Journal of
Tropical Pharmacy
And Chemistry

REVIEW: ANTIBACTERIAL ACTIVITIES OF VARIOUS PARTS OF MENGKUDU (*Morinda citrifolia* L.) PLANTS ON SOME SPECIES OF BACTERIA

Barolym Tri Pamungkas, Moelyono Muktiwardojo, Tina Rostinawati

Departement Biology Pharmacy, Faculty of Pharmacy, Padjadjaran University
Jl. Raya Bandung-Sumedang KM 21, Jatinangor 45363
Telephone (022) 7796200, Fax (022) 7796200
email: barolym@rocketmail.com

ABSTRACT

The high incidence of infections and the increase in antibiotic resistance have become a global health concern. The emergence of strains of resistant bacteria has also encouraged the exploration of potential antibacterial agents, especially from natural sources. This review aims to provide information regarding the antibacterial activity of stems, leaves, fruits and seeds of mengkudu (*M. citrifolia* L,) in inhibiting various bacterial species. In this article review, online and offline literature were used. Online literature was obtained from local and international journals and scientific articles of the last 10 years, 2008-2018, which were obtained through direct search results online using online search engines namely Google and Google Scholar. Whereas the offline literature used is books and e-books. It is known that the root, stem, leaves, fruit, and seeds of mengkudu (*M. citrifolia* L,) with various solvents used can inhibit various species of bacteria with different diameter inhibition zones.

Keywords: *M. citrifolia* L, antibacterial, solvents

Submitted on: 11 January 2019 Accepted on: 03 June 2019

DOI: https://doi.org/10.25026/jtpc.v4i5.207

INTRODUCTION

The high incidence of infections and the increase in antibiotic resistance caused by overuse and misuse of antibiotics, improper administration, and limited availability of new generation antibiotics are becoming a global health concern. In addition, the emergence of resistant bacterial strains has also encouraged the exploration of potential antibacterial agents, especially from natural sources.[1]

The use of natural materials as medicine is the right thing that can support public health because it has minimal side effects when compared with drugs from chemicals. Medicinal plants play an important role in the treatment of several diseases, especially in developing countries. Many medicinal plants have been documented in pharmacopeia for

herbal medicines because of their efficacy against pathogenic microbes.[2]

One of the plants that have been used by the community as a natural medicine ingredient is Morinda citrifolia L., commonly known as Mengkudu. Mengkudu is a plant that has almost all parts of its body as a medicine for both the stems, leaves, fruits, and seeds. This is because Mengkudu contains a lot of secondary metabolites which have many pharmacological activities in dealing with various diseases. Secondary metabolite compounds have polyvalent activity so that they can overcome various diseases.[3] Therefore, the authors are interested in conducting a review of mengkudu. This review aims to provide information regarding the antibacterial activity of stem, leaves, fruit, and seeds of mengkudu (*M. citrifolia* L,) in inhibiting various bacterial species.

RESEARCH METHODS

The data presented in this article, obtained from the literature online and offline. Online literature is obtained from local and international journals and scientific articles of the last 10 years, 2008-2018, which are obtained through direct search results online using online search engines namely Google and Google Scholar. Whereas the offline literature used is books and e-books.

DISCUSSION

Based on the search in several scientific journals, the authors found that various parts of Mengkudu (*M. citrifoilia* L.) plants can inhibit various species of bacteria, can be seen in Table 1.

Table 1. 'Antibacterial activity of stem, leaves, fruit, and seeds of mengkudu (*M. citrifoilia* L.) against various bacterial species (in mm).

