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Screening of *bael* selections for preparation of sweet wine

Neelima Garg*, Preeti Yadav, Sanjay Kumar and Abhay Dikshit
Central Institute for Subtropical Horticulture, Rehmankhera, PO Kakori, Lucknow 227107, Uttar Pradesh

ABSTRACT

***Bael* selections CISH B1, CISH B2 and CISH B9 were screened for preparation of *bael* wine using *Saccharomyces cerevisiae*. Though, all the selections were found suitable for preparation of wine, the product prepared from variety CISH B2 was found best in terms of sensory parameters, *viz.* colour, clarity, aroma, acidity, freedom from acetic acid, sweetness and astringency. It maintained uniformly higher sensory score throughout the storage period. The wine contained 12.4ºBrix TSS, 0.94% acidity, 5.14 mg/100 ml ascorbic acid, 0.69% tannins, 5.37% reducing sugars and 8.9% alcohol. During 12 months of storage of wine, the contents of TSS and reducing sugars increased, while acidity, ascorbic acid and tannins decreased. The study indicated that good quality wine could be prepared from *bael* selection CISH B2.**

Key words: *Bael*, *Aegle marmelos*, alcohol, wine, quality.

INTRODUCTION

Wine is traditionally prepared from grapes, however, it can also be prepared from other fruits such as apple, plum, pomegranate, apricot, strawberry, Kinnow, guava, litchi, *jamun*, sapota, etc. (Joshi and Devendra, 1). *Bael* (*Aegle marmelos* Correa) fruit is used in traditional systems of medicine for relieving constipation, diarrhea, dysentery, peptic ulcer and respiratory infections (Sharma *et al*., 2). It is a good source of carbohydrates, protein, fibre, tannins and ascorbic acid (Anon, 3). The pulp of *bael* fruit contains two important compounds, psoralen and marmelosin, which have therapeutic importance. Unripe *bael* fruits are generally processed into conventional products like preserve, candy and powder. Ripe fruit, however, has limited use as fresh as well as for processing purpose (Roy, 5). There are few reports on utilization of ripe fruits for preparation of preserved pulp, beverage, etc. (Roy and Singh, 6; Tandon *et al*., 7), however, its use for wine preparation has not been explored as yet. In the current study, three *bael* selections were screened for preparation of wine.

MATERIALS AND METHODS

Bael fruits of selections CISH B1, CISH B2 and CISH B9, harvested from Institute orchards, were brought to the laboratory and ripened at room temperature (35 ± 5°C). The pulp was extracted manually and mixed with equal amount of warm water, homogenized and a sieve filtered to remove fibre and seeds (Roy and Singh, 6). The pulp was diluted with water and ameliorated with sugar and citric acid to maintain total soluble solids (TSS) to 22°Brix and acidity to 0.45%. The must was treated with 100 ppm SO_2 to kill any native microbial population in the pulp and inoculated with yeast *Saccharomyces cerevisiae* obtained from culture maintained on Yeast Extract Peptone Dextrose (YEPD) agar slants at Microbiology Laboratory of CISH, Lucknow. The inoculated must was kept for fermentation at 20°C for 15 days (till TSS became constant). The wine was siphoned out, aged at 16°C for one month and bottled in 200 ml capacity glass bottles. The bottles were pasteurized at 55°C for 5 min. and stored for one year at room temperature.

Biochemical analysis of stored *bael* wine was carried out at three month intervals up to one year. Microbiological quality of the wine was carried out as per the method described by Speck (8). TSS was recorded by using hand refractometer (Erma, Japan). Titratable acidity, ascorbic acid, tannins and non-enzymatic browning were determined as per the methods described by Ranganna (9). Ascorbic acid content of beverage was measured by titrating samples against 2,6-dichloro phenol indophenol dye solution, while tannins content was estimated by using Folin and Ciocalteu's reagent. The amount of reducing sugars was determined by spectrophotometric method developed by Folin and Wu (10). Non-enzymatic browning was determined by measuring optical density of methanol extracted wine samples at 440 nm in UV-visible spectrophotometer (ECIL, India). The concentration of ethanol in fermented beverage was measured spectrophotometrically as per the method of Caputi *et al*. (11). Antioxidant activity in wine was determined as ferric reducing antioxidant potential

*Corresponding author's E-mail: neelimagargg@redifmail.com

(FRAP) (Benzie and Strain, 12). The phenolics in *bael* wine were analyzed by high performance liquid Chromatography using protocol of Basha *et al*. (13). Marmelosin and psoralen contents in wine were also estimated through HPLC using C-18 column, UV detector and methanol-water mixture as mobile phase. The sensory evaluation of wine was carried out by a panel of eight semi-skilled judges on composite scoring (Amerine *et al*., 14). The judges were given coded samples for scoring on the basis of colour, clarity, aroma, acidity, freedom from acetic acid, sweetness and astringency. The experiment was laid in two factor CRD design using values in triplicate and data was subjected to statistical analysis applying statistical package for agricultural workers developed by CCSHAU, Hisar.

