Journal of Engineering and Applied Sciences 14 (1): 312-314, 2019
ISSN: 1816-949X

Utilization of Burmese Grape (*Baccaurea sapida*) for Wine Fermentation

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Abstract: Burmese grape (*Baccaurea sapida*) is an underexploited fruit in South of Vietnam. It is a mild acidic fruit and mainly used as fresh fruit consumption. There is limited study mentioning to processing of this nutritional fruit. Therefore, we explored a wine fermentation from Burmese grape by focusing on the effect of different parameters such as pectinase concentration and time of treatment for juice extraction, yeast inculate for wine fermentation and secondary fermentation to wine quality. Our results proved that 0.3% pectinase was used for juice extraction, 3% *Sacchromyces cerevisiae* was used for the main fermentation at 12°C and 3 weeks of sencondary fermentation in dark bottle at 10°C was applied to get a pleasant Burmese grape quality.

Key words: Burmese grape, wine, fermentation, *Sacchromyces cerevisiae*, pectinase, parameters

INTRODUCTION

Baccaurea sapida known as Burmese grape. It flowers during the Summer months and fruits are mature in rainy season. Bearing habit of Burmese grape is adventitious or cauliflory in nature. It is a slow growing, dioecious, short to medium height, evergreen, shade loving plant. It flowers during the Summer months and fruits are mature during the rainy season (Bhowmick, 2011). The fruit is oval to round in shape and turns yellow or yellowish brown in ripen condition. The type of fruit is berry and edible portion is aril which is covered by leathery rind. Burmese grape is propagated by seeds and as it is dioecious in nature, so, variation is present among the present plant population (Deb and Bhowmick, 2013). Fruit weight has strong positive correlation with peel weight, pulp percentage and ascorbic acid content, whereas the pulp content has strong negative correlation with peel content (Bhowmick *et al*., 2016). It is one of the valuable nutritional sources for human being and the hard durable wood is often used in furniture production (Hossain *et al*., 2017). The average Burmese grape fruit and peel weight is 9.0 and 3.75 g, respectively. Average yield varies from 70-80 kg/plant/year. Burmese grape shows around 100 brix TSS, 4.42% total sugar and 2.1% acidity. It contains 5.5% protein, 178 mg vitamin C per 100 g of pulp and among the minerals the fruit contains 169 mg calcium, 137 mg potassium, 177 mg phosphorous and 100 mg iron per 100 g of fruit pulp (Kermasha *et al*., 1987). Burmese grape finds its importance as a novel food additive because of its high content of vitamin C, protein and iron. This fruit is suitable for making good wine. The wine is rich in natural antioxidants including phenols, flavonoids, flavonols and proanthocyanidins which in turn can have health benefits if consumed in limited amount (Goyal *et al*., 2013). t is also reported from other parts of world that fruits are used as medicinally to treat skin disease (Hasan *et al*., 2009).

Burmese grape is an underutilized fruit crop and still now there is very limited research available regarding to processing of this fruit into value added product. Therefore, we utilized this fruit as subtrate for wine fermentation. We focused on the effect of different parameters such as pectinase concentration and time of treatment for juice extraction, yeast inculate for wine fermentation and secondary fermentation to wine quality.

MATERIALS AND METHODS

We collected Burmese grape in Ca Mau Province, Vietnam. They must be cultivated following VietGAP without pesticide and fertilizer residue to ensure food safety. After harvesting, they must be conveyed to laboratory within 8 h for experiments. Apart from collecting Burmese grape, we also used other materials such as pectinase, yeast. Lab utensils and equipments included knife, weight balance, fermentation tank, refractometer, viscometer, flow UV system, pH meter, ethanol meter, buret (Fig. 1).

Effect of pectinase concentration and time for juice extraction: Burmese grape extract was treated with

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Fig. 1: Burmese grape (*Baccaurea sapida*)

pectinase enzyme with different concentration (0.1, 0.2, 0.3, 0.4%) in different duration (10-40 min). We analyzed the extract recovery (%), viscosity (cP) and turbidity (mJ/cm^2).

