Development of Lubeg (*Syzygiumlineatum* (Roxb.) Merr.& Perry) Processed Products

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Abstract - *Lubeg(Syzygiumlineatum(Roxb.) Merr.& Perry) is a lesser known fruit in the province of Apayao, Philippines. It is a highly perishable fruit and belongs to family Myrtaceae. The primary object of this study is to develop processed products from lubeg fruits. The experimental method of research was conducted. From the result of the study, the following are concluded: Lubeg wine is preferred over other locally produced wine namely bignay and duhat. However, no significant differences were observed in their taste, appearance and aroma. On the other hand, strawberry jam is preferred over lubegandbignay jam. No significant differences were observed in their taste, appearance and aroma. Lubeg fruit preserves, Jam and jelly can be best used as fillers to baked products when mixed with pineapple jam; lubeg juice can be improved when mixed with lemongrass in 1:2, 1:1 and 2:1 ratio.*

In the light of the findings and conclusion, the following are forwarded as recommendations: mass production of lubeg products should be done; promotion of the developed technology through trainings and attendance to trade fairs should be done; and similar research should be conducted using other flavors fruits or herbs to improve the quality of lubeg products.

Keywords: *Lubeg, Processed Products, Wine*

INTRODUCTION

Indigenous trees are often neglected and underutilized. The potentials of these trees can contribute to food security and poverty alleviation in all parts of the world [1]–[3]. Some of these are domesticated for its large scale production [4],-[8]. They are the good source of vitamins, minerals and antioxidant [9] and bioactive compounds [10]**.**

Lubeg (*Syzygiumlineatum* (Roxb.) Merr.& Perry) is a lesser-known species commonly growing in the province of Apayao and some parts of Cagayan, known locally as "*Malubeg"* and "*Alebadu*". Lubeg are naturally growing small trees usually used as a shade and live fence . The tree grows in partly shaded and open areas.

Lubeg is an erect, medium fruit tree usually 4-5 meters in height and belongs to the family Myrtaceae [11]. Leaves are simple attached to the stem oppositely arranged. Flowers have an inferior ovary, regular and complete. Fruits are in cluster, whitish in appearance that gradually turn red to violet as they ripen.

Ripe lubeg fruits are eaten fresh or can be used as ingredients in *sinigang* fish or even meat due to its sour taste. The fruit is highly perishable and only lasts for about two weeks when ripe.

Fruits are just wasted during peak season which often create messy surroundings and oftentimes the breeding site of flies and other harmful insects and microbes. Processing the said fruit is one consideration to increase its economic value. Possible products that can be derived from it are fruit preserves such as jam and jellies, beverages such as wine, vinegar and fruit concentrate.

Edible fruits Myrtacea family such as bignay, bignaykalabaw, duhat and lubeg contain vitamin C and a lot of antioxidant. The vitamin C in lubeg fruit helps in enhancing the immune systems. Antioxidants present in lubeg fruits can help lower the risk of having cancer cells. The red wine derived from fruits helps in the digestion of food, can treat anorexia nervosa, can stimulate gastric juice secretion, can work against food poisoning [12].

Fruit preserves such as jam and jellies are used in various means- as bread filler, confectionaries in baking industries, filler for doughnuts, ice cream flavorings and the like. Red wine is used as beverage and can also be used in the preparation of foodstuff and for baking.. The product is suitable for use both

on a small scale at home or at work and on a large scale in food, confectionery, beverage and stimulant manufacturing industries. Fruit concentrate can be used in the preparation of fruit juices. It can be combined with herbs such as lemongrass or pandan and others.

The study also made use of available herbs and fruits to improve its quality. These include lemongrass, pandan, and pineapple. Pineapple is one of the major fruit crops produced in Apayao and during its peak season, bulk of the production is wasted.

The production of lubeg products will significantly benefit the people from Apayao and Cagayan provinces. It will bring additional income to farmers and smallholder processors. The production of lubeg products will bring about employment opportunity to people in the locality thereby contributory not only in the area but to the national economy.

OBJECTIVES OF THE STUDY

This study was conducted to develop processed products from lubeg fruits.Specifically, it is intended to: compare lubeg wine and lubeg jam with commercially processed local fruit wine and jam; evaluate lubeg jam and jelly as fillers in the production of baked products; and evaluate lubeg fruit concentrate when blended with lemongrass.

