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Evaluation of unique mango accessions for whole-fruit pickle

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ABSTRACT

Studies conducted to evaluate the suitability of nineteen unique mango accessions for preparation of tender whole mango pickles revealed that these varieties were characterized by their acidic taste and rich raw mango flavour, which are most prefered for pickle production. The physical and quality parameters viz. fruit shape, weight, raw mango flavour, firmness, titrable acidity, latex flow, pH, dry matter and vitamin C which are important in pickle quality, showed wide variations among different varieties. Based on the sensory evaluation of whole immature green mango pickle prepared by standard fermentation and curing method, the accessions viz., Kashimidi, Isagoor Appe, Malange, Appemidi, Dantimamidi and Jeerige were considered to be most suitable for preparation of tender mango pickles.

Key words: Germplasm, raw tender mango, pickle, variability, sensory evaluation, unique accession

INTRODUCTION

Mango (*Mangifera indica* L.) popularly known as 'King of fruits' is the most important native fruit crop of India, showing high heterozygosity and wide genetic variability. The large number of about 1000 varieties available in India has not been fully exploited. Brined raw mango slices, various types of pickles and chutneys are the major products commonly made from raw mango (Maneepun and Yunchalad, 2004). Canned slices, beverages, fruit bars, nectars, syrups and aseptically packed pulp are the important processed products of ripe mango fruits (Doreyappa Gowda and Huddar, 2004). Currently, various forms of mango products have good export market in South-East-Asia, Europe and U.S.A. Raw tender mango is best suited for pickle production due to its high acidity, texture and characteristic typical mango flavour. Several formulated recipes with diversified taste, flavour, aroma and texture have been developed in India both for domestic and international markets. Pruthi (1992) summarized the technological developments in unripe mango products. The quality of raw mango pickle depends mainly on the raw material and hence, varietal suitability and maturity stage play an important role in pickling. Studies on physico-chemical characteristics of some important mango varieties with respect to pickling have been carried out by many workers (Jha *et al*, 2003, Kambale *et al*, 2004; Shinde *et al*, 2002). Suresh *et al* (1999) studied the suitability of a few acidic mango varieties for brining preservation and recommended 'Kolanka Goa and 'Karanjio' as the most suitable varieties for preparation of pickles. Mango germplasm collection at IIHR, Bangalore has some unique indigenous types from the Western Ghats and peninsular regions of our country, which are the hot spots for mango industry. These unique types are gaining importance in export market because of its suitability for pickling as whole fruit (tender mangoes) called 'midi' in local language (Radhakrishna Holla, 2007). In order to identify suitable varieties for pickling, nineteen accessions from the germplasm of pickling type mango were evaluated and the results are presented in this paper.

MATERIAL AND METHODS

The study was carried out during mango season of 2007 using 19 accessions viz., Kana Appe 1, Isagoor Appe, Appemidi, Kashimidi, Adderi Jeerige, Aruna Gowda Appe, Gaddalalli Appe, Jeerige, Mani Bhatta Appe, Malange, Anantha Bhatta Appe, Balekoppa Appe, Halasage, Holekoppada Appe, Kalkuni, Kovesara, Muregeer, Tatimidi and Dantimamidi, maintained in the Institute's Field Gene Bank. Fruits were harvested 75 days after flowering at tender green stage before formation of stony endocarp. The fruits were washed thoroughly with tap water and shade dried to remove surface water. Physical and quality

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parameters were recorded using 10 fruits per accession. The quality parameters like pH, titrable acidity, Vitamin C and dry matter content were analysed as described by Ranganna (1986). The shape of fruits, raw mango flavour and quantity of latex flow from fruits were also recorded based on visual observations. The firmness was measured using Instron Universal Testing Machine model 4201 with 3 mm dia. probe and was expressed as kg/cm^2.

Standard dry salting process was adopted for pickling of raw tender whole mango, about 500g fruits from each variety in triplicate lots were mixed with common salt at the rate of 250g/ kg fruits. Tender whole mango and salt were spread in alternate layers in wide mouthed plastic jars of 750 ml capacity and allowed to undergo natural fermentation. At the end of 4 weeks of fermentation period, mango pickle was prepared using a standard spice recipe (Anon., 1999) for quality. The quality of freshly prepared pickle was judged by sensory evaluation as described by Ranganna (1986). A panel of ten judges evaluated the quality of the finished product with respect to colour, flavour, texture and overall quality using a rating scale of 1 to 5 for individual characters, (5-very good, 4-good, 3-average, 2-bad, 1-very bad). Statistical analysis was carried out by following standard analysis of variance as described by Panse and Sukhatme (1985). The accession with maximum overall score was rated as the best.

RESULTS AND DISCUSSION

The physical and quality characteristics of different mango accessions are presented in Table 1. Significant differences were observed in these quality parameters.

