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Evaluation of promising lines of pomegranate for preparation of anardana

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Abstract
The objective of this research work was to analyze the proximate composition of pomegranate and to study the effect of two packaging material and storage life of anardana. The proximate analysis of pomegranate fruit showed moisture 80.51 %, reducing sugars 12.19 %, total sugars 13.48 %, total soluble solids 15 °Brix, acidity 3.1 % and ascorbic acid 12.55 mg/100 g, anthocyanin 76.30 mg/100 g. The fresh healthy and well matured fruits of genotype 1/1920, 1/2324, 2/2324 were selected for preparation of anardana. The anardana was prepared with the help of cabinet dryer, dried at 60 ºC for 8 hr and stored in two packaging material like polythene pouches and aluminium foil and stored for 90 days at ambient condition. The fresh anardana contained average 10.33 per cent, moisture, 30.35 per cent reducing sugars, 8.33 per cent total sugars, 13.57 ^{0}Brix total soluble solids, 3.72 per cent acidity, 8.33 mg/100 g ascorbic acid and 69.23 mg/100 g anthocyanin. During storage study of anardana TSS, reducing sugars and total sugars were increased whereas moisture content, acidity, ascorbic acid and organoleptic quality was slightly decreased with increased storage period. The anardana prepared from 2/2324 genotype and packed in aluminium foil (P_2T_2) was found more acceptable as compared to other samples after 90 days of storage.

Keywords: pomegranate fruit, anardana, genotype, anthocyanin

Introduction
Pomegranate (*Punica granatum* L.) belongs to the Punicaceae family and is one of the commercially important fruit which is extensively cultivated in many tropical and subtropical regions (Dhandar and singh, 2002) [7]. The fruit is symbolic of prosperity and liked for its cool, refreshing juice as well as valued for its medicinal properties (Duman *et al* 2009) [9]. The pomegranate tree is native from Iran (Akbarpour *et al*., 2009) [3] to the Himalayas in the northern India and has been cultivated since ancient times throughout the Mediterranean region of Asia, Africa and Europe. The generic term, Punica, was the Roman name for Carthage from where the best pomegranates came to Italy.

It is an ideal crop for the sustainability of the small holdings, as pomegranate is well suited to the topography and agroclimate of arid and semi-arid regions. It is also known as Chinese Apple or Apple of Carthage (Hindi-Anar) and has been cultivated extensively in Mediterranean countries (Tunisia, Turkey, Israel, Egypt, Spain and Morocco), Afghanistan, India and to some extent in the U.S, China, Japan and Russia. As a commercial crop, pomegranate is grown to a limited extent in selected locations in many states of India. The estimated area under pomegranate cultivation in India has grown up by 35.19 per cent during the last decade, as area increased from 96.9 thousand hectares (2003-04) to 180.64 thousand hectares (2014-15) with an annual production of 17.90 lakh tones. At present, Maharashtra an area of 128.65 thousand ha is the leading state in acerage covering about 68.7 per cent of area under pomegranate. Similarly, around 70.2 per cent of total production comes from Maharashtra.

Small-scale plantations are also seen in Gujarat, Rajasthan, Karnataka, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Punjab and Haryana (Patil and Karale, 1990). It thrives best under hot and dry summer and cold winter provided irrigation facilities are available. 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. It is believed that pomegranate has cancer fighting properties and a glass full of pomegranate juice is said to contains more antioxidants than 10 cups of green tea.

The edible part of fruit (57.51% of total fruit wt.) comprised 63.58% of juice and 36.21% of seeds also contains considerable amounts of acids, sugar, vitamins, polysaccharides, polyphonies and important minerals (Al-Maiman and Ahamad, 2002) [4].

The consumption of pomegranate has been associated with beneficial health effects, such as prevention of oxidation of both low- and high-density lipoprotein, blood pressure, inflammatory, atherosclerosis, prostate cancer, heart disease and HIV-1 (Neurath *et al*., 2005; Rosenblat *et al*., 2006) [14, 23]. The juice stimulates appetite and is used in the treatment of stomach disorders as well as a painkiller. The fruit juice is beneficial for dry coughs, provides relief in urinary disorders and can be used to wash wounds and ulcers. It is well known as an excellent treatment for anemia. Pomegranates have been reported to have antimicrobial activity against a range of gram positive and negative bacteria. Pomegranate seeds are rich in oil, which have hormone producing effects and estrogen hormone.

