Antibacterial Activity of Plant Family *Lamiaceae*: A Review

HelinTelaumbanua¹, Anzharni Fajrina¹, Dwi DinniAulia Bakhtra^{1*}

¹(Department of Pharmacy Biology, School 0f Pharmaceutical science(STIFARM) Padang West Sumatra, Indonesia, 25147

Abstract:

Background: Lamiaceae family is a plant from the mint tribe so that it has a distinctive odor for each species and is widely used as a source of perfumes, essential oils, spices, and cooking spices. Plants from the Lamiaceae family contain flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins that act as antibacterial. This review article was written to study the antibacterial activity of plants from the Lamiaceae family.

Materials and Methods: Generally, the extract that is most widely used in plants is the leaf part, although a small portion uses stems and roots.

Results: Several tests of extracts and essential oils from these plants have been carried out against grampositive and gram-negative bacteria

Conclusion:The results of the analysis showed that 13 types of plants from the family Lamiaceae has antibacterial activity, namely Anisomeles malabarica, Coleus aromaticus, Coleus blumei, Coleus atropurpureus Benth, Hyptis suaveolens, Leucas aspera, Mentha arvensis Linn, Ocimum bascilicum, Ocimum gratissimum, Ocimum sanctum, Ocimum obovaflorum, Ocimum tenuiflorum, and Pogostemon cablin. The strength of the antibacterial activity of each plant part depends on the solvent used, concentration, and levels of secondary metabolites contained therein

Key Word: Antibacterial, Extract, Lamiaceae, Essential oil.

Date of Submission: 12-11-2022

Date of Acceptance: 28-11-2022

I. Introduction

Biodiversity in Indonesia is used as an alternative medicine from various plants that spread throughout Indonesia. Various floras in Indonesia are used as a source of food, building materials, medicines, and so on. Quite a lot of flora in Indonesia is used as medicine because of the compounds contained in the tissue.¹

One of the plants that are efficacious as a medicinal plant is the *Lamiaceae* family. Various chemical compounds contained in species in the *Lamiaceae* family are flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins which are useful for treating various diseases so that they can be used as medicinal ingredients. Generally, the Lamiaceae contains pain-relieving, diuretic, tonic, anti-fungal, anti-microbial, anti-inflammatory, and anti-infection properties. Extracts from plants have the potential to be further analyzed so as to produce products that have the potential to be used as drugs. Based on the results of the review, the compounds contained in plant extracts have the potential as antioxidants, anti-inflammatory, and others.²

Plant species of the *Lamiaceae* family are plants that are found in the surrounding environment. These plants are generally herbs and shrubs, most of which are ground cover. The stems and branches are rectangular, and the leaves are opposite or crossed opposite each other, with no supporting leaves. Compound flowers and petals do not fall, numbered 4-5, and the flower crown is attached in the shape of a lip. The *Lamiaceae* family is a plant from the mint tribe that has a distinctive odor for each species. This plant is also used as a source of fragrances, essential oils, spices, and cooking spices.¹³⁴

These types of plants from the *Lamiaceae* are rich in phytochemical compounds and secondary metabolites. Besides being used as a medicinal plant, this plant of the *Lamiaceae* also has various kinds of biological activity plants⁵⁶

The Lamiaceae plant is one of the families of the class Magnoliopsida. The *Lamiaceae* family consists of 600 species of plants with 240 genera. The following is the scientific classification of *Lamiaceae*:⁷

Kingdom	:	Plantae
Super division	:	Spermatophyta
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Sub class	:	Asteridae
Order	:	Lamiales
Familys	:	Lamiaceae

Based on this, the authors are interested in conducting a review study of antibacterial activity studies on plant extracts and fractions of the Lamiaceae family. The method used in this review is a literature study. It is hoped that in the future this review can be used as a reference for further researchers for the development of the Lamiaceae family plant by conducting an analysis of the content and risk factors as well as its prospects in the pharmaceutical world.