MATERIALS AND METHODS

Project location

The project was conducted at ASC processing center at Luna, Apayao. The processing center is a DOST funded project of the college where food products are being processed. The processing center also serves as venue for various food processing trainings.

Processing of Fruit-based Products

There are three (3) sets of products developed: Alcoholic beverage specifically wine, Non-alcoholic beverage (fruit juice, fruit concentrates) and fruit preserves (jam, and jellies). There are process flow that are already developed in the production of these products

FRAMEWORK

The process flow of developing products from lubeg fruit is presented below:

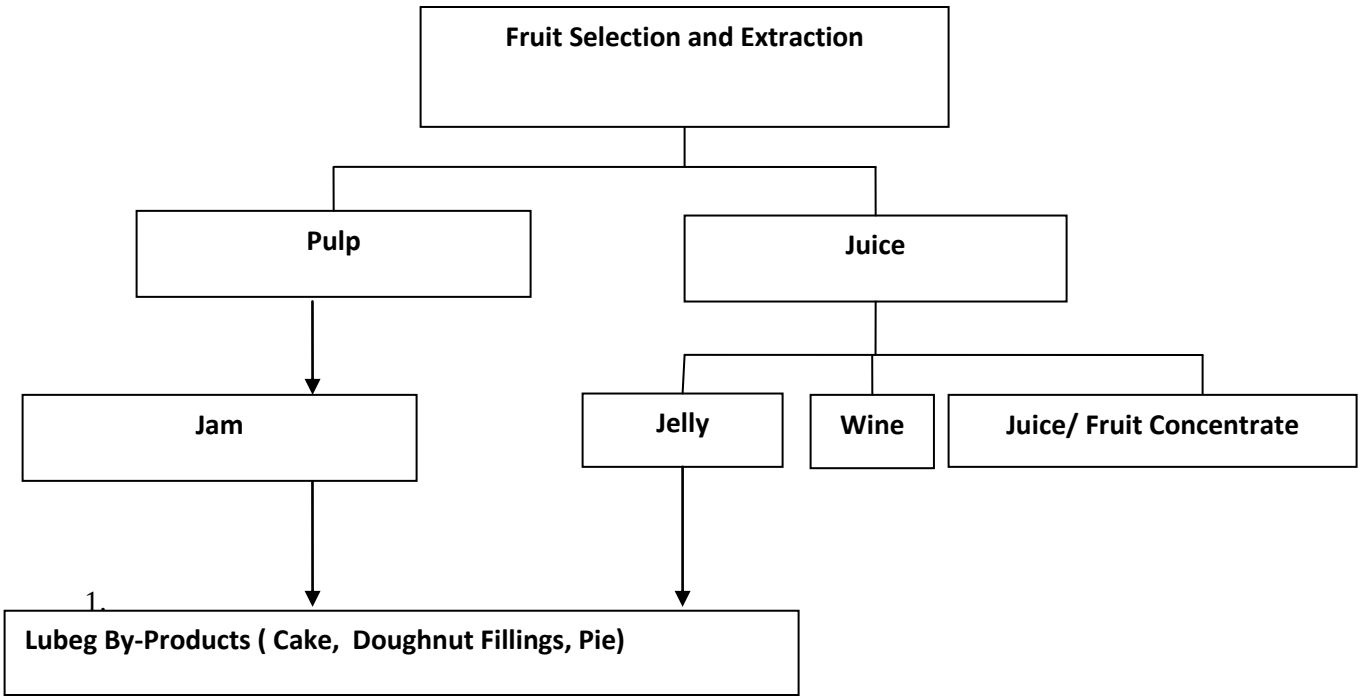

Figure 1. Schematic Diagram of the processes involved in processing lubeg fruits

Lubeg Wine

Process of producing fruit wine involves the following: Fruit selection, washing and extraction, fermentation, distillation, pasteurization and bottling sealing and labeling.