Global demand for pomegranate fruit and their value-added products is rising very fast. The new products such as minimally processed seed (arils), jam jellies frozen seeds are being developed. Product diversification in context of increased pomegranate production is the need time. Despite numerous health benefits, fresh consumption of pomegranate still not wide spread. This because of difficulty in extracting arils from the fruit and staining of hands. There for many people don't like it as a table fruit. Hence, the minimally processed ready to eat arils and frozen arils packed in punnets present more appealing to consumers than whole fruit due to their convenience and unique sensory characteristics. Though there is great potential for pomegranate derived products, the industrial processing of pomegranate is scare due to lack of technological development. Fruit arils are dried traditionally without any treatment, as a result poor quality product is produced, while fetches low price in the market. Keeping this view study was undertaken to for the preparation of good quality anardana from wild pomegranate genotype fruits.

2. Materials and Methods

The experiment was conducted in the fruit and vegetable unit of the Department of Food Science and Technology, Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2014-2015. The pomegranate fruits of genotype 1/1920, 1/2324, 2/2324 was obtained from the All India Co-Ordinated Research Project on Arid Zone Fruit, Mpkv Rahuri.

2.1 Preparation of anardana

The fresh healthy and well matured fruits of genotype 1/1920, 2/2324, 2/2324 were selected for preparation of anardana then fruits were cut superficially by sharp knife and arils were separated by manually. After that arils were dehydrated by using cabinet dryer at 60 ºC for 8 hrs. immediately after cooling the arils called anardana was packed in polythene bag (200 gauge) and aluminium laminated pouches flow chart for the preparation anardana shown in fig 1.

2.2 Description of the Treatments

1. P_1T_1= Genotype 1/1920 + Polythene Bag
2. P_1T_2= Genotype 1/1920 + Aluminium laminated pouch
3. P_2T_1= Genotype 1/2324 + Polythene Bag
4. P_2T_2= Genotype 1/2324 + Aluminium laminated pouch
5. P_3T_1= Genotype 2/2324 + Polythene Bag
6. P_3T_2= Genotype 2/2324 + Aluminium laminated pouch

Where, P_1= Genotype 1/1920, P_2 = Genotype 1/2324, P_3 = Genotype 2/2324,

T_1 = Polythene Bag, T_2 Aluminium laminated pouch

Flow Chart

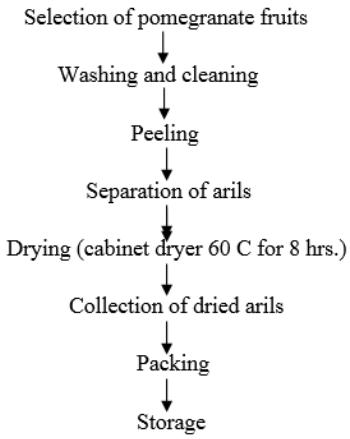

Fig 1: Flow sheet for preparation of anardana from pomegranate fruit

2.3 Chemical analysis of pomegranate fruit and anardana

The method described in AOAC (1990) [1] for determining moisture was used for moisture estimations in fruit and anardana. The titratable acidity was determined by the procedure as reported by Ranganna (1986) [20]. The ascorbic acid content in the products was estimated by titrimetic method as summarized by Ranganna (2009) [21] using 2-6, dichlorophenol indophenol dye and sugars by Lane and Eynon (1923) [12] as reported by Ranganna (1986) [20] method. The total anthocyanin pigments were measured by the methods reported by Khurdiya and Roy (1984) [11]. Total soluble solids (TSS) was determined with the help of Erma Hand Refractometer 0-32 range in duplicate (A.O.A.C., 1990) [1]. The total sugars and reducing sugars were estimated by the volumetric method of Lane and Eynon (1923) [12] as reported by Ranganna (1986) [20].

2.4 Sensory evaluation of anardana

The Sensory evaluation of anardana samples were carried out according to the standard method of Amerine *et al*. (1965) on 9 points Hedonic scale, the mean score minimum 10 semi trained judges for each quality attributes *viz*., colour, texture, taste and overall acceptability was recorded.

2.5 Storage of anardana

The anardana was packed in polythene bag (200 gauge) and aluminium laminated pouches stored up to 90 days at ambient temperature condition.

