Bioactive Compounds and Antibacterial Activity of Ethanolic Extracts of *Curcuma mangga*. Val Against ***Staphylococcus aureus***

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Abstract. *Temu mangga (Curcuma mangga) is a medicinal plants as antioxidants because it contains curcuminoids. The compounds bioactive and antibacterial activity from temu mangga had not been widely researched and other scientific information is still limited. This study aimed to examine the antibacterial activity of the Curcuma mangga against pathogenic bacteria Staphylococcus aureus and determine the phytochemical compounds. Antibacterial research conducted by the diffusion method of ethanol extracts against pathogenic bacteria, and qualitatively tested for the presence of chemical constituents. The results showed the antibacterial activity against Staphylococcus aureus. the inhibitory wide diameter for S. aureus (30.5 mm) at a concentration of 8% of ethanol extracts were equal with Amoxicillin 30 µg/ml. Minimum Inhibitory Concentration was 2% of ethanolic extracts. Phytochemical analysis of the results of the ethanol extract of Curcuma mangga showed varying bioactive compounds consisting of flavonoids, saponins, quinones and steroids were the most prominent. The research results prove that the C. mangga is a good source of antibacterial against S. aureus.*

Keywords : Antibacterial, *Curcuma mangga*, Ethanolic Extracts**,** *Staphylococcus aureus*

1. Introduction

Curcuma mangga Val. is a member of the Zingiberaceae family that grows in Java, Indonesia. The plant has the potential to produce new drugs that are beneficial to humans. Many approaches to search for the principle of the biological activity of this plant. Extract of medicinal plant used have varied the effect according with Elizabeth in [3]. The increasing number of failures in the treatment showed due to the many microorganisms that are resistant to antibiotics then the search for medicinal plants which has antimicrobial need to be investigated. *S. aureus* is found as normal flora of the skin, especially areas of glandular of apocrine, respiratory tract, gastrointestinal tract and on protein-containing foods such as eggs, sausage and bacon. Source of infection in humans can be caused by the carrier or the patient. *S. aureus* is the most common microorganisms in food poisoning cases. Toxin of *S. aureus* called enterotoxin. This toxin has incubation period of 2-6 hours with a sudden onset of symptoms are nausea, vomiting and diarrhea. Vomiting effect arises because the toxins stimulate the vomiting center in the central nervous system. Thermostable enterotoxin so if the food has been heated enterotoxins will persist despite *S. aureus* had been die. Therefore interest in search of medicinal plants spread in Indonesia the greater because the safe, no side effects and more reliable than the synthetic drugs. In Indonesia some medicinal plants have been used since ancient times to cure certain diseases. Rhizome efficacious as upset stomach, chest pain, fever and general weakness. According to Abas *et.al* in [1] compounds from *C. mangga* showed strong cytotoxic activity against a human tumor cells, such as human leukemia (HL-60), breast cancer (MCF-7) and liver cancer (HepG2). The present study is aimed to examine the antibacterial activity of the plants *Curcuma mangga* against the bacterial pathogens *Staphylococcus aureus* and describes the phytochemical analysis.

2 Methods

The moisture content and ash accordance with Regulation of Ministry of health Republic of Indonesia (1985). The powder was extracted via Soxhlet extraction using ethanolic 96% for 8 h, the resulting filtrate was evaporated using a rotary evaporator at 5 to 6 rpm and at 68^0C temperatur. Finally extract is dried using a freeze dryer and store in a sealed container. Rejuvenation *S. aureus* were grown in nutrient broth at temperature 30^0C for 3x24 h which can then be used for testing antibacterial. Antibacterial testing was performed

using disc-diffusion methods against *Staphylococcus aureus*. Nutrient agar mixed with the inocula in petri dich. Steril discs with a diameter of 6 mm was filled with 20 µl ethanolic extracts of *Curcuma mangga* concentration of 5%, 6%, 7%, 8%, 9% from 5 g of dry extracts and combined with sterile media and test organism in a petri dish. Subsequently incubated at 37^0C for 24 h. The antibacterial activity is determined from the magnitude of the inhibition zone. And the Minimum Inhibitory Concentration is determined from the smallest concentration which can inhibit the bacteria. All sampling is conducted four replications. Positive and negative controls are also determined inhibitory power. DMSO 2% is used as a negative control to determine its effect on test organisms. Amoxicillin 30 µg/ml is used as a positive control to compare the effects of *Curcuma mangga* against the test organisms. Qualitative test conducted to identify the content of flavonoids, saponins, tannins, quinone, alkaloids, and steroid-triterpenoid were carried out for flour test by the method in accordance with the Harbone in [5].

