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RESEARCH ARTICLE OPEN ACCESS

Antibacterial Properties of *Lubeg* (*Syzygium lineatum* (DC.) Merr. & L.M. Perry) Leaf Extracts

Maria Christina Z. Manicad[1]* and Agustina G. Pattung[2]

[1]Bachelor of Science in Forestry Department, Apayao State College Luna Campus, San Isidro Sur, Luna 3813, Apayao, Philippines.
[2]Bachelor of Elementary Education Department, Apayao State College Conner Campus, Malama, Conner 3807,Apayao, Philippines.

Abstract

The present study sought to perform antibacterial screening of the *Lubeg* leaf extracts derived from a 12-year *Lubeg* Plantation at Apayao State College, Payanan, San Gregorio, Luna, Apayao, against *Escherichia coli* and *Staphylococcus aureus.* The antimicrobial activity was evaluated using the disk diffusion method. The 100% *Lubeg* leaf extracts exhibited the highest mean zone of inhibition against *E. coli* after 20 hours while after 30 hours of incubation, the 50% *Lubeg* leaf extracts exhibited the highest mean zone of inhibition and active antibacterial activity against *E. coli*. Meanwhile, the 25% *Lubeg* leaf extracts exhibited the highest mean zone of inhibition and active antibacterial activity against *S. aureus* for both 20 hours and 30 hours of incubation. The *Lubeg* leaf extract has potential antimicrobial activities against these two bacterial strains, revealing its high potential as an antibacterial agent.

Keywords: Antibacterial, *Syzygium lineatum, E. coli, S. aureus*

***Correspondence:** manicad1972@yahoo.com

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INTRODUCTION

The genus *Syzygium* comprises 1200–1800 species that belong to the family of Myrtaceae.[1] One species is commonly called "*Lubeg," "Malubeg,"* and "*Alebadu*," or Philippine cherry. It inhabits some areas of Cagayan, Apayao, and Isabela provinces of Region 02.[2] *Lubeg* abundantly thrive in Apayao and in terms of medicinal value, *Lubeg* have a wide range of medicinal properties, including digestive, antidiabetic, astringent, antihelminthic, anti-bacterial, analgesic, anti-inflammatory, ant-oxidant, anti-hyperglycemic, gastro-protective agents, stomachic activity, anti-scorbutic activity, diuretic, anti-carminative, anti-genotoxicity, antileishmanial and anti-fungal activity.

Researches were conducted on *Lubeg* species along propagation,[3] molecular characteristics and chemical composition of leaves and fruits,[3] taxonomic classification and molecularly identification using the *rbcL* gene.[4] Moreover, in Apayao, there was research on the development of *Lubeg* fruits into processed products such as wine, fruit preserved, and nonalcoholic beverages.[5] Further, research on the qualitative phytochemical composition of *Lubeg* species in Apayao revealed presence of flavonoids, tannins, and saponins[6] and total phenolic contents of the extracts of *Lubeg* leaves at 1.05 mg/g of the Gallic acid equivalent (GAE),[7] however, the antibacterial properties need to be explored.

The preceding results of studies previously conducted are encouraging, laying the groundwork for the widespread use of the *Lubeg* in traditional and folk medicines. The literature review showed chemical screening of *Lubeg* and other species of *Syzygium* but not for the antimicrobial properties of *Lubeg* species. Balangcod et al.[8] mentioned the prevalence of diseases and the increasing prices of medicine have resulted in the demand for the discovery of less expensive but more vital sources of drugs. Different diseases are emerging, becoming primary health problems experienced by the community and human populations. With this, there is a need to discover potential plant resources that have medicinal value.

This study performed antibacterial screening of the *Lubeg* leaf extracts derived from a 12-year-old *Lubeg* Plantation at Payanan, San Gregorio, Luna, Apayao, and determined the anti-bacterial properties of *Lubeg* leaves against *Escherichia coli* and *Staphylococcus aureus.*

MATERIALS AND METHODS

Plant extraction preparations

Plant specimens' fresh leaves were collected from a 12-year-old *Lubeg* Plantation at the Experimental site of Apayao State College, Payanan, San Gregorio, Luna, Apayao. The collected leaves were air-dried for two (2) weeks, chopped finely, and stored in a tightly sealed container.

100 grams of the finely chopped sample were macerated using 80% Ethanol and stood for 24 hours for each plant. The mixtures were then filtered and concentrated in a water bath with a maintained temperature of 50°C at 20% of the filtrate was left. These extracts were used both for antibacterial screening.

Antibacterial activity of the plant extracts
Bacterial strains

Two (2) microbial strains, *E. coli* and *S. aureus,* were selected for the treatment. The microbial cultures were provided from the culture collection of the University Science Laboratories of Saint Paul University Philippines, Tuguegarao City, Philippines.

Inoculum preparation

The test organism was subcultured into test tubes containing nutrient agar using a loopful from each of their agar stands. At 37°C, the test tubes were incubated for 24 hours. The acquired microorganisms were standardized using a standard saline solution to ensure the bacteria had a consistent population density.

Antibacterial activity of the plant extracts

The disk diffusion method is used to evaluate the antimicrobial activity of each leaf plant extract.[9] Four treatments namely, 25%, 50%, 75%, and 100% *Lubeg* leaf extracts were used in the study while Amoxicillin was used as a control. The plates were then incubated for 20 hours and 30 hours at 37°C.

