature, mature, and ripened.

Chlorophylls were estimated following the method of Arnon (1949). Carotenoids were extracted from the weighed material as per the procedure described for chlorophylls earlier. Carotenoids were estimated following the method described by Kirk and Allen (1965). The method of Folin and Dennis (1915) was employed for determination of the total polyphenol content. Ascorbic acid content in plant material was estimated as per the method described. The soluble proteins in the enzyme extraction were determined according to the method of Lowry et. al. (1951). The method described by Kurt and Randerath (1966) was followed for preparation of TLC plates. Glass plates (6 cm x 12 cm) and (6 cm x 18cm) were coated with a thin uniform layer of slurry of silica gel (40g silica gel G with binder 13 % CaSO₄, Qualigens fine chemicals) mixed with 80 ml distilled water. The plate was air dried and activated in oven at 100 degree centigrade for 1 hour. A method described by J Jayaraman (1981) was employed for the qualitative estimation of amino acids. Inorganic constituent was estimated from the acid digest which was prepared following the method of Toth et. al. (1948). The inorganic elements like Calcium, Magnesium, Zinc and Copper were estimated using AAS (Parkin Elmer 3030). For Calcium estimation in addition to acid digest, hot water extract was also used to get an idea about soluble Calcium level. The Phosphorus content was estimated according to the method of Sekine et al; (1965). The Potassium was estimated according to standard flame photometric procedure employing ELICO Flame photometer model C L 22 A. Total nitrogen was estimated following the method of Hawk et al (1948). For estimation of fiber, 2 gm of plant material was extracted with petroleum ether, refluxed it with H₂SO₄ and NaOH respectively for half an hour. Then filtered through muslin cloth and removed the residue and transferred to pre-weighed ashing dish. After drying of residue and cooling of dish again weight it (W₂). Cooled in the desiccators and again weighed it (W₃). By using formula, percentage crude fiber = $\frac{(W_2 - W_1) - (W_3 - W_1)}{W_1} \times 100$ wt. of sample, crude fiber% is estimated. Carbohydrates were estimated following the method of Nelson (1944).

III. RESULT AND DISCUSSION

Table 1. The chlorophyll content mg /100 gm of *P. granatum* cultivars during ripening

Pomegranate cultivars		Chlorophyll content mg/100gm fresh wt.		
		Chl. a	Chl. b	Total Chl.
Ganesh	Immature	5.13	5.99	11.12
	Mature	11.96	14.77	26.99
	Ripened	10.37	13.04	23.41
Bhagawa	Immature	5.92	9.65	15.55
	Mature	17.49	23.79	41.26
	Ripened	10.27	15.93	26.2
Mridula	Immature	6.91	8.4	15.31
	Mature	8.1	12.79	20.87
	Ripened	5.52	8.42	13.44

Table 2: Total Carotenoids content mg / 100 gm of *P. granatum* cultivars during ripening

Pomegranate cultivars		Total Carotenoids content mg/100 gm fresh wt.
Ganesh	Immature	0.98
	Mature	3.18
	Ripened	4.08
Bhagawa	Immature	1.84
	Mature	3.74
	Ripened	2.72
Mridula	Immature	2.1
	Mature	2.2
	Ripened	2.6

Table 3. The Biotic compounds mg/100 gm of *P. granatum* cultivars during ripening

Pomegranate cultivars		Biotic Compounds mg/100gm fresh wt.		
		Polyphenols	Soluble Proteins	Ascorbic acid
Ganesh	Immature	1146.62	857.14	10
	Mature	1622.81	1116.07	9.4
	Ripened	776.94	812.5	10.6
Bhagawa	Immature	989.98	2392.86	8.6
	Mature	1240.6	1624.99	10
	Ripened	1259.4	1017.86	16
Mridula	Immature	1328.32	1223.21	6
	Mature	1177.95	1330.36	8.6
	Ripened	2105.26	1678.57	19.4