3 Results

Ethanolic extracts of five different concentration of *Curcuma mangga* were examined for the antibacterial activity against *Staphylococcus aureus* (from Biopharmaca Research Center Bogor Agricultural University). The results of measuring the diameter of inhibitory areas are listed in Table 1.

Table 1. Data inhibition area diameter antibacterial activity of ethanol extracts of *Curcuma mangga*

Repetition	Inhibition area diameter (mm)						
	5%	6%	7%	8%	9%	A*	(-)
1	22	25	27	30	26	30	0
2	23	24	28	28	27	31	0
3	27	26	28	34	25	30	0
4	18	25	27	30	27	28	0
Mean	22.5	25	27.5	30.5	26.25	29.75	0

Note : A* : Amoxicillin 30 µg/ml

(-) : DMSO 2%

Inhibition area diameter in this study was 30.5 mm as maximum inhibition on 8% ethanolic extracts which showed the same activity with Amoxicillin 30 µg/ml against *Staphylococcus aureus*. Phytochemical analysis results of powder and ethanolic extract of *Curcuma mangga* indicate the active compound varies, especially prominent are flavonoids, saponins, quinone and steroid. Phytochemical analysis has been summarized in the Table 2.

Table 2. Phytochemical analysis of powder and ethanolic extract of *Curcuma mangga*

Bioactive components	Sample	
	powder	extract
Flavonoids	++	++
Saponins	+++	+++
Tannins	-	-
Quinone	+++	+++
Alkaloids	-	-
Steroids	+	+
Triterpenoid	-	-

Note: + prominent -no chemical constituents

4 Discussion

Based on these result the ethanolic extracts of roots of *C. mangga* inhibits the activity of the bacteria *S. aureus* , it is because *C. mangga* contain bioactive compounds that cause damage to the bacterial growth. With all concentrations of ethanol extract of *C. mangga* for this study could indicate barriers against *S. aureus*. According to Palombo and Semple in [7] if ethanol, hexane and methanol is used as a solvent to extract the plant, mostly from the extraction may indicate an inhibitory effect on gram- positive and gram-negative. According to Renisheya *et.al* in [9] activity of ethanol extract of *C. mangga* as an antibacterial can be seen by the size of the width of the barriers. The essential oils of *C. mangga* had the highest activity and most broad-spectrum by inhibiting all microorganisms tested, according to Sri Nurestri *et. al* in [11]. The ethanol extract of *Curcuma mangga* contain bioactive compounds consists of flavonoids, saponins, quinone and steroids. Flavonoids are known as antioxidants according to Parekh and Chandren in [8], which is very important in heart health and prevent cancer. Additionally useful as antihistamines, antimicroba, improve memory and tranquility. Flavonoids are plant secondary metabolites. Secreted by plant roots and helps the bacteria *Rhizobia* in holding a symbiotic relationship with legumes such as peas, soybeans and others. *Rhizobia* which live in the soil can feel flavonoids and triggers the secretion of Nod factors, which ultimately perceived by the host plant and can cause deformation of the hair roots and some cellular responses such as fluctuation of ions and the formation of root nodules. Some flavonoids have inhibitory activity against organisms according to Zamora-Ros *et. al* in [13], according to Galeotti *et. al* in [4] flavonoids can inhibit *Fusarium oxysporum* that causes pain to the plant. Saponins are phytosterol compounds that occur naturally in some plants according to Xu *et. al* in [12]. Saponins have effectiveness as antimicrobial, antifungal, anti-inflammatory and stimulates the immune system. Saponins there in some foods so it's easy to add these compounds to a