Lubeg wine can be produced following the procedure below:

1. Select round, ripe berries and wash
2. Boil the berries with an equal part of H_2O to get the extract. Strain and measure
3. For every five parts of the extract, add one part of first class sugar. Boil the sweetened extract.
4. Place in a stopper (with cotton plug) container and allow to cool.
5. Add 3 teaspoon of yeast to every 15 to 20 liters of extract for fermentation. Set aside for at least two weeks to complete fermentation.
6. When fermentation is over, pour the clear wine in another container and heat to 50^0 centigrade to kill undesirable organisms.
7. Age in earthen jars for one year or more.

Jam and Jelly

Jam preparation includes the following steps: Use regular size of lubeg fruit. Wash and remove the seeds. Chop into small pieces. For every 1 cup to 2 cups of pulp add 1c of sugar. Boil until thick while still hot, pour into sterilized jars and seal tightly.

Jelly preparation has the following procedure: Select just ripe berries. Wash very well and remove the stems or caps, including the seeds. Place in a pan. Add enough H_2O to barely cover the fruits. Boil slowly until fruits is soft. Transfer the boiled fruits in a damp jelly bag and drain out the juice. Allow the juice to settle. Then filter through two thickness of cheese cloth. For every cup of juice and ¾ to 1 cup sugar, stir to dissolve sugar. Boil and strain again to remove any undissolved sugar, scum or dirt. Cook rapidly until jelly point is reached. Skin and pour while still hot in sterilized jars. Before jelly is completely cooled, pour paraffin one-eight inch thick. Prick air bubbles that appears in paraffin to ensure complete sealing.

Fruit Concentrate (Non-Alcoholic Beverage)

Non-alcoholic beverage include fruit concentrates and Herbal fruit flavored beverages. Process of producing non-alcoholic beverages include: fruit selection, washing, crushing, juice extraction, cooking in double boiler for about 15-20 minutes at 60-70 degrees celcius, bottling, sealing and packaging and labeling. Sugar concentration depends on the type of fruit to be processed.

There are already technologies for Lubeg products which are registered as Utility models under the Intellectual Property Office (IPO). These are process of producing wine and Lubeg fruit preserves. Fruit preserves such as jam and jelly are used in the production of lubeg by products such as cakes, pie, and as fillings for sandwich and doughnuts.

Good manufacturing practices were observed during the processing of products to ensure safety. Packaging and labelling were done for greater marketability of the products.

Preparation of Lubeg Fruit-flavored Baked Products

Lubeg jelly and jam in combination with Pineapple jam were used as fillings for baked products. Procedure in preparing the baked products was followed. Three products were prepared: inipit, cupcake and doughnut.

Preparation of Lemongrass-Lubeg Juice

Five bundles of lemongrass were boiled in a liter of water for 15 minutes. The extract was blended with lubeg fruit concentrate in the following proportions which serves as treatments of the study: T0- pure lubeg, T1 -1:2 Lubeg: Lemongrass, T2- 1:1 Lubeg-Lemongrass, T3- 2:1 Lubeg-Lemongrass.

Respondents of the Study

The participating respondents of the study constituted the 30 panel of evaluators, who judged the products in terms of taste, color and aroma. The panel of evaluators was selected from the faculty members and students of the Apayao State College . Panel of examinees consisted of 8 faculty member and 28 college students.

Data gathering

There were 30 panelists who were asked to evaluate the product. Each of the panelists asked to rate the sample products in terms of taste, color and aroma using the 5-point likert scale. Each sample were coded to hide the identity of the products being evaluated.

Data Analysis

Data were analyzed using the 5-point likert scale which is presented below. ANOVA was used to

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determine if differences in mean rating is significant or not.

Table 1. Scale and verbal interpretation of 5-point likert scale

Scale	Limits of Description	Interpretation
5	4.20-5.00	Like Very much/ Very much accepted
4	3.40- 4.19	Like Much/ much accepted
3	2.60- 3.39	Like/ accepted
2	1.80- 2.59	Moderately like/ moderately accepted
1	1.00-1.79	Not like/ not accepted

RESULTS AND DISCUSSION

Preference Test of Lubeg wine

The Process of producing lubeg wine involves the following: Fruit selection, washing and extraction, fermentation, distillation, pasteurization and bottling sealing and labeling. Lubeg wine was compared to bignay(*Antidesmabunius*)and duhat (*Syzygiumovatum*) wines. Samples were coded and subjected to sensory evaluation by ten panelists. The data is presented below.