Table 4: The Carbohydrate, Crude fiber, and Nitrogen content of P. granatum cultivars during ripening

Pomegranate cultivars		Crude Fiber %	Carbohydrate %	Nitrogen %
Ganesh	Immature	8.46	70.3	0.32
	Mature	23.23	58.89	0.2
	Ripened	8.55	65.51	1.71
Bhagawa	Immature	9.80	69.64	0.83
	Mature	10.83	60.59	2.26
	Ripened	10.44	61.71	2.10
Mridula	Immature	7.78	70.74	0.96
	Mature	7.28	67.79	1.71
	Ripened	7.36	73.24	1.12

Table 5: Mineral uptake potential in P. granatum cultivars during ripening

Pomegranate cultivars		Mineral Uptake (mg 100-1g Dry Wt.)						
		K	P	Ca	Zn	Fe	Co	Mg
Ganesh	Immature	400	556	561.12	2.11	18.57	2.31	1.73
	Mature	200	240	320.64	1.89	45.70	3.19	5.49
	Ripened	130	165	400.8	1.25	23.46	5.22	1.56
Bhagawa	Immature	80	300	240	3.18	23	2.18	1.56
	Mature	40	600	481	14.35	12.16	2.05	1.39
	Ripened	100	280	641	0.82	18.19	2.31	1.56
Mridula	Immature	130	276	480	3.82	42.30	3.76	2.42
	Mature	225	225	721	8.23	27.61	3.51	1.73
	Ripened	320	320	481	5.65	21.20	10.4	0.88

IV. CONCLUSION

As per above result we conclude that *Punica granatum* L. variety Bhagawa contain higher amount of biochemical content than variety Ganesh and Mridula. Vitamin C (ascorbic acid) content is more in variety Mridula. Macro elements like Nitrogen, Phosphorus, Potassium, Magnesium and Calcium or more in variety Ganesh while microelements like Iron, Zinc and Copper are more in variety Mridula. Carbohydrate percentage is more in all the three varieties during ripening. Crude fiber content is more in variety Ganesh and Bhagawa.

REFERENCES

- [1]. Arnon. D.I. (1949) "Copper enzymes isolated chloroplasts, Polyphenol oxidase in Beta Vulgaris", Plant Physiol, 24:1-15.
- [2]. Folin, O. and Denis, W. (1915) "A colorimetric estimation of phenol and phenol derivatives in urine". J. Biol. Chem., 22:305-308.
- [3]. Hawk, P.B., Oser, B.L. and Summerson, W.H. (1948) "Practical physiological chemistry (Publ.)", The Blockiston Co. USA.
- [4]. J Jayaraman (1981) "Laboratory Manual in Biochemistry".
- [5]. Kirk, J.O.T. and Allen, R.L. (1965) "Dependence of Chloroplast pigment synthesis on protein synthesis. Effect of actidione. Archh Biochem", Biophys. Res. Commun. 21:523-530.
- [6]. Kurt Randerath (1966). "Thin Layer Chromatography" Veriag Chemie GmbH. Weinheim/Bergstr. (Publ.) Academic Press. New York and London. PP-208-211.
- [7]. Lowry, O.H.; Rosenbrough, N.J.; Furr, A. L. and Randall, R.J. (1951) "Protein measurement with Folin phenol reagent", J. Biol. Chem. 193:262-263.
- [8]. NELSON, N. (1944) "A photometric adaptation of the Somogyi method for the determination of sugar" J. biol. Chem., 153, 375.

- [9]. Sekine, T., Sasakawa, T., Morita, S., Kimura, T. and Kuratom, K. (1965) "A laboratory manual for physiological studies of Rice (Eds.)".
- [10]. Toth, S.J., Prince, A.L., Wallace, A. and Mikkenlsen, D.S. (1948) "Rapid quantitative determination of eight mineral elements in plant tissue. Systematic Procedure involving use of a flame photometer", Soil Sci., 66: 459-466.