Determination of zone of inhibition

The antibacterial properties of the *Lubeg* leaf extracts and the antibiotics were observed by measuring the diameter of the zone of inhibition in millimeters using a vernier calliper laid in three (3) replications after the experiment. The activity of the *Lubeg* leaf extract was compared with corresponding references.[10]

RESULTS

The antibacterial activity of the *Lubeg* leaf extracts was determined by the disk diffusion method against *E. coli* and *S. aureus,* provided from the culture collection of University Science Laboratories of Saint Paul University Philippines, Tuguegarao City, Philippines. There were four ethanolic leaf extract concentrations tested such as 25%, 50%, 75%, and 100% *Lubeg* leaf extracts. After 20 hours and 30 hours of incubation, the plates were observed for the zone of inhibition in millimeters using a vernier calliper. Amoxicillin was also tested on the same bacteria to compare the antibacterial activity of the *Lubeg* leaf extracts and the antibiotic. Table 1 shows the standard zones of inhibition and corresponding inferences.

Table 1. Standard zones of inhibition and corresponding inferences[10]

Zone of Inhibition	Inferences
< 10 mm	Inactive
10-13 mm	Partially Active
14-19 mm	Active
>19 mm	Very Active

The 100% *Lubeg* leaf extracts exhibited the highest mean zone of inhibition against *E. coli* after 20 hours of incubation. Moreover, all four (4) treatments showed inactive antibacterial activity against *E. coli.* However, after 30 hours of incubation, 50% *of Lubeg* leaf extracts exhibited active antibacterial activity and the highest mean zone of inhibition of 16.83 mm against *E. coli.* All the other three treatments showed partial activity against *E. coli. Moreover, th*e mean zone of inhibition increased with increased incubation periods.

As shown from Table 2, the highest mean zone of inhibition was exhibited by 25% *Lubeg* leaf extracts against *S. aureus* after 20 hours of incubation. Moreover, this treatment demonstrated active antibacterial activity for *S. aureus* as indicated by the 14.66 mm diameter zone of inhibition. The lowest mean of inhibition was 75% *Lubeg* leaf extract, with a mean zone of inhibition of 9.97 mm. After 30 hours of incubation, 25% *Lubeg* leaf extracts still exhibited the highest mean zone of inhibition against *S. aureus.* On the other hand, the mean zone of inhibition was decreased as the incubation period increased for 25%, 50%, and 75% *Lubeg* leaf extracts against *S. aureus*. Only the 100% *Lubeg* leaf extract showed

Table 2. Anti-bacterial screening of *Lubeg* leaves against *Escherichia coli* and *Staphylococcus aureus*

Treatment	*E. coli*				*S. aureus*			
	20 hrs		30 hrs		20 hrs		30 hrs	
	Mean Zone of Inhibition (mm)	Inferences	Mean Zone of Inhibition (mm)	Inferences	Mean Zone of Inhibition (mm)	Inferences	Mean Zone of Inhibition (mm)	Inferences
25% *Lubeg* Leaf Extract	7.55	Inactive	11.25	Partially active	14.66	Active	14.17	Active
50% *Lubeg* Leaf Extract	7.50	Inactive	16.83	Active	13.33	Partially Active	8.75	Inactive
75% *Lubeg* Leaf Extract	8.75	Inactive	11.10	Partially active	9.97	Inactive	9.72	Inactive
100% *Lubeg* Leaf Extract	9.48	Inactive	12.27	Partially active	10.13	Partially Active	10.53	Partially Active
Control	77.48	Very active	55.00	Very active	41.58	Very active	56.90	Very Active

an increased mean zone of inhibition after 30 hours of incubation. Amoxicillin showed very active antibacterial activity against *E. coli* and *S. aureus,* as positive control.

DISCUSSION

Syzygium is a large genus of plants throughout the tropical regions. The genus has medicinal applications in the pharmaceutical, cosmetic, agricultural, and food industries. Moreover, it is known for medicinal properties like anti-bacterial activity. The genus was utilized in different ethnomedicinal systems worldwide.[11] The biological activity of some plant species of *Syzygium* are reported, and some are not; thus, it is a subject of interest to researchers of medicinally useful parts like leaves, roots, fruit, seed or bark.[12]

The present research constitutes the first investigation conducted on the *Syzygium lineatum* locally called *Lubeg* against *E. coli* and *S. aureus* in the province of Apayao. The antibacterial properties against Gram-positive and Gram-negative bacteria were evaluated through inhibitory assay. Remarkably, the leaf extracts displayed activity against *E. coli* and *S. aureus* in the disk diffusion method. Furthermore, variations in antibacterial properties were observed from inactive to active antibacterial activity against the strain of bacteria following corresponding references by Guevarra.[10] The results are aligned with reports that *Syzygium* species show rich medicinal applications.[13] Recent studies demonstrated the efficacy of *Syzygium* species against different types of bacterial strains,[14] which contain various phytochemicals that exhibit antioxidant and antimicrobial properties that result in their inhibitory abilities [15] and methanolic extracts have biological activities like antibacterial properties.[16] The findings are supported by the previous findings that *Lubeg* contains phenolic,[6-7] tannins, saponins, steroids, and flavonoids.[6]

CONCLUSION

The study focused on the screening of *Syzygium lineatum* or *Lubeg* leaf extracts against *E. coli* and *S. aureus*. The findings revealed that the leaf extracts have active antibacterial components that inhibit the growth of *E. coli* and *S. aureus*. Remarkably, the 50% *Lubeg* leaf extracts against *E. coli* and 25% *Lubeg* leaf extracts against *S. aureus*. The presence of antibacterial activities of *Lubeg* leaves is thought to have health-promoting qualities and beneficial importance in medicinal sciences.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

Both authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

ETHICS STATEMENT

Not applicable.

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