II. Methods

The method that the authors used in this review is a literature study both domestically and internationally. The literature search was carried out in a structured manner to obtain the most current and relevant discussion for the purpose of the review. The literature is taken from various online journal search sites such as digital libraries, Science Direct, NCBI, Researchgate, and Google Scholar for research that have been published from 2011 - 2021. The keywords used in the search were as follows: Lamiaceae, antibacterial. The selection of a number of articles includes the results of the review (title, abstract, and full text) according to the inclusion criteria covering the antibacterial activity of plants of the *Lamiaceae* family. Then the journals obtained were processed and discussed using the narrative method.

III. Resultand Discution Table 3.1. Antibacterial Activity of Plants of the Laminaceae Family

N o	Plant	Pa rt Pla nt	Ingredi ent test	Method	Test Bacteria	Concentration	Obsta cles zone (mm)	refere nce
1	Anisomelesmala barica	Leaf	Methan ol Extract	Agar DiscDiffusion	Salmonella typhi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	$ \begin{array}{c} 10 \pm 0,3 \\ 10 \pm 0,3 \\ 7 \pm 0,1 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	
					Salmonella paratyphi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0.9 8 ± 0.9 7 ± 0.1	[8]
					Pseudomonas vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	9 ± 0.7 9 ± 0.7 7 ± 0.1 7 ± 0.1	
					Streptococcusaureus.	50 mg/ml	8 ± 0.9	
					Staphylococcus awreus	25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	$7 \pm 0,17 \pm 0,17 \pm 0,17 \pm 0,17 \pm 0,17 \pm 0,1$	
					aureus Klebsiella vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	$\begin{array}{c} 8 \pm 0.7 \\ 7 \pm 0.1 \end{array}$	
						50 mg/ml	$8 \pm 0,5$	