Parts of plants used	Extract	Species	The diameter of the inhibition zone (mm)	Concentration	Method	Ref
Stem	Ethyl acetate	1. *Staphylococcus aureus* 2. *Streptococcus sp.* 3. *Proteus mirabilis* 4. *Pseudomonas diminuta* 5. *Enterobacter cloacae*	6 6 6 7 6	1000 µg/mL 1000 µg/mL 1000 µg/mL 1000 µg/mL 1000 µg/mL	*Disc diffusion*	4
	Petroleum ether	1. *Escherichia coli* 2. *Bacillus subtilis* 3. *Staphylococcus aureus*	17 19 20 21 17 18	5 mg/mL 10 mg/mL 5 mg/mL 10 mg/mL 5 mg/mL 10 mg/mL	*Disc diffusion*	8
	Ethanol	1. *Escherichia coli* 2. *Bacillus subtilis* 3. *Staphylococcus aureus*	17 19 20 21 17 18	5 mg/mL 10 mg/mL 5 mg/mL 10 mg/mL 5 mg/mL 10 mg/mL		
		1. *Staphylococcus aureus* 2. *Streptococcus sp.* 3. *Shigella flexneri* 4. *Pseudomonas diminuta* 5. *Enterobacter cloacae*	6 6 6 10 6	1000 µg/mL 1000 µg/mL 1000 µg/mL 1000 µg/mL 1000 µg/mL	*Disc diffusion*	4
	Methanol	1. *Escherichia coli* 2. *Pseudomonas aeruginosa* 3. *Staphylococcus aureus*	7 6 6	1000 µg/mL 1000 µg/mL 1000 µg/mL	*Disc diffusion*	4

		4. *Streptococcus sp.*	8	1000 µg/mL		
		5. *Shigella flexneri*	6	1000 µg/mL		
		6. *Proteus mirabilis*	6	1000 µg/mL		
		7. *Pseudomonas diminuta*	6	1000 µg/mL		
		8. *Enterobacter cloacae*	6	1000 µg/mL		
Leaf	Methanol	1. *Escherichia coli*	10,8	5 mg/mL	*Disc diffusion*	4,5,6
		2. *Pseudomonas sp.*	8,8	5 mg/mL		
		3. *Salmonella sp.*	12,6	5 mg/mL		
		4. *Staphylococcus aureus*	11,6	5 mg/mL		
		5. *Klebsiella sp.*	6,2	5 mg/mL		
		1. *Escherichia coli*	8	1000 µg/mL	*Disc diffusion*	
		2. *Pseudomonas aeruginosa*	6	1000 µg/mL		
		3. *Staphylococcus aureus*	9	1000 µg/mL		
		4. *Klebsiella pneumonia*	7	1000 µg/mL		
		5. *Streptococcus sp.*	6	1000 µg/mL		
		6. *Shigella flexneri*	8	1000 µg/mL		
		7. *Proteus mirabilis*	6	1000 µg/mL		
		8. *Pseudomonas diminuta*	11	1000 µg/mL		
		9. *Pseudomonas fluorescens*	8	1000 µg/mL		
		10. *Enterobacter cloacae*	7	1000 µg/mL		
	Chloroform	1. *Escherichia coli*	8,8	5 mg/mL	*Disc diffusion*	
		2. *Pseudomonas sp.*	8,4	5 mg/mL		
		3. *Salmonella sp.*	11,6	5 mg/mL		
		4. *Staphylococcus aureus*	11,0	5 mg/mL		
		5. *Klebsiella sp.*	8,8	5 mg/mL		
	Acetone	1. *Escherichia coli*	14,2	5 mg/mL	*Disc diffusion*	
		2. *Pseudomonas sp.*	11	5 mg/mL		
		3. *Salmonella sp.*	13,2	5 mg/mL		
		4. *Staphylococcus aureus*	11,2	5 mg/mL		
		5. *Klebsiella sp.*	6,211,2	5 mg/mL		
	Hydro-alcohol	1. *Bacillus subtilis*	7	5 µL	*Disc diffusion*	
			11	10 µL		
			10	20 µL		
		2. *Pseudomonas aeruginosa*	11	5 µL		
			11	10 µL		
			11	20 µL		
		3. *Staphylococcus aureus*	12	5 µL		
			10	10 µL		
			11	20 µL		
		4. *Proteus vulgaris*	-	5 µL		
			6	10 µL		
			6	20 µL		
		5. *Eschericia coli*	6	5 µL		
			7	10 µL		
			7	20 µL		
		6. *Serratia marcescens*	7	5 µL		
			8	10 µL		
			8	20 µL		
	Ethanol	1. *Escherichia coli*	7	1000 µg/mL	*Disc diffusion*	4
		2. *Staphylococcus aureus*	8	1000 µg/mL		
		3. *Klebsiella pneumonia*	6	1000 µg/mL		
		4. *Shigella flexneri*	8	1000 µg/mL		
		5. *Proteus mirabilis*	6	1000 µg/mL		
		6. *Pseudomonas diminuta*	10	1000 µg/mL		
		7. *Pseudomonas fluorescens*	6	1000 µg/mL		
		8. *Enterobacter cloacae*	6	1000 µg/mL		
	Ethyl acetate	1. *Escherichia coli*	6	1000 µg/mL	*Disc diffusion*	4
		2. *Staphylococcus aureus*	7	1000 µg/mL		
		3. *Klebsiella pneumonia*	6	1000 µg/mL		
		4. *Streptococcus sp.*	6	1000 µg/mL		
		5. *Shigella flexneri*	7	1000 µg/mL		
		6. *Proteus mirabilis*	6	1000 µg/mL		
		7. *Pseudomonas diminuta*	9	1000 µg/mL		
		8. *Pseudomonas fluorescens*	7	1000 µg/mL		