Effect of yeast inculate for wine fermentation: Burmese grape wort after being treated by pectinase would be inoculated with *Saccharomyces cerevisiae* at different ratio (1-4%). After 7 days of fermentation at 12°C, we analyzed the soluble dry matter (°Brix), ethanol (%v/v), acidity (g/L) and sensory characteristics (score) in wine.

Effect of secondary fermentation to wine quality: We preserved Burmese grape wine at 10°C in dark bottle by different time (1-4 weeks) as the secondary fermentation. We monitored soluble dry matted (°Brix), ethanol (% v/v), acidity (g/L) and sensory characteristics (score) in wine.

Statistical analysis: Data were statistically summarized by statgraphics.

RESULTS AND DISCUSSION

Effect of pectinase concentration and time of treatment for juice extraction: Burmese grape extract was treated with pectinase enzyme with different concentration (0.1, 0.2, 0.3, 0.4%) in different duration (10-40 min). Our results were depicted in Table 1-3. We clearly found that 0.3% pectinase in 30 min treatment was optimal for Burmese grape extraction. So, we selected these values for next experiments.

Effect of yeast inculate for wine fermentation: Burmese grape wort after being treated by pectinase would be inoculated with *Saccharomyces cerevisiae* at different ratio (1-4%). After 7 days of fermentation at 12°C, we noticed the change of soluble dry matter (°Brix), ethanol (%v/v), acidity (g/L) and sensory characteristics (score) in wine as in Table 4-7. We found that the approprate yeast inculate should be 3% to get the highest wine quality.

Effect of secondary fermentation to wine quality: We preserved Burmese grape wine at 10°C in dark bottle by different time (1-4 weeks) as the secondary fermentation.

Table 1: Extract recovery (%) by diffferent pectinase concentration (%) and time of treatment (minutes)

	Extract recovery (%)			
Pectinase concentration (%)	10 (min)	20 (min)	30 (min)	40 (min)
0.1	57.24^e	58.29^e	59.25^e	59.32^e
0.2	59.47^b	61.05^b	62.12^b	62.27^b
0.3	62.01^a	63.89^a	65.75^a	65.81^a
0.4	62.12^a	64.00^a	65.77^a	65.83^a

Table 2: Viscosity (cP) by diffferent pectinase concentration (%) and time of treatment (minutes)

	Viscosity (cP)			
Pectinase concentration (%)	10 (min)	20 (min)	30 (min)	40 (min)
0.1	1.04^a	0.92^a	0.80^a	0.79^a
0.2	0.93^b	0.87^b	0.79^b	0.77^b
0.3	0.88^c	0.81^c	0.75^c	0.74^c
0.4	0.80^d	0.78^d	0.75^c	0.74^c

Table 3: Turbidity (mJ/cm^2) by diffferent pectinase concentration (%) and time of treatment (minutes)

	Optical density (mJ/cm^2)			
Pectinase concentration (%)	10 (min)	20 (min)	30 (min)	40 (min)
0.1	74.78^a	72.36^a	70.11^a	70.06^a
0.2	72.42^b	70.09^b	68.22^b	67.59^b
0.3	70.11^c	68.29^c	66.79^c	66.75^c
0.4	70.04^c	68.33^c	66.74^c	66.70^c

Table 4: Effect of yeast ratio to soluble dry matter (°Brix) in wine

	Soluble dry matter in wine (°Brix)			
Fermentation time (days)	Yeast ratio 1%	Yeast ratio 2%	Yeast ratio 3%	Yeast ratio 4%
1	18.55^a	17.35^a	16.21^a	15.01^a
2	17.26^b	16.34^b	15.49^b	14.78^b
3	16.11^c	15.29^c	14.06^c	13.65^c
4	14.78^d	13.87^d	13.19^d	12.39^d
5	13.38^e	12.78^e	12.36^e	11.17^e
6	12.01^f	11.47^f	10.75^f	9.84^f
7	11.95^f	11.42^f	10.69^f	9.79^f