Antibacterial Activity of Plant Family Lamiaceae: A Review

		1	1					
1						25 mg/ml	$7 \pm 0,1$	
						12,5 mg/ml	$7 \pm 0,1$	
						6,25 mg/ml	$7 \pm 0,1$	
						3,125 mg/ml	$7 \pm 0,1$	
2		Leaf		Agar				
_	Coleus		Methan	DiscDiffusion	Salmonella typhi	50 mg/ml	$7 \pm 0,1$	
	aromaticus		ol	Discolyjusion	Samonena iypin	25 mg/ml	, _ 0,1	
	aromaneus		Extract			12,5 mg/ml	_	
			Extract			6,25 mg/ml	-	
						3,125 mg/ml	_	[8]
						5,125 mg/m	-	[0]
					Streptococcusaureus.	50 mg/ml	10 ± 0.3	
					streptococcusaureus.			
						25 mg/ml	$9 \pm 0,7 \\ 8 \pm 0,9$	
						12,5 mg/ml		
						6,25 mg/ml	$7 \pm 0,1$	
					C (3,125 mg/ml	$7 \pm 0,1$	
					Staphylococcus	50 / 1	15 0.4	
					Aureus	50 mg/ml	15 ± 0.4	
						25 mg/ml	12 ± 0.1	
						12,5 mg/ml	$11 \pm 0,1$	
						6,25 mg/ml	8 ± 0.7	
1						3,125 mg/ml	$7 \pm 0,1$	
1					Klebsiella vulgaris			
1						50 mg/ml	$7 \pm 0,1$	
						25 mg/ml	$7 \pm 0,1$	
						12,5 mg/ml	$7 \pm 0,1$	
						6,25 mg/ml	$7 \pm 0,1$	
						3,125 mg/ml	-	
3	Coleus blumei			Disc				
		Leaf	Methan	DiffusionMeth	Staphylococcus	100 mg/ml	$14,56 \pm$	[9]
			ol	od	aureus		0,444	
			Extract					
					Streptococcus mitis			
					_	100mg/ml	13 ±	
						-	0,726	
4	Coleus	Leaf	Ethanol	Well method				
	atropurpureu		Extract		Streptococcus Sp	20%	2	
	sBenth				· ·	40%	3,17	
						60%	8,67	
						80%	11,17	
						100%	12,8	
								[10]
					Pseudomonas Sp.	20%	5,17	
					I I I I I I I I I I I I I I I I I I I	40%	7,17	
						60%	9,5	
						80%	10,67	
						100%	12,17	
			1	1			, ,	
1 1						10070		
						100/0		
				agar difussion				
		Leaf	Ethanol	agar difussion with modification	Staphylococcus		8.17	
		Leaf	Ethanol Extract	agar difussion with modification	Staphylococcus aureus	5%	8,17 9,83	
		Leaf				5% 10%	9,83	
		Leaf				5% 10% 20%	9,83 10,67	
		Leaf				5% 10% 20% 40%	9,83 10,67 11,17	[]1]
		Leaf				5% 10% 20%	9,83 10,67	[11]
		Leaf			aureus	5% 10% 20% 40% 80%	9,83 10,67 11,17 12,33	[11]
		Leaf				5% 10% 20% 40% 80% 5%	9,83 10,67 11,17 12,33 9,17	[11]
		Leaf			aureus	5% 10% 20% 40% 80% 5% 10%	9,83 10,67 11,17 12,33 9,17 10,33	[11]
		Leaf			aureus	5% 10% 20% 40% 80% 5% 10% 20%	9,83 10,67 11,17 12,33 9,17 10,33 11,17	[11]
		Leaf			aureus	5% 10% 20% 40% 80% 5% 10% 20% 40%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50	[11]
		Leaf			aureus	5% 10% 20% 40% 80% 5% 10% 20%	9,83 10,67 11,17 12,33 9,17 10,33 11,17	[11]
		Leaf			aureus Escherichia coli	5% 10% 20% 40% 80% 5% 10% 20% 40% 80%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17	[11]
		Leaf			aureus Escherichia coli Pseudomonas	5% 10% 20% 40% 80% 5% 10% 20% 40% 80% 5%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00	[11]
		Leaf			aureus Escherichia coli	5% 10% 20% 40% 80% 5% 10% 20% 40% 80% 5% 10%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00 8,00	[11]
		Leaf			aureus Escherichia coli Pseudomonas	5% 10% 20% 40% 80% 5% 10% 20% 40% 80% 5% 10% 20%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00 8,00 9,33	[11]
		Leaf			aureus Escherichia coli Pseudomonas	5% 10% 20% 40% 80% 5% 10% 20% 40% 5% 10% 20% 40%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00 8,00 9,33 11,00	[11]
		Leaf			aureus Escherichia coli Pseudomonas	5% 10% 20% 40% 80% 5% 10% 20% 40% 80% 5% 10% 20%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00 8,00 9,33	[11]
		Leaf			aureus Escherichia coli Pseudomonas	5% 10% 20% 40% 80% 5% 10% 20% 40% 5% 10% 20% 40%	9,83 10,67 11,17 12,33 9,17 10,33 11,17 12,50 14,17 6,00 8,00 9,33 11,00	[11]