Physical characteristics

The fruit weight ranged from 17.43 g in Kanappe 1 to 191.75g in Gaddalalli Appe which is attributed to the inherent nature of different accessions and are heritable under all environments. The fruit firmness was in the range of 3.59 to 5.65 kg/cm^2 in Kashimidi and Malange respectively. The accessions Mani Bhatta Appe, Isagoor Appe and Balekoppa Appe had better firmness (>5.0) which is a desirable trait for pickling. The fruit shapes recorded were elliptic, oblong and round in various accessions. The raw mango flavour is one of the most reliable traits for preparation of pickle. Nine accessions were found to possess rich raw mango flavour (Table 1). The latex flow which is also a preferable trait for pickle production was found to be medium to high in all the midi types except Kalkuni, Kovesara and Tatamidi.

Quality characteristics

The acidity in raw mango is one of the most important quality parameters which decides the taste and stability of pickled product. In the present study, wide

Table 1. Physical and quality parameters of mango accessions evaluated for whole fruit pickle

Sl.no	Accession	Fruit shape	Raw mango flavour	Latex flow	Fruit weight (g)	Firmness of fruit kg/cm^2	Titrable Acidity (%)	pH	Dry matter(%)	Vit. C (mg/100 g)
1	Adderi Jeerige	Oblong	Medium	Medium	45.37	3.62	2.72	2.54	17.60	36.60
2	Anantha Bhatta Appe	Elliptic	Medium	High	61.53	3.95	2.55	2.52	16.82	68.93
3	Appemidi	Elliptic	Strong	High	25.23	4.32	2.67	2.98	14.19	101.30
4	Aruna Gowda Appe	Elliptic	Strong	Medium	57.67	3.68	3.05	2.80	16.20	42.70
5	Balekoppa Appe	Oblong	Strong	High	33.41	5.21	3.34	2.32	14.60	54.94
6	Danti Mamidi	Round	Medium	Medium	149.87	4.75	2.56	2.41	14.62	50.63
7	Gaddalahalli Appe	Round	Medium	Medium	191.75	4.84	2.45	2.51	19.24	54.92
8	Halasage	Oblong	Strong	Medium	34.54	4.19	2.73	2.41	13.85	106.43
9	Holekoppada Appe	Oblong	Medium	Medium	55.93	4.59	2.42	2.38	15.22	87.23
10	Isagoor Appe	Oblong	Strong	High	36.47	5.16	2.85	2.90	18.94	109.6
11	Jeerige	Oblong	Strong	High	36.30	4.86	3.26	2.26	18.88	45.75
12	Kalkuni	Oblong	Low	Low	43.32	3.88	2.75	2.75	19.95	51.85
13	Kana Appe 1	Oblong	Medium	High	17.43	3.67	2.32	2.67	15.76	90.28
14	Kashimidi	Oblong	Strong	Medium	26.07	3.59	2.66	3.00	17.80	114.10
15	Kovesara	Round	Low	Low	54.01	4.42	2.56	2.85	18.98	76.86
16	Malange	Round	Strong	High	30.77	5.65	3.14	2.28	17.94	36.65
17	Mani Bhatta Appe	Round	Strong	High	173.97	5.57	3.07	2.24	18.65	64.15
18	Muregeer	Oblong	Medium	Medium	26.94	4.16	2.89	2.95	20.08	75.03
19	Tatamidi	Oblong	Low	Low	31.51	4.08	1.95	3.20	16.00	88.52
	CD *(P=0.05)*				4.65	0.49	0.39	0.38	3.67	13.11

variations in titrable acidity ranging from 1.95% in Tatamidi to 3.34% in Balekoppa Appe was observed (Table 1). The accessions viz., Jeerige, Malange, Mani Bhatta Appe and Aruna Gowda Appe also recorded higher acidity of above 3%. The pH value ranged from 2.24 in Mani Bhatta Appe to 3.2 in Tatamidi. The accessions Malange, Jeerige, Balekoppa appe and Holekoppada appe also recorded a pH in the range of 2.26 to 2.38, which is on par with Mani Bhatta Appe (2.24). The dry matter content was in the range of 13.85% in Halasage to 20.08% in Muregeer, which is on par with Kalkuni, Gaddalalli Appe, Mani Bhatta Appe, Kovesara, Jeerige, Isagoor Appe and Anantha Bhatta Appe. The Vitamin C content was high (114.1 mg/100g) in Kashimidi to low (36.6 mg/100g) in Malange and Adderi Jeerige. All these variations observed in the quality parameters were attributed to the genetic make up of these accessions expressed with respect to their environment where they are grown. Based on the above data, it is presumed that the accessions in general possessed desirable traits for preparation of tender mango pickle.

The physical and quality parameters of mango accessions after dry salting and fermentation are presented in Table 2. Significant variations were observed for physical and quality characters among different accessions. The firmness ranged from 1.57 to 3.96 (kg/cm^2) in Halasage and Isagoor Appe respectively. Maximum retention of firmness (kg/cm^2) was recorded in the accessions Appemidi (3.94), Jeerige (3.40), Muregeer (3.22) and Kalkuni (3.0). Dry salting is the primary step in traditional mango pickling process (Bhatnagar and Subramanyam, 1973). During the process of fermentation, the fruit firmness reduced significantly among various accessions. The osmotic effect of salt on mango results in shriveling and moisture loss. The softening phenomenon during this process makes the variety unsuitable for pickle making. After fermentation, there was a slight increase in the acidity, decrease in pH and Vitamin C content of fruits while the dry matter content increased to a greater extent. The Vitamin C content ranged from 14 mg/100g in Tatamidi to 52.7mg/100g in Kashimidi. The loss in Vitamin C is attributed to the decomposition by hydrolysis producing fructose (Adsule and Roy, 1974). Since Vitamin C is known to possess antioxidant property, its presence is useful in the prevention of browning and colour retention in pickles. The dry matter content was in the range of 36.28% in Dantimamidi to 58.4% in Mani Bhatta Appe. These variations could be attributed to the differential response of accessions to salt absorption during fermentation.

