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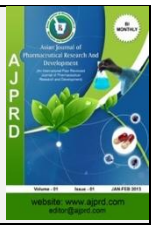

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Review Article

Antimicrobial Activity of *Morinda Citrifolia L.*

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ABSTRACT

Objectives: The aim of this research was to provide knowledge that *Morinda citrifolia L.*was not only fruit and the leaves can be used as an antimicrobial. Parts of *Morinda citrifolia L.*(Noni) such as seeds were proven to be able to inhibit microbial growth. Antimicrobial was substances that inhibit growth or kill other microorganisms such as bacteria, viruses, fungi, protozoa and rickets.

Data Sources Study Selection: The main references used in this review article through trusted sites such as Pubmed, Pubcem, Science Direct, NCBI, Research Gate, Google Scholar, and other published and trustworthy journals.

Conclusion: Noni plant (*Morinda citrifolia* L.) was a medicinal plant that has antimicrobial properties because it contained secondary metabolites of flavonoid and phenol. The fruit and leaves were part of noni plant which has the highest potential for antimicrobial activity. The use of antimicrobial is one way of dealing with infectious diseases. So, the noni plant could be developed as an alternative of herbal product in overcoming the problem of antibiotic resistance.

Keywords: *Morinda citrifolia L.*, Antimicrobial, Inhibition zone

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INTRODUCTION

Morinda citrifolia L. (Noni) is a plant that can be used as a medicinal ingredient. Noni plants contain antibacterial compounds, namely anthraquinon, alkaloid, flavonoid, acubin and alizarin which can against pathogenic microorganisms. *Morinda Citrifolia*L. is a medicinal plant that has antioxidant and antimicrobial bioactive compounds[1].

The parts of noni plant that are often used for treatment are the leaves, fruit, and seeds showing that there is activity of antimicrobial compounds. Traditionally, Noni leaves are known as stomachache medicine, antidiabetic, antihypertensive, and nourish the body after give a birth[2]. The fruit is effective in removing moisture in the body, strengthens bones, and cleanses the blood and is used to treat cough, intestinal worm, dysentery, intestinal inflammation, inflammation of the tonsil, swollen lymph, liver, thrush, diabetes mellitus, high blood pressure, dandruff and constipation[3].

METHODS

In preparing this research, the technique used is to use literature study by searching for sources or literature in the form of primary data or in the form of official books and international journals in the last 10 years (2010 - 2020). In addition, in making this research, data search was also carried out using online media with the keywords *Morinda citrifolia* L., Antimicrobial. The main references used in this review article through trusted sites such as Pubmed, Pubcem, ScienceDirect, NCBI, Research Gate, Google Scholar, and other published and trustworthy journals.

RESULTS AND DISCUSSION

A. Botanical

Noni (Morinda citrifolia L.) plant in the systematics (taxonomy) of plants is classified as follows[4].

Kingdom : Plantae
Sub kingdom : Tracheophyta
Superdivision : Spermatophyta

Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Asteridae
Ordo : Rubiales
Family : Rubiaceae
Genus : *Morinda*
Species : *Morinda citrifolia L.*

Figure 1. *Morinda citrifolia* L. (Noni)[4]

Noni (*Morinda citrifolia* L.) is a tropical plant, included in the *Rubiaceae* family. In Indonesia, noni grows in almost all regions, is planted in house yard or grows wild in garden and in the forest. Plants start producing about eight months from planting and continue to produce until 20 years[4].

Figure 2. Noni leaves

Noni has a single leaf, flat edge, pinnate, 10-40 cm length, 5-17 cm wide and dark green. Wavy leaf edges, sharp leaf tips, peg-shaped leaf base, shiny green leaf color and hairless[4].

Figure 3. Noni fruit

Fruit with an oval and round shape, 5-10 cm length, in the form of compound buni fruit that gather as a large fruit. The surface of fruit is lumpy, hard green, soft flesh and watery when ripe, pale yellow or dirty yellow, rotten therapist, contains many blackish brown seeds. The ripe noni is whitish yellow[4].