2.6 Statistical analysis

During storage study of anardana data were recorded at monthly interval on different parameters were subjected to statistical analysis using Factorial Completely Randomized Design (FCRD) using three replications.

3. Results and Discussion

The results of various experiments conducted during the study period are summarized below:

3.1 Proximate composition of pomegranate fruit

The data on proximate composition of fresh pomegranate fruits presented in Table No 1. The data revealed that fruits genotypes 1/1920 was pink colour and genotype 1/2324 and 2/2324 showed dark red colour and the average weight of fruits was recorded maximum in 2/2324 (260g) followed by 1/2324 (240g) and lowest weight was recorded in 1/1920

(210g). The maximum weight of peel (82g) and 31.53 per cent) was observed in genotype 2/2324 and lowest peel weight was recorded in (65g and 30.95 per cent) in genotype 1/1920. The arils weight was recorded maximum in genotype 2/2324 (187g and 68.46 per cent) and lowest weight was recorded in 1/1920 (145g and 69.09 per cent). The rind thickness of fruit peel was maximum recorded in genotype 1/2324 (2.8mm) and lowest rind thickness was recorded in genotype 1/1920 (2.1mm). The fresh pomegranate fruit contained maximum moisture per cent in genotype 1/1920 (80.51 per cent) followed by 1/2324 (79.80 per cent) and lowest was recorded in (79.30 per cent) in genotype 2/2324. The maximum TSS (15 ºB) was noted in genotype 1/1920 and lowest TSS (12.90 ºB) was recorded in 2/2324 genotype. The titrtable acidity per cent was recorded maximum in genotype 2/2324 followed by in genotype 1/2324 and lowest titrable acidity per cent recorded in 1/1920. Ascorbic acid content was recorded maximum in genotype 2/2324 (14.00 mg/100g) and lowest ascorbic acid content recorded in (12.55mg/100g) in 1/1920 genotype. The maximum reducing sugars (12.40 per cent) was recorded in genotype 2/2324 followed by (12.29 per cent) in 1/2324 genotype, (12.19 per cent) in 1/1920. The total sugar per cent. The maximum total sugars (13.48 per cent) was recorded in genotype 1/1920 followed by (12.50 per cent) in 1/2324 genotype, (12.46 per cent) in 2/2324. The total sugar per cent. The maximum anthocyanin content (76.3 per cent) was observed in genotype 1/1920 and lowest anthocyanin content was observed in (73.25 per cent) in genotype 1/2324.

The findings of present investigation are in accordance with Dhumal (1984) [8] who reported 16.20 ºB TSS, 0.25 per cent acidity, 12.93 total sugar, 0.28 per cent non-reducing sugar and 9.2 mg/100g in ascorbic acid pomegranate juice. The edible portion of fresh pomegranate fruit contained TSS 14.17 ºB, acidity 0.35 per cent, total sugar 13.52 per cent, reducing sugar 11.65 per cent and ascorbic acid 12.60mg/100g (Garande *et al*, 2004) [10].

Table 1: Proximate compositions pomegranate fruit

Sr. no	parameters	Mean values of genotype		
a	**Physical parameters**			
		1/1920	1/2324	2/2324
1	Colour of fruits	Pink	Dark red	Dark red
2	Weight of fruit(g)	210	240	260
3	Weight of peel (g)	65	80	82
	Weight of peel (%)	30.95	33.33	31.53
4	Weight of aril (g)	145	160	178
	Weight of aril (%)	69.04	66.66	68.46
5	Rind thickness (mm)	2.1	2.8	2.6
b	**Chemical parameters**			
1	Moisture, %	80.51	79.80	79.30
2	Titrable acidity, %	3.1	3.79	3.90
3	TSS, ^{0}Brix	15	13	12.90
4	Reducing sugars, %	12.19	12.29	12.40
5	Total sugars, %	13.48	12.50	12.46
6	Ascorbic acid, mg/100 g	12.55	13.82	14.00
7	Anthocyanin, mg/100 g	76.30	73.25	75.93

3.2 Proximate composition of fresh anardana

The data on proximate composition of fresh anardana is presented in Table 2. The mean values of fresh anardana for moisture 10.33 per cent, TSS was 13.37 °Brix, acidity 3.72 per cent, reducing sugars 29.52 per cent, total sugars 30.35 per cent, ascorbic acid 8.33 mg/100g and anthocyanin 69.26 mg/100 gm. The similar results for composition of fresh anardana prepared from Cv. Ganesh reported that moisture content was 10.20 per cent, TSS was 12.25 °Brix, acidity 1.30 per cent, reducing sugars 29.00 per cent, total sugars 30.20per cent, ascorbic acid 6.7 mg/100g and from anardana prepared from Cv. Arakta was moisture 10.50 per cent, TSS was 13.25 °Brix, acidity 1.5per cent, reducing sugars 29.52 per cent, total sugars 30.50 per cent, ascorbic acid 7.0 mg/100g Patil *et al*. (2013) [17].