Sensory quality of tender mango pickle

The sensory quality scores of tender mango pickles made from different accessions indicated that the accession, Malange recorded the highest score for colour (4.17), which is on par with Isagoor Appe, Danti mamidi, Mani Bhatta Appe, etc. This could be attributed to the lower amount of tannins and other oxidizing compounds. The accession Mani

Table 2. Physical and quality parameters of mango accessions after dry salting

Sl.No	Accession	Firmness of fruit (kg/cm^2)	Titrable Acidity(%)	pH	Dry weight(%)	Vit. C (mg/100 g)
1	Adderi Jeerige	2.85	2.91	2.44	47.46	16.50
2	Anantha Bhatta Appe	2.86	2.69	2.38	42.40	22.10
3	Appemidi	3.94	2.91	2.45	42.40	40.73
4	Aruna Gowda Appe	2.61	3.28	2.56	46.56	23.40
5	Balekoppa Appe	2.35	3.53	2.25	39.26	33.50
6	Danti Mamidi	2.63	2.65	2.32	36.28	17.10
7	Gaddalalli Appe	2.35	2.57	2.14	47.00	14.80
8	Halasage	1.57	2.48	2.36	46.86	34.70
9	Holekoppada Appe	2.68	2.65	2.24	38.18	39.72
10	Isagoor Appe	3.96	2.96	2.30	49.44	43.51
11	Jeerige	3.40	3.44	2.18	48.86	26.43
12	Kalkuni	3.00	2.88	2.41	39.86	37.54
13	Kana Appe 1	2.57	2.41	2.12	47.56	37.22
14	Kashimidi	2.90	2.75	2.63	55.42	52.70
15	Kovesara	2.62	2.88	2.55	46.41	19.74
16	Malange	1.63	3.20	2.14	45.96	17.74
17	Mani Bhatta Appe	2.46	3.28	2.09	58.40	38.15
18	Muregeer	3.22	2.97	2.39	48.20	20.72
19	Tatamidi	2.97	2.08	2.65	43.46	14.00
	CD *(P=0.05)*	0.55	0.36	0.34	5.86	7.66

Table 3. Sensory evaluation of tender mango pickle

Sl.No	Accession	Colour (Appearance)	Texture	Taste (Flavour)	Overall quality	Average score out of 5
1	Adderi Jeerige	3.50	3.15	3.75	3.45	3.46
2	Anantha Bhatta Appe	3.35	2.55	3.45	3.25	3.15
3	Appemidi	3.90	3.75	4.12	3.95	3.93
4	Aruna Gowda Appe	3.90	3.80	3.60	3.83	3.78
5	Holekoppada Appe	3.30	2.95	3.60	3.21	3.27
6	Danti Mamidi	4.10	4.00	4.00	4.00	4.03
7	Gaddalalli Appe	3.48	3.71	3.85	3.81	3.71
8	Halasage	3.60	3.10	2.95	3.12	3.19
9	Balekoppa Appe	3.95	3.42	4.00	3.75	3.78
10	Isagoor Appe	4.15	3.85	4.25	4.05	4.08
11	Jeerige	4.00	3.70	3.85	3.95	3.88
12	Kalkuni	3.20	3.70	3.85	3.50	3.56
13	Kana Appe 1	3.70	3.10	3.80	3.45	3.51
14	Kashimidi	4.00	3.90	4.00	4.13	4.01
15	Kovesara	3.50	3.51	3.94	3.60	3.64
16	Malange	4.17	4.00	4.04	4.04	4.06
17	Mani Bhatta Appe	4.00	4.08	4.51	4.16	4.19
18	Muregeer	3.51	3.17	3.44	3.26	3.35
19	Tatamidi	4.00	3.55	3.00	3.75	3.58
	CD *(P=0.05)*	0.42	0.33	0.32	0.34	

Bhatta Appe recorded the highest score for texture (4.08) and flavour (4.5) mainly due to the presence of higher number of flavouring compounds as indicated by intensive characteristic raw mango flavour. The overall acceptability score (4.16) and average score out of five (4.19) was higher for the accession Mani Bhatta Appe. Based on this study it is concluded that high acid mango accession Mani Bhatta Appe produces best quality pickle with better colour, texture and flavour. The accessions viz., Kashimidi, Isagoor Appe, Malange, Appemidi, Dantimamidi and Jeerige were also on par with Mani Bhatta Appe. Hence, these accessions are considered to be most suitable for preparation of tender whole mango pickles.

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