Agar DiscDiffusion 50 mg/ml 5 Hyptissuaveolen Leaf Methan Salmonella typhi $8 \pm 0,1$ ol 25 mg/ml 7 ± 0.1 S Extract 12,5 mg/ml $7 \pm 0,1$ 6,25 mg/ml $7\pm0,\!1$ 3,125 mg/ml $7\pm0,1$ 50 mg/ml $11 \pm 0,6$ Salmonella paratyphi 25 mg/ml $9 \pm 0,7$ [8] 12,5 mg/ml 6,25 mg/ml 8 ± 0,9 $7\pm0,\!1$ 3,125 mg/ml $7\pm0,1$ Streptococcusaureus. 9 ± 0,7 50 mg/ml 25 mg/ml $8 \pm 0,9$ 12,5 mg/ml 6,25 mg/ml -3,125 mg/ml _ Staphylococcusaureu 50 mg/ml $7\pm0,1$ 25 mg/ml 12,5 mg/ml $7 \pm 0,1$ $7\pm0,1$ 6,25 mg/ml $7\pm0,\!1$ Klebsiella vulgaris 3,125 mg/ml 50 mg/ml $7\pm0,1$ 25 mg/ml $7\pm0,1$ $7\pm0,1$ 12,5 mg/ml 6,25 mg/ml -3,125 mg/ml _ Methan DiskDiffusion Root 6 Leucas ol Technique Escherichia coli 100 mg/ml $9,0 \pm 0,5$ aspera Extract 100 mg/ml 10,0 ± [12] Streptococcusaureus0,6 Salmonella 100 mg/ml 11,0 \pm Choleraesuis 0,5 Salmonella 100mg/ml typhimurium $11,0 \pm$ ShigellaFlexneri 0,6 100mg/ml Pseudomonas $11,0 \pm$ 100 mg/ml 0,5 aeruginosa 11,0 \pm 0,6 Methan disk diffusion 100 mg/ml $7,0 \pm 0,4$ Stem Streptococcusaureus technique ol Extract Salmonella 100 mg/ml $7{,}0\pm0{,}6$ [12] Choleraesuis Shigella*Flexneri* 100 mg/ml $7,0 \pm 0,7$ Pseudomonas.Aerug 100 mg/ml $7,0 \pm 0,6$ inosa

		Flow er	Methan ol Extract	disk diffusion technique	Escherichia coli	100 mg/ml	7,0 ± 0,7	
		CI	Extract		Streptococcusaureus	100 mg/ml	$7,0\pm0,6$	[12]
					Salmonella Choleraesuis	100 mg/ml	$8,0 \pm 0,5$	
					Salmonella typhimurium	100 mg/ml	9,0 ± 0,6	
					Pseudomonas.Aerug inosa	100 mg/ml	$7,0\pm0,6$	
		Leaf	Methan ol	disk diffusion technique	Streptococcusaureus	100 mg/ml	7,0 ± 0,5	
			Extract		Salmonella Choleraesuis	100 mg/ml	$8,0 \pm 0,5$	[12]
					Salmonella typhimurium	100 mg/ml	$7,0 \pm 0,6$	
					ShigellaFlexneri	100 mg/ml	$7,0 \pm 0,5$	
				1.20				
		Leaf	Methan ol Extract	Agar diffusion	Salmonella typhi	50 mg/ml 25 mg/ml 12,5 mg/ml	$\begin{array}{c} 7 \pm 0, 1 \\ 7 \pm 0, 1 \\ 7 \pm 0, 1 \end{array}$	
						6,25 mg/ml 3,125 mg/ml	-	
					Salmonella paratyphi	50 mg/ml 25 mg/ml	$8 \pm 0,9 \\ 7 \pm 0,1$	[8]
					Staphylococcus	12,5 mg/ml 6,25 mg/ml 3,125 mg/ml		
					aureus	50 mg/ml 25 mg/ml 12,5 mg/ml	7 ± 0,1	
						6,25 mg/ml 3,125 mg/ml	-	
					Klebsiella vulgaris			
						50 mg/ml 25 mg/ml 12,5 mg/ml	8 ± 0.7 7 ± 0.1	
						6,25 mg/ml 3,125 mg/ml	-	
7	<i>Menthaarvensis</i> Linn	Leaf	Methan ol Extract	agar disc diffusion	Salmonella typhi	50 mg/ml 25 mg/ml 12,5 mg/ml	8 ± 0,9 7 ± 0,1	
			Laudet			6,25 mg/ml 3,125 mg/ml	-	
					Pseudomonas vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml	7 ± 1,0	[8]
						6,25 mg/ml 3,125 mg/ml	-	
					Streptococcusaureus.	50 mg/ml 25 mg/ml 12,5 mg/ml	$7 \pm 0,1 \\ 7 \pm 0,1 \\ -$	
						6,25 mg/ml	-	