Figure 4. Noni seeds

Noni seeds are blackish brown, have a hard albumen and visible air space. Noni seeds have a high germination power, although stored within six months. Germination occurs after 35 days of sowing seeds[2].

ANTIMICROBIAL ACTIVITY OF (*Morinda citrifolia L.)*

Antibacterial activity of noni leaves (*Morinda citrifolia L.*)

Ethanol extract 96% of noni leaf has antimicrobial activity against the fungus *Colletotrichum acutatum* by diffusion method. The diameter of the inhibition zone obtained at a concentration of 20%, 40% and 60% was 8.125 cm, 7.578 cm and 5.075 cm. *Colletotrichum acutatum* is an important plant pathogen such as chili, orange, mango, strawberry and avocado. The optimum concentration of ethanol extract of noni leaf in inhibiting the growth of *Colletotrichum acutatum* fungus was 60% at 5.075 cm. The concentration of 60% of noni leaf ethanol extract in inhibiting the growth of the fungus *Colletotrichum acutatum* has the highest percentage 39%. The secondary metabolites of noni leaves are phenol, flavonoid, tannin which could inhibit microbial growth[6].

Ethanol extract 96% of noni leaf has antimicrobial activity against *Salmonella typhimurium* bacteria by diffusion method. The inhibition zone diameter obtained at concentrations of 2.5%, 5%, 7.5%, 10% were 2.4 mm, 5.4 mm and 15.4 mm which could inhibit the growth of *Salmonella typhimurium* bacteria. At a concentration of 7.5%, there was no inhibition zone against bacteria and the highest zone of inhibition was found at a concentration of 10% at 15.4 mm. Noni leaves qualitatively contain active phenolic compound, flavonoid, tannin, saponin, steroid, and triterpenoid[7].

Ethanol extract 96% of noni leaf has antibacterial activity against the bacteria *Bacillus subtillis, Pseudomonas aeruginosa, Staphylococcus aureus, Proteus vulgaris, Escherichia coli,* and *Serratia marcescens* using the diffusion method with a concentration of 5 µL, 10 µL, 20 µL. Among these bacteria, the largest antibacterial activity

of noni leaf ethanol extract was found in *Staphylococcus aureus* bacteria with inhibition zone diameters of 12 mm, 10 mm, and 11 mm[8].

Ethanol extract 96% of noni leafhas antimicrobial activity against *Fusarium oxysporum* fungus by diffusion method. The diameter of the inhibition zone obtained at a concentration of 20%, 40%, 60%, 80% was 6.32 ± 0.67, 5.42 ± 0.15, 5.12 ± 0.26 and 4.72 ± 0.15. The highest zone of inhibition was obtained at a concentration of 20% of 6.32 ± 0.67. Noni leaves contained secondary metabolite compound, namely anthraquinone, alkaloid, flavonoid and terpenoid. Anthraquinone is one of the active compounds that could contribute to inhibiting fungal growth[9].

Ethanol extract 96% of noni leafhas antimicrobial activity against *Salmonella sp* and *Escherichia coli* bacteria by diffusion method. The diameter of the inhibition zone obtained at concentrations of 25%, 50%, 75% were 6.2 mm, 7.1 mm, and 6.6 mm against *Salmonella sp* bacteria. In *Escherichia coli* bacteria resulting in an inhibition zone of 7.3 mm, 7, 2 mm, 7.5 mm. The largest inhibition zone for *Salmonella sp* bacteria was found at a concentration of 50% of 7.1 mm and the largest inhibition zone of *Escherichia coli* was found at a concentration of 75% of 7.5 mm. From these result, it was found that noni leaf extract had a weak inhibitory against the growth of *Salmonella sp*. bacteria and *Echerichia coli*[10].