Table 2.Preference test of lubeg wine

Samples	Taste	Appearance	Aroma	Overall	Verbal Interpretation
Lubeg	4.00	4.50	4.4	4.30	Like very much
Duhat	3.80	4.20	4.2	4.06	Like much
Bignay	4.00	4.20	4.3	4.16	Like much

Lubeg wine was rated 4.3 (like very much) while *bignay and duhat* wine were rated 4.16 and 4.06 respectively . The appearance of lubeg wine makes it attracted to panelist making it better from the other sample wines.

Table 3. Difference on the three wine samples in terms of taste, appearance and aroma

Parameter	Computed F	F tab 5%	Ftab 1%
Taste	0.375ns		
Appearance	1.05 ns	3.35	5.48
Aroma	0.44 ns		

ANOVA test shows no significant differences of the three sample wine in their taste, appearance and aroma with computed F values as 0.375, 1.05 and 0.44. These values are lower than the critical values of F at 5% (3.35) and 1 % (5.48) level of significant. Hence, the null hypothesis is accepted.

Results of the sensory evaluation show no significant differences of the three wines in terms of taste, appearance and aroma is attributed to the fact that the fruit wines have almost the same sweet-sour taste. When ripened, the strong purple color of the 3 fruits contributed to the dark red to red color of the wines which are indistinctive to each other. Likewise, the sweet- and a little of sour aroma flavor of the three wines are also undistinguished when codified.

Preference Test of Lubeg Jam

Lubeg Jam was compared to Strawberry Jam and Bignay Jam. The result is presented below.

Table 2. Preference test of Lubeg jam

Samples	Taste	Appearance	Aroma	Overall-Verbal Interpretation
Lubeg	3.9	4.1	4.2	4.06-Like Much
Strawberry	4.1	4.2	4.3	4.20-Like Very Much
Bignay	3.8	3.9	4.1	3.93-Like Much

Strawberry jam obtained the highest rating in terms of taste with a mean value of 4.1, followed by lubeg jam (3.9) and bignay jam (3.8). Similarly, strawberry jam obtained the highest rating in terms of appearance and aroma, followed by lubeg jam and bignay jam.

Based from the sensory evaluation strawberry jam was rated like very much with a mean rating of 4.2. Lubeg Jam and bignay jam were rated like much with mean ratings 4.06 and 3.93 respectively.

Table 4. Difference on the three jam samples in terms of taste, appearance and aroma

Parameter	Computed F	F tab 5%	F tab 1%
Taste	1.85ns		
Appearance	1.85 ns	3.35	5.48
Aroma	0.56 ns		

ANOVA shows no significant difference in the three jams in their taste, appearance and aroma with F values as 1.85, 1.85 and 0.56 respectively (F critical 5%=3.35 and 1%=5.48). Lubeg, strawberry and bignay have common distinct sweet-sour taste when processed into jam. They appear red to dark red and have a sweet and a little of sour aroma flavor.

Cost and Return Analysis of Processed Lubeg Products (per bottle)

Table 3. Cost and return analysis of lubeg food products

Product	Gross Income (Php)	Production cost (Php)	Net Income (Php)	Return above variable cost (%)
Wine	60.00	35.00	25.00	71.43
Jam	50.00	35.00	15.00	42.86
Jelly	50.00	35.00	15.00	42.86
Fruit Concentrate	35.00	20.00	15.00	75

Table 3 presents the cost and return analysis of lubeg products. Fruit concentrate gave the largest return followed by wine. For every 100 pesos invested, it can earn 75 pesos for lubeg fruit concentrate, 71 pesos for wine and 43 pesos for both jam and jelly.

Lubeg Fruit Preserves as Fillers

Lubeg jam and jelly were evaluated as fillers in the production of baked products such as doughnut, inipit, and cupcake

Table 4. Evaluation of lubeg fruit preserves as fillers of Doughnut, inipit and cupcake.