Table 2: Chemical composition of fresh anardana

Treatments	Moisture (%)	TSS ^{0}Brix	Acidity (%)	Reducing sugars (%)	Total sugar (%)	Ascorbic Acid mg/100g	Anthocyanin mg/100g
P_1T_1	10.37	13.60	3.58	29.34	30.23	8.12	72.86
P_1T_2	10.31	10.80	3.50	29.35	30.42	8.08	79.74
P_2T_1	10.37	15.40	3.90	29.55	30.24	8.42	57.67
P_2T_2	10.29	12.40	3.62	29.58	30.49	8.37	63.81
P_3T_1	10.33	15.00	4.00	29.60	30.33	8.56	68.13
P_3T_2	10.29	13.00	3.76	29.68	30.43	8.47	73.33
Mean	10.33	13.37	3.72	29.52	30.35	8.33	69.26
SE±	0.048	0.108	0.120	0.013	0.126	0.019	0.89
CD at 5%	0.130	0.335	0.62	0.042	0.390	0.035	0.98

Where, P_1= Genotype 1/1920, P_2 = Genotype 1/2324, P_3 = Genotype 2/2324,
T_1 = Polythene Bag, T_2 Aluminium laminated pouch

3.3 Sensory evaluation of fresh anardana

The data regarding sensory evaluation of fresh anardana is presented in Table 3. The data indicates that the values for mean score for colour and appearance were 7.94, texture 7.84, taste 7.98 and overall acceptability 7.74 of fresh anardana. The overall acceptability score was higher 8.29 for P_3T_2 treatment. Similar results were reported for sensory parameters of anardana prepared from fresh pomegranate fruit (Garande *et al.* 2004) [10].

Table 3: Sensory evaluation of fresh anardana

Treatment	Colour and appearance	Texture	Taste	Overall acceptability
P_1T_1	7.40	7.32	7.42	7.15
P_1T_2	7.82	7.91	7.62	7.56
P_2T_1	7.81	7.52	7.52	7.28
P_2T_2	7.96	7.54	7.87	8.12
P_3T_1	8.30	8.13	8.54	7.89

P_3T_2	8.40	8.38	8.70	8.29
Mean	7.94	7.84	7.98	7.74

Where, P_1= Genotype 1/1920, P_2 = Genotype 1/2324, P_3 = Genotype 2/2324,
T_1 = Polythene Bag, T_2 Aluminium laminated pouch

3.4 Effect of storage period on chemical composition of anardana after 3 months storage

The data on the chemical composition of anardana during storage are tabulated in Table 4. The anardana stored in ambient condition were analyzed for moisture, TSS, acidity reducing sugars, total sugars, ascorbic acid and anthocyanin content at 30 days interval during storage study.

Table 4: Effect of storage period on chemical composition of anardana after 3 months storage

Treatments	Moisture (%)	TSS ^{0}Brix	Acidity (%)	Reducing sugars (%)	Total sugar (%)	Ascorbic Acid mg/100g	Anthocyanin mg/100g
Genotypes							
P1	10.06	14.15	3.40	29.81	30.41	7.23	71.34
P2	9.96	14.50	3.60	29.83	30.43	7.27	53.75
P3	9.91	14.63	3.74	29.84	30.45	7.29	64.10
SE±	0.036	0.69	0.044	0.069	0.021	0.009	0.10
CD at 5%	0.106	2.15	0.128	0.204	0.062	0.028	0.29
Packaging material							
T1	9.60	11.81	3.74	29.83	30.50	7.32	61.08
T2	10.25	11.87	3.18	29.79	30.36	7.20	65.04
SE±	0.030	0.59	0.036	0.052	0.018	0.008	0.08
CD at 5%	0.086	1.79	0.104	0.157	0.056	0.026	0.25
Two factor interaction							
P_1T_1	9.84	14.50	2.95	29.43	30.49	6.81	68.90
P_1T_2	9.90	11.95	2.18	29.42	30.30	6.68	73.78
P_2T_1	9.91	15.95	3.51	29.67	30.54	6.93	51.70
P_2T_2	9.87	14.15	3.42	29.62	30.31	7.13	55.80
P_3T_1	9.95	15.60	3.54	29.74	30.50	7.13	62.65
P_3T_2	9.98	14.10	3.50	29.68	30.41	7.18	65.55
Mean	9.97	14.38	3.18	29.59	30.43	6.98	63.06
SE±	0.051	0.76	0.062	0.073	0.030	0.017	0.14
CD at 5%	0.151	2.33	0.081	0.218	0.093	0.053	0.41