Fruit	Methanol	1. *Bacillus subtilis*	10	100 mg/mL	*Cup Plate Tehnique*	7
		2. *Staphylococcus aureus*	11,3	100 mg/mL		
		3. *Lactobacillus lactis*	10,0	100 mg/mL		
		4. *Streptococcus thermophilus*	11,3	100 mg/mL		
		5. *Pseudomonas aeruginosa*	10,3	100 mg/mL		
		6. *Salmonella typhi*	10,3	100 mg/mL		
		7. *Eschericia coli*	11,0	100 mg/mL		
		8. *Vibrio harveyi*	11,3	100 mg/mL		
		9. *Klebsiella pneumonia*	9,3	100 mg/mL		
		10. *Shigella flexneri*	11,0	100 mg/mL		
		11. *Salmonella paratyphi*	26,0	100 mg/mL		
		12. *Aeromonas hydrophila*	12,3	100 mg/mL		
		13. *Vibrio cholera*	7,7	100 mg/mL		
		14. *Chromobacterium Violaceum*	12,3	100 mg/mL		
		15. *Enterobacter faecalis*	13,0	100 mg/mL		
		1. *Escherichia coli*	7	1000 µg/mL	*Disc diffusion*	5
		2. *Pseudomonas aeruginosa*	7	1000 µg/mL		
		3. *Staphylococcus aureus*	7	1000 µg/mL		
		4. *Klebsiella pneumonia*	8	1000 µg/mL		
		5. *Streptococcus sp.*	6	1000 µg/mL		
		6. *Shigella flexneri*	7	1000 µg/mL		
		7. *Proteus mirabilis*	8	1000 µg/mL		
		8. *Pseudomonas diminuta*	8	1000 µg/mL		
		9. *Pseudomonas fluorescens*	6	1000 µg/mL		
		10. *Enterobacter cloacae*	8	1000 µg/mL		
	Ethanol	1. *Escherichia coli*	6	1000 µg/mL	*Disc diffusion*	4
		2. *Pseudomonas aeruginosa*	7	1000 µg/mL		
		3. *Staphylococcus aureus*	8	1000 µg/mL		
		4. *Streptococcus sp.*	8	1000 µg/mL		
		5. *Shigella flexneri*	9	1000 µg/mL		
		6. *Proteus mirabilis*	6	1000 µg/mL		
		7. *Pseudomonas diminuta*	7	1000 µg/mL		
		8. *Pseudomonas fluorescens*	6	1000 µg/mL		
		9. *Enterobacter cloacae*	6	1000 µg/mL		
	Ethyl acetate	1. *Bacillus subtilis*	6,3	100 mg/mL	*Cup Plate Tehnique*	7
		2. *Staphylococcus aureus*	6,7	100 mg/mL		
		3. *Lactobacillus lactis*	5,7	100 mg/mL		
		4. *Streptococcus thermophilus*	6,0	100 mg/mL		
		5. *Pseudomonas aeruginosa*	-	100 mg/mL		
		6. *Salmonella typhi*	6,0	100 mg/mL		
		7. *Escherichia coli*	6,3	100 mg/mL		
		8. *Vibrio harveyi*	6,3	100 mg/mL		
		9. *Klebsiella pneumonia*	-	100 mg/mL		
		10. *Shigella flexneri*	8,0	100 mg/mL		
		11. *Salmonella paratyphi*	15,7	100 mg/mL		
		12. *Aeromonas hydrophila*	11,3	100 mg/mL		
		13. *Vibrio cholera*	10,7	100 mg/mL		
		14. *Chromobacterium violaceum*	12,0	100 mg/mL		
		15. *Enterobacter faecalis*	14,7	100 mg/mL		
		1. *Escherichia coli*	6	1000 µg/mL	*Disc diffusion*	4
		2. *Klebsiella pneumonia*	6	1000 µg/mL		
		3. *Shigella flexneri*	7	1000 µg/mL		
		4. *Enterobacter cloacae*	6	1000 µg/mL		
	n-hexan	1. *Bacillus subtilis*	-	100 mg/mL	*Cup Plate Tehnique*	7
		2. *Staphylococcus aureus*	-	100 mg/mL		
		3. *Lactobacillus lactis*	6,3	100 mg/mL		
		4. *Streptococcus thermophilus*	-	100 mg/mL		
		5. *Pseudomonas aeruginosa*	-	100 mg/mL		
		6. *Salmonella typhi*	-	100 mg/mL		
		7. *Eschericia coli*	-	100 mg/mL		
		8. *Vibrio harveyi*	-	100 mg/mL		
		9. *Klebsiella pneumonia*	-	100 mg/mL		
		10. *Shigella flexneri*	-	100 mg/mL		
		11. *Salmonella paratyphi*	-	100 mg/mL		