Treatment	Mean Rating				Overall Mean
Doughnut	Taste	Appearance	Aroma	Overall	
T1-pure lubeg	3.2	3.4	4.0	3.50	much accepted
T2-1:2 Lubeg-Pineapple	3.4	3.5	3.5	3.47	much accepted
T3-1:1 Lubeg-Pineapple	4.3	4.2	4.6	4.40	very much accepted
T4-2:1 Lubeg-Pineapple	4.6	4.4	4.5	4.50	very much accepted
Cupcake					
T1-pure lubeg	3.2	3.4	4.0	3.53	much accepted
T2-1:2 Lubeg-Pineapple	3.8	3.5	4.1	3.80	much accepted
T3-1:1 Lubeg-Pineapple	3.9	3.6	4.2	3.90	much accepted
T4-2:1 Lubeg-Pineapple	3.8	3.5	4.0	3.80	much accepted
Inipit					
T1-pure lubeg	4.0	4.2	4.2	4.10	much accepted
T2-1:2 Lubeg-Pineapple	4.1	4.0	4.3	4.10	much accepted
T3-1:1 Lubeg-Pineapple	4.2	4.1	4.2	4.20	very much accepted
T4-2:1 Lubeg-Pineapple	4.4	4.0	4.4	4.30	very much accepted

The above table shows the sensory evaluation of lubeg-pineapple filled baked products. On doughnut, treatment 4 has the highest overall rating followed by T3 with mean rating as 4.5 and 4.4 respectively. When lubeg jam/ jelly was used as flavor for cupcake, T3 with 1:1 ratio has the highest mean rating followed by T2 and T4. On the other hand, Lubeg-Pineapple in 2:1 ratio has the highest mean rating when used as filler for *inipit* baked products. The above findings indicate that lubeg can be best used as filler to baked products when mixed with pineapple.

Lubeg-Lemongrass Juice

Lemongrass has been known for its multipurpose uses in culinary, tea, and perfumery industry. To increase the acceptability of lubeg concentrate, lemongrass was mixed. The result of the sensory evaluation is presented in Table 5.

Table 5. Mean ratings lubeg-lemongrass juice.

Treatment	Taste	Appearance	Aroma	Overall	Overall Mean
T1-pure lubeg	4.1	4.0	4.0	4.0	much accepted
T2-1:2 Lubeg-lemongrass	4.2	4.4	4.2	4.3	very much accepted
T3-1:1 Lubeg-lemongrass	4.3	4.2	4.4	4.3	very much accepted
T4-2:1 Lubeg-lemongrass	4.6	4.6	4.5	4.6	very much accepted

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Table 5 revealed that treatment 6 in 2:1 lubeg – lemongrass ratio exhibited the highest mean rating (4.6) for sensory evaluation. This is being followed by treatment 2 and treatment 3 with mean ratings of 4.3. Pure lubeg juice is rated as 4.0. The addition of lemongrass extract to lubeg concentrate in the production of juice added flavor to the product.

CONCLUSION

Lubeg(*Syzygiumlineatum*) is an indigenous fruit found in some part of Ilocos Norte, Cagayan and Apayao. It is a highly perishable fruit that its fruit only last for one or two weeks when ripen. Due to this characteristics, the Apayao State College processed products for marketability. Three main products were derived namely: wine, fruit preserved and non-alcoholic beverage. The primary object of this study is to compare lubeg wine and jam with locally made wines and jams, utilize lubeg fruit preserves as fillers to baked products and use lubeg in the preparation of lemongrass-lubeg juice. The study was conducted at the Apayao State College, Food Processing Center. The experimental method of research was conducted.

From the result of the study, the following are concluded: Lubeg wine is preferred over other locally produced wine namely bignay and duhat. However, no significant differences were observed in their taste, appearance and aroma. On the other hand strawberry jam is preferred over lubeg and bignay jam. No significant differences were observed in their taste, appearance and aroma. Lubeg fruit preserves, Jam and jelly can be best used as fillers to baked products when mixd with pineapple jam; lubeg juice can be improved when mixed with lemongrass in 1:2, 1:1 an 2:1 ratio.

RECOMMENDATIONS

Mass production of lubeg products should be done as part of the income generating activity of the college. Promotion of the developed technology through trainings and attendance to trade fairs should be done. Similar research should be conducted using other flavors fruits or herbs to improve the quality of lubeg products.

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