Where, P_1= Genotype 1/1920, P_2 = Genotype 1/2324, P_3 = Genotype 2/2324,
T_1 = Polythene Bag, T_2 Aluminium laminated pouch

3.4.1 Moisture

The moisture content was reduced from 10.33 to 9.97 per cent at ambient temperature when stored for three months. It was observed that reduction in moisture content was lower in packaging material T_2 than T_1 after 90 days. The moisture content in anardana stored in packaging material T_1 was reduced at higher rate. This might be due to evaporation during storage at ambient condition. Two factor interaction effect showed statistically significant results. Among the all treatments, P_3T_2 was found more suitable to maintain the moisture level at higher value in anardana than the other treatments in present investigation. In consistent with these results the decrease in moisture content during storage was reported in pomegranate anardana (Garande at al. 2004; Singh D.B and Kingsly A.R.P.2008 and Patil *et al.* 2013) [10, 26, 17], The results obtained in present investigation are parallel with literature.

3.4.2 Total soluble solids (TSS)

The TSS content of anardana ranged from 13.37 to 14.38 per cent from which sample P_2T_1 stored at ambient temperature had the highest content of total soluble solids. While other treatments had lower results for TSS. The increase in TSS content might be due to decrease in moisture content. Two factor interaction effect showed statistically significant results. The increase in TSS content during storage period was reported in pomegranate anardana (Singh *et al*. 2008; Biradar *et al*. 2009 and Thakur at al. 2010) [26, 5, 27] The results obtained in present investigation showed similar trend as shown in literature.

3.4.3 Titratable acidity

The acidity in all treatment combinations decrease throughout the storage period increase. The interaction effects of two factor analysis were become statistically significant results. The maximum acidity of anardana 3.54 per cent observed in P3T1 treatment combinations and minimum acidity 2.18 per cent in P1T2 after 90 days of storage. The decrease in acidity during storage could be due to increase in reducing and total sugars in anardana. Sharma *et al*., (2013) [25] studied that acidity of anardana decrease from 9.7 to 4.8 during storage for 12 months period packed in polythene bag (200 gauge). Initial acidity of anardana stored in aluminium laminated pouch was 1.59 per cent which decreases to 1.28 per cent during storage period of 3 months (Dak *et al*., 2014) [6]. Similar results are in confirmation with Garande *et al*. (2004) [10] in pomegranate anardana.

3.4.4 Reducing sugars

The reducing sugar level observed with in all treatment combination was increasing order. The two factor interaction effects showed statistically significant results of anardana packed in polythene pouches and aluminium laminated pouches. The maximum reducing sugars 29.74 per cent in P_3T_1 treatment combination and the minimum reducing sugars 29.42 per cent recorded in P_1T_2 treatment combination. The increase in reducing sugar can be attributed to conversion of non-reducing sugars to reducing sugars and thus increasing reducing sugar. Garande *et al*. (2004) [10] reported that reducing sugars content of anardana increase from 29.40 to 29.68 per cent during storage of 6 months period packed in

polythene pouches. Singh D.B and Kingsly A.R.P. (2008) [26] concluded that reducing sugar content increased in anardana sample from 44.2 to 45.5 per cent stored for six months of period. Patil *et al*. (2013) [18] revealed that reducing sugar content of mouth freshener prepared from pomegranate found to be increased during storage period of two months from 29 to 29.40 per cent and in anardana from 28.50 to 29.68 per cent.