		12. *Aeromonas hydrophila* 13. *Vibrio cholera* 14. *Chromobacterium violaceum* 15. *Enterobacter faecalis*	- - - -	100 mg/mL 100 mg/mL 100 mg/mL 100 mg/mL		
Seeds	Methanol	1. *Escherichia coli* 2. *Pseudomonas sp.* 3. *Salmonella sp.* 4. *Staphylococcus aureus* 5. *Klebsiella sp.*	12,8 12,4 12 13,4 12	5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL	*Disc diffusion*	6
	Chloroform	1. *Escherichia coli* 2. *Pseudomonas sp.* 3. *Salmonella sp.* 4. *Staphylococcus aureus* 5. *Klebsiella sp.*	11,6 12,6 11,2 13,0 11,2	5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL	*Disc diffusion*	
	Acetone	1. *Escherichia coli* 2. *Pseudomonas sp.* 3. *Salmonella sp.* 4. *Staphylococcus aureus* 5. *Klebsiella sp.*	11,8 13,6 12,2 11,4 12,2	5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL 5 mg/mL	*Disc diffusion*	

The extraction process is one of the first important steps in the preparation of plant formulations. Some researchers have made considerable efforts to find efficient extraction methods in order to obtain high efficiency and efficacy of course.[9] The choice of the right solvent is very important because if the choice of solvent is not suitable, the results obtained are little or not obtained at all because the solvent is not appropriate.[10]