natural diet. Saponins are compounds that are dissolved in fat (soap), as a reserve at the cellular level making it possible to reduce cholesterol. The cell walls of microorganisms consist of fatty chain molecules and saponins may have the ability to break this walls as antimicrobial activity and antifungal. If Saponins from *Quillaja saponaria* is injected in vitro or into the blood stream of animal; it will cause a damage of red blood cell. Not all saponin had the same reaction. Some of them indicate anti-inflammatory and stimulate immune system as well as antimicrobial towards fungi and bacteria. Saponins are being promoted as dietary supplements and nutriceuticals according to Skene and Philip in [10]. According to Akinjogunla *et. al* in [2] Saponin can increase the permeability of the cell membrane so that it occurs cell haemolisis. Saponin has an antibacterial activity that contains of a cluster of polar (sugar) and non-polar (Terpenoids) so it can decrease the surface tension of cell wall and intervere microbial cell permeability. Most of saponins can be easily dissolve in water, and are toxic for fish according to Jonathan *et. al* in [6]. Quinones and their derivatives are intermediate products in the production of dyes. They are also used as fungicides, insecticides, and tanning agents. *2-Methyl-1,4-naphthoquinone* is a vitamin of the vitamin K group. Quinones, it is a chemical term used to describe a molecule which contains a benzene ring with two double bonded oxygen atoms attached. A number of quinone pigments have been isolated from plants and animals. Steroids are types of organic compounds containing the composition of the four ring cycloalkanes are joined to each other. steroid function depends on the type of steroid, but generally build muscle and reduce inflammation. Steroids are molecules that mimic the effects of the body's natural hormones. There are a number of different varieties of steroid that helps build muscle and steroid that helps reduce inflammation. All natural steroids are fatty molecules. The immune system also uses steroids, which in this case are called adrenocorticosteroids, to regulate inflammation in response to injury and infection. Some adrenocorticosteroids are regulators of metabolism, and help move glucose other nutrients around the body. Although steroids are natural molecules, steroids used in the treatment. Steroid is a form of testosterone that mimics the body's natural testosterone. Effects of steroids are very different. Steroid is a compound of fats of plant and animal.

5 Conclusions

The result showed that bioactive compounds contained in extracts of *Curcuma mangga* Val. are flavonoids, saponins, quinones, steroid-triterpenoids. Ethanol extract of *Curcuma mangga* Val. can inhibit the growth of bacteria or have antibacterial activity against *S. aureus*. The *C. mangga* is a good source of antibacterial against *S. aureus*.

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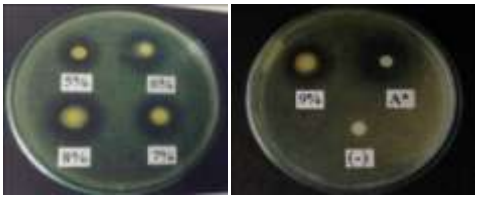

Figure 1. Diameter of inhibition antibacterial activity of ethanolic extracts of Curcuma mangga on Staphylococcus aureus
Note: A* : Amoxicillin 30 µg/ml
(-) : DMSO 2%

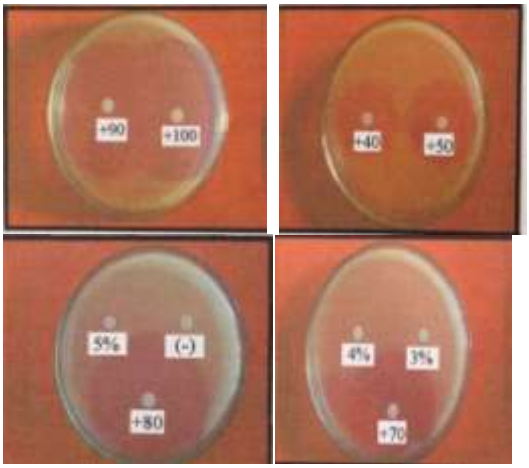

Figure 2. Minimum Inhibitory Concentration is 2% of ethanolic extracts
Note: (-) : DMSO 2%