3.4.5 Total sugars

The total sugars level observed with in all treatment combination was increasing order during three months of storage and significant difference was found between total sugars of anardana packed in polythene pouches and aluminium laminated pouches. The maximum total sugar was observed were 30.54 per cent in treatment combination P_2T_1 and minimum total sugars were recorded 30.30 per cent in P_1T_2 treatment combination at 90 days of storage. Total sugars increase more in polythene bags as compared to aluminium laminated foil stored at ambient condition for 90 days of storage. The increase in total sugar can be attributed to conversion of non-reducing sugars to reducing sugars and thus increasing total sugars. In consistent with these results the decrease in moisture content during storage was reported in pomegranate anardana (Ahire, 2007 and Patil *et al*. 2013) [2, 17].

3.4.6 Ascorbic acid

The ascorbic acid content of anardana showed a slight decrease in all treatment combination throughout the storage period. The interaction effect of two factor analysis showed significant difference. The maximum ascorbic acid content 7.18 mg/100gm in P_3T_2 treatment combination and minimum ascorbic acid content 6.68 mg/100g in P_1T_2 treatment combination during storage of 3 months. Ascorbic acid content was found to be decrease slightly during storage, this may be attributed due to oxidation by trapped oxygen in pouches which results in formation of dehydro ascorbic acid. Similar results are in confirmation with Patil *et al*. (2013) [18] and Sharma *et al*. (2013) [25] in pomegranate anardana.

3.4.7 Anthocyanin

The anthocyanin level observed with in all treatment combination was decreasing order. The two factor interaction effects showed statistically significant results. Maximum anthocyanin content of anardana was observed 73.78 in P1T2 treatment and minimum anthocyanin content of anardana was observed 51.70 in P2T1 treatment combinations in 90 days of storage. Aluminium laminated pouch contains more anthocyanin as compare to plastic pouch. The decrease in anthocyanin content of anardana in all treatment might be due to hydrolysis of the protective 3 glucoside linkage to give unstable anthocyanin. Similar results were also reported by Ahire (2007) [2] in pomegranate and Sandhan (2003) [24] in pomegranate beverages.

3.5 Effect of organoleptic properties of anardana during storage

The data sensory scores of pomegranates anardana during storage for parameters like colour and appearance, texture, taste and overall acceptability of anardana samples are tabulated in Table 5.

Table 5: Effect of sensory quality of anardana after 3 months storage

Treatment	Colour and appearance	Texture	Taste	Overall acceptability
P_1T_1	5.71	6.72	6.54	6.45
P_1T_2	6.82	7.26	7.10	7.05
P_2T_1	6.21	6.89	6.84	6.88
P_2T_2	7.31	7.12	7.18	7.90
P_3T_1	7.41	7.58	7.64	7.45
P_3T_2	7.91	8.02	7.93	8.00
Market sample	7.90	8.04	8.10	7.81
Mean	7.04	7.38	7.33	7.36
SE±	019	0.10	0.09	0.13
CD at 5%	0.59	0.30	0.26	0.65

Where, P_1= Genotype 1/1920, P_2 = Genotype 1/2324, P_3 = Genotype 2/2324,
T_1 = Polythene Bag, T_2 Aluminium laminated pouch

3.5.1 Colour and appearance

A slight decrease in colour from 7.94 to 7.04 was observed during storage of anardana for 3 months at ambient temperature packed in aluminium pouches and polythene pouches. The maximum score 7.41 was observed in P_3T_2 treatment and minimum score 5.71 was observed in P_1T_1 treatment after storage period of three months. The score for colour decreased significantly during storage with respect to packaging material. Anardana packed in P_3T_2 showed maximum 7.91 colour score for three months storage than other treatment of combination and storage period, followed 7.4 in P_2T_2 treatment and lowest colour was noted 5.71 in P_1T_1 treatment. The colour and appearance decrease during storage. Aluminium packed samples showed good colour retain than plastic pouches. Colour decrease in anardana stored at room temperature more, this is might be due to higher rate of millard reaction that might have occurred at room temperature. Garande *et al*. (2004) [10] reported that colour score was decrease from 7.85 to 7.10 during storage period of 6 months. It was reported that colour score decreased during storage condition and period with respect to packaging material in polythene 150 guage for dried figs (Palve 2002) [15]. Aluminium foil pouch for mango bar (Nadansabapathi *et al*., 1993) [13].

