



## Review Article

# Study of Antibacterial Activity of Green Betel Leaf (*Piper betle* L.) and Red Betel Leaf (*Piper Crocatum* L.) Extract Against *Pseudomonas Aeruginosa* Bacteria

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## ARTICLE INFO

## ABSTRACT

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Green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) are plants commonly used for traditional medicine. The betel plant can treat infections. *Pseudomonas aeruginosa* is a bacteria that causes nosocomial infections. This article's purpose is to describe previous research on the antibacterial activity of green betel leaf extract (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against *Pseudomonas aeruginosa* bacteria. We used a traditional review. A search in the literature was carried out by entering the keywords: *Piper betle* L., *Piper crocatum* L., *Pseudomonas aeruginosa*, and antibacterial in PubMed, Science Direct, and Google Scholar databases. Data sources were obtained online, then selected based on inclusion criteria, namely in the form of complete articles in Indonesian and English, explaining the extracts of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against both *Pseudomonas aeruginosa* bacteria in single or combination from the years 2008-2021. The search results for articles obtained were 344.122 articles, and 15 articles were included from various countries. The results showed that the extracts of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) were able to inhibit *Pseudomonas aeruginosa* bacteria with strong to weak inhibition zones. Betel leaf extract (*Piper betle*) has been shown to have antibacterial properties and can inhibit *Pseudomonas aeruginosa* bacteria with strong to weak inhibition zones. Single or combination from the years 2008-2021.

## 1. INTRODUCTION

Infectious disease is one of the health problems because this disease is the leading cause of high morbidity and mortality, especially in developing countries, one of which is Indonesia. Infectious diseases are caused by the entry of pathogenic microorganisms that can attack humans, one of which is bacteria (Indonesian Ministry of Health, 2011). One of the most common infectious diseases the Indonesian people suffer from is nosocomial infections or Healthcare-Associated Infections (HAIs) caused by the bacterium *Pseudomonas aeruginosa*. Nosocomial infections or Healthcare-Associated Infections (HAIs) are infections that occur in hospitals and attack patients who are in the treatment process, who are not found, and who are not in the incubation period when the patient is admitted to the hospital. Microorganisms can survive and thrive in the hospital environment, such as floors, air, water, hospital furniture, food, and medical and non-medical equipment. Hapsari et al., 2018). Many types of research on antibacterial activity with plant materials have been carried out, including betel plants. Therefore, a literature review study on the antibacterial activity of extracts of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against *Pseudomonas aeruginosa* was carried out. Betel is known as a plant that is widely used in medicine in Southeast Asia.

Betel (*Piper betle* L.) is one of the species in the genus *Piper* which is very well known by the public because it is not only used as an herb but also has essential values in the culture of the community. Traditionally, betel leaf is used for antibacterial, anti-inflammatory, antiseptic, bleeding stops, cough suppressants, laxative farts, stimulants for salivation, prevention of worms, itching relievers, and sedatives (Widiyastuti et al., 2016). The purpose of this study was to investigate the antibacterial activity of extracts of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against the bacterium *Pseudomonas aeruginosa* and to determine the research potential of green betel leaf (*Piper betle* L.) and leaf extracts. Red betel (*Piper crocatum* L.) against *Pseudomonas aeruginosa* bacteria.

## 2. MATERIALS AND METHODS

This research uses the Traditional Review research method. Traditional Review aims to identify some exciting research to be studied and reviewed. A literature search was conducted to determine all articles related to the antibacterial activity of Green Betel leaf (*Piper betle* L.) and Red Betel leaf (*Piper crocatum* L.) in inhibiting *Pseudomonas aeruginosa* bacteria. The selection of the period for publishing articles is limited to 2008-2021.

### Materials and Tools

The tools used in this research are cellphones and laptops that can be used for searching the literature, while the materials used in this research are search engines or databases used to search for journals/articles, namely Google Scholar, PubMed, and Science Direct.