Ethanol extract 96% of noni leafhas antimicrobial activity against *Staphylococcus aureus* bacteria by diffusion method. The inhibition zone diameters obtained at concentrations of 25%, 50% and 75% were 6.35 mm, 6.73 mm, and 6.86 mm. The largest zone of inhibition was found at a concentration of 75% of 6.86 mm. From these result, it was found that the noni leaf extract had a weak inhibitory against the growth of *Staphylococcus aureus* bacteria[11].

Ethanol extract 96% of noni leaf has antimicrobial activity by diffusion method. The inhibition zone diameter was obtained at a concentration of 25 mg/ml against *Escherichia coli* (7 mm), *Staphylococcus aureus* (8 mm), *Klebsieella pneumonia* (6 mm), *Shigella flexneri* (8 mm) and *Proteus mirabilis* (6 mm). Based on the inhibition zone value obtained, it could be seen that the test microbes that have activity on the ethanol extract of noni leaves (*Morindacitrifolia* L.) were *Staphylococcus aureus* and *Shigella flexneri*, while *Escherichia coli*, *Klebsieella pneumonia* and *Proteus mirabilis* were bacteria that have low sensitivity to extract ethanol of noni leaves[12].

Ethanol extract 96% of noni leaf has antimicrobial activity by diffusion method. The diameter of the inhibition zone obtained at a concentration of 2%, 5%, 10% against *Escherichia coli* bacteria was 8 mm, 9 mm and 20 mm. *Staphylococcus aureus* has an inhibition zone of 8 mm and 9 mm. *Candida albicans* has an inhibition zone of 9 mm and 11 mm. *Aspergillus niger* has an inhibition zone of 8 mm, 9 mm and 14 mm. It can be concluded that the activity of noni leaf ethanol extract was very good with 10% concentration resulting in an inhibition zone of 20 mm found in*Escherichia coli* bacteria[13].

Ethanol extract 96% of noni leafhas antimicrobial activity by diffusion method. The inhibition zone diameter obtained at concentration of 40%, 50% and 60% against *Staphylococcus epidermidis* bacteria were 3.1 mm, 3.5 mm and 2.5 mm. This showed that the activity of 96% ethanol extract in noni leaves has the greatest activity found in *Staphylococcus epidermidis* bacteria with 40% concentration and inhibition zone 3.5 mm[14].

The methanol extract of noni leaves has antimicrobial activity by diffusion method. The inhibition zone diameter obtained at a concentration of 20 µg against *Candida albicans*, *Aspergilusniger* and *D.flafida* fungi showed that the largest inhibition zone diameter was found in *Candida albicans*, the inhibition zone diameter obtained was 18.0 mm, in *Aspergilusniger* 17.0 mm and *D.flafida* microbe have an inhibition zone of 12.0 mm[15].

Antibacterial activity of noni fruit (*Morinda citrifolia* L.)

Ethanol extract 96% of noni fruit has antimicrobial activity by diffusion method. The diameter of inhibition zone obtained at a concentration of 5% (7.87 mm), 10% (7.75 mm), 15% (8.81 mm), 20% (9.62 mm), 25% (9 mm), 30 % (10.44 mm), 35% (10.88 mm), 40% (12 mm), 45% (8.37 mm) and 50% (12.13 mm) against *Staphylococcus aureus* bacteria. When the concentration of noni fruit extract was high, the diameter of the inhibition zone form was also high, except for some concentration (10%, 25%, and 45%) which showed a decrease in the diameter of inhibition zone. The secondary metabolite of noni fruit contains terpenoid, flavonoid and alkaloid[16].

Ethanol extract 96% of noni fruit has antimicrobial activity by diffusion method. Inhibition zone diameter was obtained at concentrations of 5 µg and 100 µg against *Bacillus subtilis* (10 mm and 15 mm), *Staphylococcus aureus* (22 mm and 10 mm), *Escherichia coli* (18 mm and 10 mm), *Pseudomonas aeruginosa* (21 mm and 11 mm) and *Klebsiella pneumonia* (16 mm and 12 mm). The antibacterial activity of noni fruit ethanol extract at a concentration 100 µg/ml was found to be more effective against *Klebsiella pneumonia* than other organisms tested[17].