3.5.2 Texture

A slight decrease in texture from 7.84 to 7.38 was observed during storage of anardana for 3 months at ambient temperature packed in aluminium pouches and polythene pouches. The maximum score (8.02) was observed in P_3T_2 treatment and minimum score (6.72) was observed in P_1T_1 treatment after storage period of three months. The score for texture decreased significantly during storage with respect to packaging material. Anardana packed in P_3T_2 for three months observed good results about maintaining maximum texture score than other treatment of combination and storage

period, followed by P_3T_1 treatment and lowest colour (6.72) was noticed in P_1T_1 treatment. Aluminium packed samples showed good texture retain than plastic pouches. Texture deteriorate in anardana stored at ambient temperature more, this is might be due to hardening effect resulting from loss of moisture during storage. Garande *et al*. (2004) [10] reported that texture score was decrease from 8.25 to 7.92 during storage period of 6 months packed in polythene bag. It was reported that texture score decreased during storage condition and period with respect to packaging material in polythene (150 guage) for dried figs (Palve 2002) [15]. Aluminium foil pouch for mango bar (Nadansabapathi *et al*., 1993) [13].

3.5.3 Taste
A slight decrease in taste from 7.98 to 7.33 was observed during storage of anardana for 3 months at ambient temperature packed in aluminium pouches and polythene pouches. The maximum score (7.93) was observed in P_3T_2 treatment and minimum score (6.54) was observed in P_1T_1 treatment after storage period of three months. The score for taste decreased significantly during storage with respect to packaging material Anardana packed in P_3T_2 for three months observed good results about maintaining maximum taste score than other treatment of combination and storage period, followed by 7.64 in P_3T_1 treatment and lowest colour was noticed 6.54 in P_1T_1 treatment. Aluminium packed samples showed good taste retain than plastic pouches. Taste decrease in anardana stored at room temperature more, this is might be due to increase in sweetness, decrease in moisture and it becomes hard during storage. Garande *et al*. (2004) [10] reported that taste score was decrease from 6.80 to 6.55 during storage period of 6 months packed in polythene bag. It was reported that taste score decreased during storage condition and period with respect to packaging material in polythene 150 gauge for dried figs (Palve 2002) [15]. Aluminium foil pouch for pineapple slices (Pokharkar, 1994) [19].

3.5.4 Overall acceptability
A slight decreased in overall acceptability from 7.74 to 7.36 was observed during storage of anardana for 3 months at ambient condition packed in aluminium pouches and polythene pouches. The maximum score (8.00) was observed in P_3T_2 treatment and minimum score (6.45) was observed in P_1T_1 treatment after storage period of three months. The score for overall acceptability decreased significantly during storage with respect to packaging material. Anardana packed in P_3T_2 (8.00) for three months observed good results about maintaining maximum overall acceptability score than other treatments of combination and storage period, followed by 7.90 in P_2T_2 treatment and lowest overall acceptability was noticed 6.45 in P_1T_1 treatment. Aluminium packed samples showed good overall acceptability retain than plastic pouches. The dried pomegranate product packed in aluminium foil pouches always obtain highest score for better quality followed by polythene pouch (200 guage). Garande *et al*. (2004) [10] reported that overall acceptability score was decrease from 8.20 to 7.95 during storage period of 6 months packed in polythene bag. It was reported that overall acceptability score decreased during storage condition and period with respect to packaging material in polythene 150 gauge for dried figs (Palve, 2002) [15]. Aluminium foil pouch for mango bar (Nadansabapathi *et al*., 1993) [13], aluminium foil pouch for pineapple slices (Pokharkar, 1994) [19]. This study reveals that sample packed in aluminium foil and polythene bag maintain their acceptability for more than 3 months at ambient condition. The result of analysis of variance indicate that the packaging material effect on mean sensory score of anardana. From above it is concluded that aluminium foil pouches were suitable for packaging and storage of anardana for a period of three months.

4. Conclusion
It can be concluded from the present findings that the good quality anardana of 1/1920, 1/2324 and 2/2324 pomegranate genotype can be prepared by drying at 60 ºC for 8 hrs in cabinet tray dryer. Among all treatments results indicated that the P_3T_2 treatment was most acceptable for preparation of anardana as compared to other samples of anardana. Anardana can be stored best in aluminium laminated foil at ambient condition with good storage stability for 90 days.

5. References

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