RESULTS AND DISCUSSION

Analysis of wine during a period of one year storage indicated that it was free from any microbial load. The physico-chemical analysis of the wine at zero time revealed lowest total soluble solids (12.4ºBrix) and reducing sugars (5.37%) in wine prepared from CISH B2 (Table 1). These values

Table 1. Changes in bio-chemical qualities of *bael* wine during storage.

Parameter	Storage period (month)	Genotype		
		CISH B1	CISH B2	CISH B9
TSS (ºBrix)	0	12.8	12.4	12.6
	3	12.8	12.6	12.8
	6	13.0	12.6	12.8
	9	13.2	12.8	12.8
	12	13.2	12.8	12.8
	CD at p = 0.05	T = 0.070; P = 0.090; T × P = 0.150		
Total acidity (%)	0	0.79	0.94	0.79
	3	0.72	0.92	0.74
	6	0.69	0.87	0.74
	9	0.68	0.87	0.72
	12	0.68	0.87	0.72
	CD at p = 0.05	T = 0.006; P = 0.008; T × P = 0.010		
Volatile acidity (%)	0	0.32	0.27	0.32
	3	0.30	0.27	0.29
	6	0.30	0.25	0.27
	9	0.29	0.24	0.25
	12	0.29	0.24	0.25
	CD at p = 0.05	T = NS; P = NS; T × P = NS		
Reducing sugar (%)	0	5.78	5.37	5.93
	3	5.98	5.46	5.98
	6	6.01	5.76	6.01
	9	6.11	5.79	6.24
	12	6.12	5.82	6.54
	CD at p = 0.05	T = 0.008; P = 0.010; T × P = 0.020		
Non-enzymatic browning (OD at 440 nm)	0	0.018	0.012	0.011
	3	0.024	0.014	0.027
	6	0.026	0.018	0.032
	9	0.027	0.020	0.036
	12	0.032	0.020	0.049
	CD at p = 0.05	T = 0.003; P = 0.004; T × P = 0.006		

T = Treatment; P = Period; T × P = Treatment × Period

increased in all cultivars during storage. The lowest value of reducing sugars was noted in CISH B2 (5.82%), while highest in CISH B9 (6.54%) after 12 months of storage. The increase in the content of reducing sugars could be attributed to hydrolysis of non-reducing sugars during processing and storage. The volatile and total acidity in wine decreased during storage. The highest ascorbic acid content was observed in CISH B2 (5.14 mg/100 ml), while lowest in CISH B9 (3.42 mg/100 ml) at zero time, which decreased significantly to 4.46 and 2.35 mg/100 ml, respectively, after 12 months of storage. The tannins content of wine varied from a minimum of 0.69 per cent in CISH B2 and CISH B9 to a maximum of 0.75 per cent in CISH B1. Gradual decrease was observed in tannins during storage of wines (Fig. 1). The loss in the contents of ascorbic acid and tannins in wine might be due to break down of these compounds during storage. Garg and Goel (15) also reported decrease in ascorbic acid and tannins contents in *aonla* cider during storage. The prepared wine contained around 9% alcohol, which remained almost unchanged till the end of storage. Non-enzymatic browning occurred during storage of wine as is evident from the increase in optical density values (Table 1). Maximum browning occurred in the wine prepared from selection CISH B9 (0.049 OD), followed by CISH B1 (0.032 OD) and CISH B2 (0.020 OD) after 12 months of storage. The browning might have occurred due to oxidation of wine by the air present in the headspace of the bottle (Fessler, 16). Woolfe (17) attributed formation of aldehydes such as furfural and hydroxymethyl furfural for non-enzymatic browning of food products during storage. Sensory evaluation of wine at zero time indicated that CISH B2 scored maximum (7.7), while CISH B1 minimum (5.9). A gradual increase in the organoleptic score of *bael* wine was recorded in all the samples. After twelve months of storage, CISH B2 was liked the most as indicated by its score (9.3) as compared to 8.3 and 6.4 obtained by CISH B9 and CISH B1, respectively (Fig. 2). The improvement in wine score might be due to increase in the clarity and solubility of compounds in the samples. The wine prepared from selection CISH B2 performed well throughout the storage period. HPLC analysis of the wine from CISH B2 (Fig. 3), revealed the presence of four phenolic compounds, *viz.* gallic acid (22.59 mg/100 ml), catechins (185.5 mg/100 ml), caffeic acid (10.85 mg/100 ml) and kaempferol (114.2 mg/100 ml). Marmelosin and psoralen contents in wine from selection CISH B2 were found to be 25.79 and 42.75 µg/100 ml, respectively.