Disc diffusion method is more widely used by some researchers because this method is quite accurate, economical, very easy to do and there are some researchers who advocate its use in routine clinical testing.[11] In addition, other researchers have also succeeded in using the Disc diffusion method to test the susceptibility of Candida species to azole antifungal agents and various types of fungi such as Fusarium, Scedosporium, and other dematiaceous fungi.[12]

CONCLUSION

Natural resources are still considered as potential candidates for drug discovery and play an important role in drug development programs. Various parts of the noni fruit in the stem, leaves, fruit and noni seeds show antibacterial activity. Some researchers believe that the presence of bioactive chemicals is primarily responsible for this antibacterial action. Further work is needed to isolate this active agent which can be used as a good source of antibiotics.

REFERENCE

[1] Ventola CL. 2015. The Antibiotic Resistance Crisis Part 1: Causes and Threats. *Pharmacy and Therapeutics*. **40(4)**:277-283.

[2] Palombo EA. 2011. Traditional Medicinal Plant Extracts and Natural Products With Activity Against Oral Bacteria: Potential Application In The Prevention And Treatment of Oral Diseases. *Evidence-based Complementary and Alternative Medicine*. **11**: 680354.

[3] Bone, K., and Mills, S. 2013. *Principles and Practice of Phytotherapy* Second Edition. Churchill Livingstone Elsevier, New York.

[4] Natheer, S.E., C. Sekar, P. Amutharaj, M. Syed Abdul Rahman, and K. Feroz Khan. 2012. Evaluation of antibacterial activity of *Morinda citrifolia, Vitex trifolia*, and *Chromolaena odorata. African*

*Journal of Pharmacy and Pharmacology***. 6(11)**: 783-788.

[5] Nayak, B.K., V. Suchitra, Anima Nanda. 2015. Antibacterial Potency of Hydro-Alcohol Leaf Extract of *Morinda Citrifolia* L. (Noni) by Soxhlet Extraction Method. *Der Pharmacia Lettre*, **7 (4)**:51-54.

[6] Sunder, J., D.R.Singh, S.Jeyakumar, A.Kundu, Arun Kumar De. 2011. Antibacterial Activity in Solvent Extract of Different Parts of *Morinda citrifolia* Plant. *Journal of Pharmaceutical Sciences and Research.* **3(8)**: 1404-1407.

[7] Jayaraman, S.K., Muthu S.M., Seethalakshmi, I. 2008. Antibacterial, Antifungal and Tumor cell suppression potential of *Morinda citrifolia* fruit extracts. *International Journal of Integrative Biology*. **3(1)**: 44-49.

[8] Devi, C.H.K and Gopala, K.D. 2013. Phytochemical Screening, Antibacterial, Antifungal and Anthelmintic Activity of *Morinda citrifolia* Stem. *Journal of Pharmacognosy and Phytochemistry.* **2(1)**: 115-117.

[9] Gupta A, Naraniwal M., Kothari V. 2012. Modern Extraction Methods for Preparation of Bioactive Plant Extracts. *International Journal of Applied and Natural Sciences*. **1(1)**: 8-26.

[10] Mujipradhana, V.N., Defny S. Wewengkang and Edi Suryanto. 2018. Aktivitas Antimikroba Dari Ekstrak Ascidian *Herdmania momus* Pada Mikroba Patogen Manusia. *Pharmacon Jurnal Ilmiah Farmasi*. **7(3)**: 2302 - 2493.

[11] Nweze, E.I., P. K. Mukherjee, M. A. Ghannoum. 2010. Agar-Based Disk Diffusion Assay for Susceptibility Testing of Dermatophytes. *Journal of Clinical Microbiology.* **48(10)**: 3750–3752.

[12] Bagul, U.S and Sivagurunathan M. Sivakumar. 2016. Antibiotic Susceptibility Testing: A Review of Current Practices. *International Journal of Pharmacy.* **6(3)**: 11-17.