Table 5: Effect of yeast ratio to ethanol formation (%v/v) in wine

	Ethanol in wine (%v/v)			
Fermentation time (days)	Yeast ratio 1%	Yeast ratio 2%	Yeast ratio 3%	Yeast ratio 4%
1	1.04^e	1.58^f	2.39^d	2.43^e
2	1.25^d	1.89^e	2.42^{cd}	2.77^d
3	2.29^c	2.35^d	2.96^c	3.05^c
4	2.31^c	2.79^c	3.03^b	3.07^{bc}
5	2.89^b	3.01^b	3.27^{ab}	3.29^b
6	3.15^a	3.23^a	3.41^a	3.42^{ab}
7	3.18^a	3.25^a	3.45^a	3.47^a

$^{a-f}$The values were expressed as the mean of three repetitions; The same characters (denoted above), the difference between them was not significant (α = 5%)

Table 6: Effect of yeast ratio to acidity (g/L) in wine

	Acidity in wine (g/L)			
Fermentation time (days)	Yeast ratio 1%	Yeast ratio 2%	Yeast ratio 3%	Yeast ratio 4%
1	1.12^{e}	1.23^{d}	1.98^{d}	2.01^{d}
2	1.14^{e}	1.29^{d}	2.02^{c}	2.09^{d}
3	1.45^{d}	1.96^{c}	2.13^{bc}	2.22^{c}
4	1.78^{c}	2.04^{c}	2.27^{b}	2.38^{b}
5	2.01^{b}	2.18^{b}	2.31^{ab}	2.40^{b}
6	2.19^{a}	2.32^{a}	2.40^{a}	2.98^{a}
7	2.22^{a}	2.35^{a}	2.42^{a}	3.01^{a}

Table 7: Effect of yeast ratio to soluble dry sensory characteristics (score, 1-5) in wine

	Sensory score of wine (1-5) by different yeast ratio			
Fermentation time (days)	Yeast ratio 1%	Yeast ratio 2%	Yeast ratio 3%	Yeast ratio 4%
1	2.45^{d}	3.01^{d}	4.17^{d}	4.65^{c}
2	2.48^{d}	3.15^{cd}	4.22^{d}	4.67^{c}
3	2.95^{cd}	3.26^{c}	4.35^{cd}	4.72^{b}
4	3.16^{c}	3.79^{bc}	4.41^{b}	4.72^{b}
5	3.69^{b}	3.98^{b}	4.42^{b}	4.72^{b}
6	4.15^{a}	4.29^{a}	4.69^{a}	4.80^{a}
7	4.17^{a}	4.33^{a}	4.70^{a}	4.81^{a}

Table 8: Effect of the sencondary fermentation to wine quality

	Secondary fermentation (weeks)			
Criteria	1	2	3	4
Soluble dry matter (°Brix)	10.55^{a}	10.49^{b}	10.23^{c}	10.04^{d}
Ethanol (%v/v)	3.89^{b}	3.91^{b}	3.98^{ab}	4.00^{a}
Acidity (g/L)	2.45^{b}	2.46^{b}	2.53^{a}	2.54^{a}
Sensory score	4.72^{b}	4.79^{ab}	4.83^{a}	4.84^{a}

$^{a-d}$The values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

We monitored soluble dry matted (°Brix), ethanol (% v/v), acidity (g/L) and sensory characteristics (score) in wine. Our results were elaborated in Table 8. We noted that the longer of the secondary fermentation, the better of wine quality we got. However, there was not significant change of samples being preserved at the 3rd and 4th week, so, we choosed 3 weeks of secondary fermentation for economy.

CONCLUSION

The Burmese grape pulp contents high amount of vitamins and minerals. The fruit is a rich source of pectin. It not only holds good nutritional properties but also has its ritual values. We have successfully utilized Burmese grape as substrate for wine fermentation by investigating different parameters such as pectinase concentration and time of treatment for juice extraction, yeast inculate for wine fermentation and secondary fermentation to wine quality. These results were important because they could help wine makers to arrange proper processing method and storage.

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