The ethanol extract of noni fruit has antimicrobial activity by diffusion method. Inhibition zone diameter obtained at concentrations of 5 µg, 10 µg and 15 µg against *Staphylococcus aureus* bacteria (1 mm and 1 mm), *Pseudomonas putida* (1 mm, 2 mm and 2 mm), *Bacillus subtillis* (3 mm, 1 mm and 2 mm), *Escherichia coli* (1 mm, 2 mm, and 3 mm) and *Klebsiella pneumonia* (2 mm and 2 mm). From the result of inhibition zone, it was concluded that noni fruit at a concentration of 5 µg, 10 µg and 15 µg had a weak inhibition zone against these five bacteria[18].

Ethanol extract 96% of noni fruit has antimicrobial activity against *Enterococcus faecalis* bacteria by diffusion method. The diameter of the inhibition zone obtained at a concentration of 6.25% (0.421 ± 0.18), a concentration of 12.5% (0.385 ± 0.09), a concentration of 25% (0.359 ± 0.15), a concentration of 50% (0.175 ± 0.14) and at a concentration of 100% (0.106±0.11). The greatest antimicrobial activity was found at a concentration of 6.25% with an inhibition zone of 0.421 ± 0.18[19].

Ethanol extract 96% of noni fruit has antimicrobial activity by diffusion method. The inhibition zone diameter obtained at a concentration of 25 mg/ml against *Escherichia coli* (6

mm), *Staphylococcus aureus* (8 mm), *Klebsieella pneumonia* did not produce an inhibitory zone, *Shigella flexneri* (9 mm) and *Proteus mirabilis* (6 mm). The largest zone of inhibition was found in *Shigella flexneri* bacteria with an inhibition zone of 9 mm[12].

The ethanol extract of noni fruit stated there is an antimicrobial activity against *Staphylococcus aureus* bacteria by diffusion method. In unripe fruit with a concentration of 10.08 µL (11.00 mm), raw fruit 10.10 µL (12.00 mm) and on ripe fruit 10.12 µL (12.16 mm). From these result, the largest inhibition zone in ripe noni fruit was 12.16 mm. Noni fruit contained phenol and flavonoid compound which could function as natural antibacterial with the highest phenol content obtained from ripe noni fruit[20].

Antibacterial activity of noni seeds (Morinda *citrifolia* L.)

Ethanol extract 96% of noni seed stated that there was antimicrobial activity against *E. coli* and *Staphylococcus aureus* by diffusion method. Inhibitory diameter obtained at concentrations of 0.5%, 1.0% and 1.5% against E. coli (0.42 mm, 1.27 mm and 2.15 mm) and Staphylococcus aureus bacteria (0.8 mm, 1.03 mm and 5.97 mm). From these result, the largest inhibition zone was obtained at a concentration of 1.5% at 5.97 was *Staphylococcus aureus*. Noni seeds contain active compounds, namely alkaloid, tannin, saponin and heart glycoside. The area of inhibition of antibacterial activity in ethanol extract was greater in *E. coli* bacteria than *Staphylococcus aureus* bacteria[21].

A. Inhibitory diameter of noni plant *(Morinda citrifolia* L.*)*

No.	Part of plant	Extract	Antimicrobial	Method	Concentration	Zone of inhibition (mm)	Ref
1.	Leaf	Ethanol	*Colletotrichum acutatum*	Diffusion	20% 40% 60%	8,125 7,578 5,075	6
		Ethanol	*Salmonella typhimurium*	Diffusion	2,5% 5% 7,5% 10%	2,4 5,4 - 15,4	7
		Ethanol	*Bacillus subtillis* *Pseudomonas aeruginosa* *Staphylococcus aureus* *Proteus vulgaris* *Escherichia coli* *Serratia marcescens*	Diffusion	5µL 10 µL 20 µL 5µL 10 µL 20 µL 5µL 10 µL 20 µL 5µL 10 µL 20 µL 5µL 10 µL 20 µL	7 11 10 11 11 11 12 10 11 - 6 6 6 7 7 7 8 8	8
		Ethanol	*Fusarium oxysporum*	Diffusion	20% 40% 60% 80%	6,32 ± 0,67 5,42 ± 0,15 5,12 ± 0,26 4,72 ± 0,15	9