## Methods

### a. Problem identification and data collection

The data collection process is carried out by searching or digging data from articles related to what is intended in formulating the problem. The data that has been extracted from various articles were collected, and a summary of the journal was made, including the title, author, year of publication, solvent, extraction method, bacterial activity test method, and antibacterial activity of betel leaf. The summary of the research articles is entered into a table and sorted according to their respective publication year.

### b. Article search strategy

Search articles are used for Review by conducting searches and paying attention to inclusion and exclusion criteria. Article searches are carried out with the help of search engines such as PubMed, Science Direct, and Google Scholar. Search the literature by entering the keywords "Antibacterial activity" OR "antimicrobial activity" AND "Piper betle L" AND "Pseudomonas aeruginosa," "Antibacterial activity" OR "antimicrobial activity" AND "Piper crocatum L" AND "Pseudomonas aeruginosa", "Antibacterial AND extract AND Piper betle AND pseudomonas aeruginosa" , and "Antibacterial AND extract AND Piper crocatum AND Pseudomonas aeruginosa."

### c. Data selection

The articles used are selected papers based on inclusion and exclusion criteria. The selected articles are articles published in the last 13 years (2008-2021). This study discusses the antibacterial activity of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against *Pseudomonas aeruginosa* bacteria. Articles that have met the inclusion criteria will be extracted and data obtained for analysis.

## 3. RESULTS AND DISCUSSIONS

In searching the database, search for literature using several search engines such as PubMed, Science Direct, and Google Scholar. In the literature selection, keywords are combined with Boolean operators such as OR and AND. This is used to make it easier to find the relevant article. The results of the article search with the total number of articles that have been identified from the database used are 344,122 articles obtained from PubMed (5 articles), Science direct (340,034 articles), and Google Scholar (4083 articles), which were selected based on abstracts and titles. The articles were then excluded according to the established criteria, so 15 articles were obtained. Fifteen articles obtained have inhibition zone parameters that are different based on the research journal. According to the Clinical and Laboratory Standard Institute edition 11, the inhibition zone standard states that the 20 mm inhibition zone has vigorous activity, 15-19 mm has moderate exercise, and 14 has weak activity. Articles from research have been

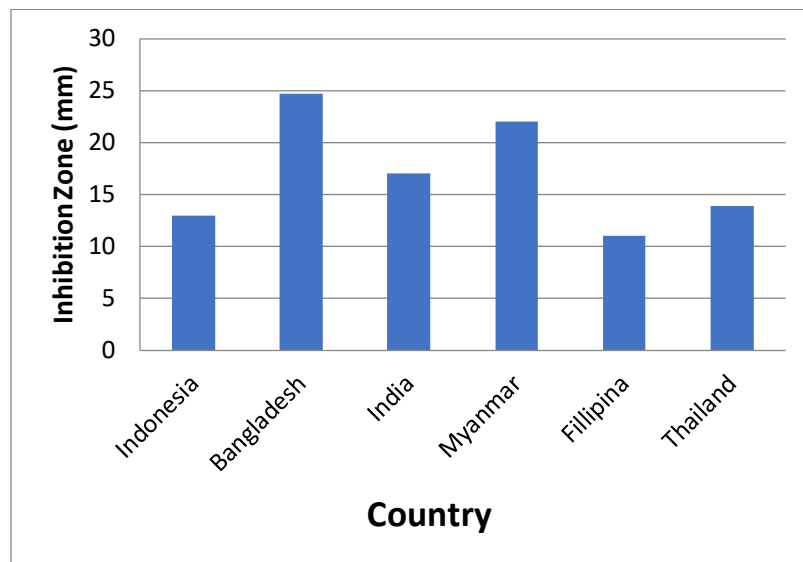
carried out from several countries, such as Myanmar, Malaysia, India, Bangladesh, Thailand, the Philippines, and Indonesia, between 2008-2021. The articles used are included following the established criteria, such as articles in full text in Indonesian and English that discuss extracts of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.).