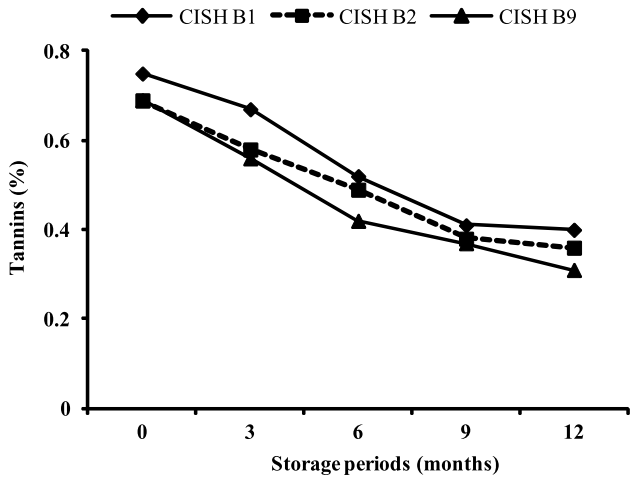

Fig. 1. Changes in tannins content of *bael* wine during storage.

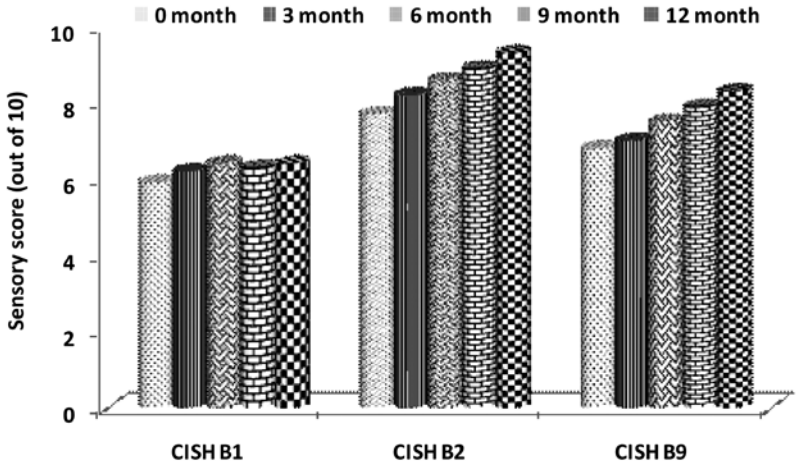

Fig. 2. Changes in sensory score of *bael* wine during storage.

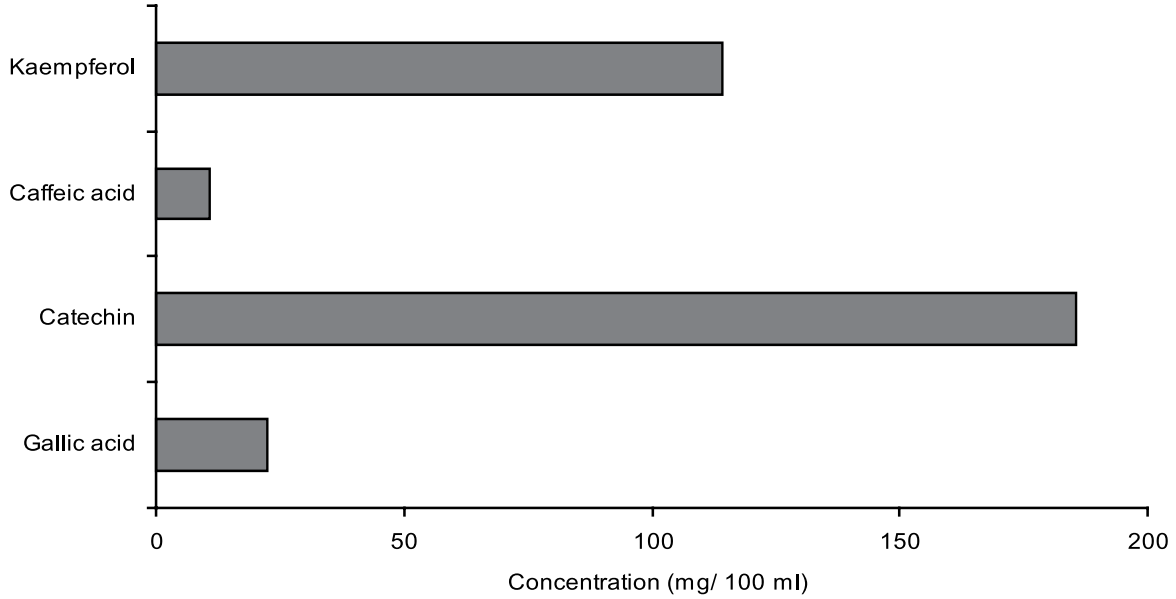

Fig. 3. Phenolic compounds present in *bael* wine.

The better quality of wine prepared from CISH B2 over other two selections might be attributed to least changes in reducing sugar content and non-enzymatic browning during storage. Moreover, it had higher amount of ascorbic acid and lower tannins content compared to CISH B1 and CISH B9. Higher sensory scores of the wine prepared from CISH B2 throughout the storage period also reflected its preference over other two selections.

It can be inferred from the present study that a good quality wine could be prepared from *bael* selection CISH B2, though CISH B1 and CISH B9 were also found suitable for wine preparation. Owing to good aroma, taste and nutraceutical value of *bael* wine, it has potential for commercialization.

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