		Ethanol	*Salmonella sp* *Escherichia coli*	Kirby-Bauer	25% 50% 75% 25% 50% 75%	6,2 7,1 6,6 7,3 7,2 7,5	[10]
		Ethanol	*Staphylococcus aureus*	Kirby-Bauer	25% 50% 75%	6,35 6,73 6,68	[11]
		Ethanol	*Escherichia coli* *Staphylococcus aureus* *Klebsieella pneumonia* *Streptococcus sp.* *Shigella flexneri* *Proteus mirabilis*	Diffusion	25 mg / ml	7 8 6 - 8 6	[12]
		Ethanol	*Escherichia coli* *Staphylococcus aureus* *Candida albicans* *Aspergillus niger*	Diffusion	2% 5% 10% 2% 5% 10% 2% 5% 10% 2% 5% 10%	8 9 11 - 8 9 - 9 11 8 9 14	[13]
		Ethanol	*Staphylococcus epidermidis*	Diffusion	40% 50% 60%	2,6 3,1 3,5	[14]
		Methanol	*Aspergilusniger* *Candida albicans* *D.flafida*	Diffusion	20 µg	17,0 18.0 12,0	[15]

2.	Fruit	Ethanol	*Staphylococcus aureus*	Diffusion	5% 10% 15% 20% 25% 30% 35% 40% 45% 50%	7,87 7,75 8,81 9,62 9 10,44 10,88 12 8,37 12,13	[16]
		Ethanol	*Bacillus subtilis* *Staphylococcus aureus* *Escherichia coli* *Pseudomonas aeruginosa* *Klebsiella pneumonia*	Diffusion	5 µg 100 µg 5 µg 100 µg 5 µg 100 µg 5 µg 100 µg 5 µg 100 µg	10 15 22 10 18 10 21 11 16 12	[17]
		Ethanol	*Staphylococcus aureus* *Pseudomonas putida* *Bacillus subtillis* *Escherichia coli* *Klebsiella pneumoniae*	Diffusion	5 µL 10 µL 15 µL 5 µL 10 µL 15 µL 5 µL 10 µL 15 µL 5 µL 10 µL 15 µL 5 µL 10 µL 15 µL	- 1 1 1 2 2 3 1 2 1 2 3 2 - 2	[18]
		Ethanol	*Enterococcus faecalis*	Diffusion	6,25% 12,5% 25% 50% 100%	0,421±0,18 0,385 ±0,09 0,359 ±0,15 0,175 ±0,14 0,106 ±0,11	[19]
		Ethanol	*Escherichia coli* *Staphylococcus aureus*	Diffusion	25 mg / ml	6	[12]

			Klebsieella pneumonia *Streptococcus sp.* *Shigella flexneri* *Proteus mirabilis*			8 - 8 9 6	
		Ethanol	*Staphylococcus aureus*	Diffusion	10,08 µL 10,10 µL 10,12 µL	11,00 12,00 12,16	20
3.	Seed	Ethanol	*E. coli* *S. aureus*	Diffusion	0,5% 1,0% 1,5% 0,5% 1,0% 1,5%	0,42 1,27 2,15 0,8 1,03 5,97	21

CONCLUSION

Noni plant (*Morinda citrifolia* L.) was a medicinal plant that has antimicrobial properties because it contained secondary metabolites of flavonoid and phenol. The fruit and leaves were part of noni plant which has the highest potential for antimicrobial activity. The use of antimicrobial is one way of dealing with infectious diseases. So, the noni plant could be developed as an alternative of herbal product in overcoming the problem of antibiotic resistance.

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