Betel leaf is reported to have anti-inflammatory, antiseptic, antibacterial activity, stop bleeding, relieve cough, laxative fart, stimulate salivation, prevent worms, ease itching, and sedative (Widiyastuti et al., 2016). Betel leaf is known to have an antibacterial activity that can inhibit gram-negative bacteria, such as *Salmonella typhi*, *E. Coli*, *B. Cereus*, and *Pseudomonas aeruginosa* (Almahdi et al., 2019).

**Table I.** Antibacterial activity of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against the bacterium *Pseudomonas aeruginosa*

Country	Sample	Antibacterial test method	Extraction method	Solvent	Obstacles zone (mm)
Indonesia	green betel	Well diffusion	Maceration	Ethanol	19.7
India	green betel	Well diffusion	Maceration	Ethanol	7.62
Indonesia	green betel	Well diffusion	Maceration	Ethanol	9
Indonesia	green betel	Well diffusion	Maceration	Ethanol	16.90
India	green betel	Disc diffusion	Soxhlet Tool	Ethanol	13
Bangladesh	green betel	Disc diffusion	Dekokta	Methanol	27
Bangladesh	green betel	Disc diffusion	Dekokta	Water	22.4
Indonesia	green betel	Well diffusion	Soxhlet Tool	Ethanol	20,12
Indonesia	red betel	Well diffusion	Maceration	Ethanol	11.43
Myanmar	green betel	Disc diffusion	Maceration	Ethanol	22
India	green betel	Disc diffusion	Maceration	Methanol	29
Philippines	green betel	Disc diffusion	Maceration	Ethanol	11

Indonesia	red betel	Well diffusion	Maceration	Ethanol	1.03
India	green betel	Disc diffusion	Soxhlet Tool	Ethanol	18.5
Thailand	green betel	Disc diffusion	Maceration	Ethanol	13.95



**Figure 1.** Bar Diagram of the country against inhibition zone (mm)

**Figure 1** showed that research from Bangladesh had the highest antibacterial activity, with an inhibition zone of 24.7 mm. The study with the lowest antibacterial activity is from the Philippines, with an inhibition zone of 11 mm.

The results of research studies on the antibacterial activity of green betel leaf (*Piper betle* L.) and red betel leaf (*Piper crocatum* L.) against *Pseudomonas aeruginosa* bacteria have high activity, namely from Bangladesh with an inhibition zone of 24.7 mm using the decoction extraction method by using methanol and water as a solvent with an antibacterial test by disc diffusion method. The plant's origin affects the inhibitory power because the betel plant has a wide distribution area, especially in the tropics and subtropics (Kumar et al., 2010).

The difference in the inhibition zone was due to differences in the levels of secondary metabolites in the betel leaf used in making the extract. The environment in which plants are grown dramatically affects the levels of secondary metabolites produced by these plants. For

instance, soil nutrients such as K, N, organic matter, and C have a linear relationship with plants' formation of secondary metabolites (Febriana, 2018). This means that the more nutrients contained in the soil will cause plants to have better secondary metabolite quality and a greater quantity of secondary metabolites. Young plants have a low secondary metabolite content because the synthesis of metabolites is not optimal. Whereas in leaves, the content of secondary metabolites in old leaves will be more when compared to young leaves because the amount of secondary metabolites stored in old leaves is more than the number of secondary metabolites stored in young leaves (Salim et al., 2016). In addition, environmental stress factors and nutrient adequacy in the soil can also affect the level of secondary metabolites (Mariska, 2013).

#### 4. CONCLUSIONS

1. Betel leaf extract (Piper betle) was proven to have antibacterial properties and inhibit *Pseudomonas aeruginosa* bacteria with a strong to weak inhibition zone.
2. Betel leaf extract (Piper betle) has a weak potency with an inhibition zone of 11 mm, a medium potency with an inhibition zone of 13.03-17.03 mm, and a strong potency with an inhibition zone of 22-24.7 mm in inhibiting *Pseudomonas aeruginosa* bacteria.

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