Antibacterial Activity of Plant Family Lamiaceae: A Review

Antibacterial Activity of Plant Family Lamiaceae: A Review

9 Octmann gradisticum Leaf Auf Maha Auf Hole Supplyhoeccess corres 500 mg/ml 3,125 mg/ml 4,100 100 mg/ml 3,125 mg/ml 4,100 100 mg/ml 3,125 mg/ml 4,100 100 mg/ml 3,125 mg/ml 4,100 100 mg/ml 4,100 100 mg/ml 3,125 mg/ml 4,100 100 mg							2 125 mg/1		
Image: state in the s						Staphylococcus	3,125 mg/ml	-	
9 Ocimum gradisticum Leaf affinisticum Methan of affinisticum Methan affinisticum Methan affinisticum Saltonella paratypic affinisticum 250 mgrad 3,125 mgrad c,25 mgr							50 mg/ml	7 + 0.1	
9 Ocimum baselicum Leaf Leaf Leaf Leaf Leaf Leaf Leaf Leaf						cititi citis			
Image: Second									
Nome Nome <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>$7 \pm 0,1$</td><td></td></th<>								$7 \pm 0,1$	
8 Ocimum Description Assellicant Leaf Leaf Leaf Leaf Assellicant Methan of Leaf Leaf Leaf Leaf Leaf Leaf Leaf Lea							3,125 mg/ml	-	
9 Ocimum gratisinam Leaf Methan ol Extract agar disc diffusion Salunonella paratypia (5.5 mg/ml 2.5 mg/ml 3.125 mg/m						Klebsiella vulgaris			
8 Ocimum baccilicum Leaf ulpsion Methan ol Extract agar disc diffusion Salmonella paratyphi diffusion So mg/ml 25 mg/ml 25 mg/ml 9 = 0.1 25 mg/ml [8] 8 Ocimum baccilicum Leaf La Methan ol Extract agar disc diffusion Salmonella paratyphi 25 mg/ml So mg/ml 9 = 0.1 25 mg/ml [8] 12.5 mg/ml - Sampiol 25 mg/ml 7 = 0.1 25 mg/ml 7 = 0.1 25 mg/ml [8] 12.5 mg/ml - Staphylococcus aircis So mg/ml 8 = 0.1 12.5 mg/ml - 12.5 mg/ml - 12.5 mg/ml - 12.5 mg/ml - 12.5 mg/ml - 12.5 mg/ml - 12.5 mg/ml - 12.6 mg/ml 12.5 mg/ml - 12.5 mg/ml 12.5 mg/ml									
Image: Section of the sectio								$7 \pm 0,1$	
8 Ocimum bascilicum Leaf Methan ol Extract agar disc diffusion Salmonella paratyhi 25 mg/ml 50 mg/ml 9 + 0.1 25 mg/ml									
Ocimum bascilicum Leaf Methan ol Extract agar disc diffusion Salmonella paratyphi Peudomonas Sompini 25 mg/ml 3,125 mg/ml 9 = 0,1 - 0,635 mg/ml 9 = 0,1 - 0,325 mg/ml 9 = 0,1 - 0,31,35 mg/ml 9 = 0,1 - - 0,31,35 mg/ml 9 = 0,1 - 0,31,35 mg/ml 9 = 0,1 - 0,31,35 mg/ml 9 = 0,1 - - - - <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									
bascilicum Image: Starter in the second							3,125 mg/ml	-	
bascilicum Image: Starter in the second	0	Qaimum	Loof	Mathan	agar disa	Salmonalla naraturhi	50 mg/ml	0 ± 0.1	
9 Ocimum gratissimum Leaf Methan ol Extract Hole-Plate of the hole Escherichia colifrom the hole 12.5 mg/ml 3.125 mg/ml 2.5 mg/ml 3.125 mg/ml - [8] 9 Ocimum gratissimum Leaf Methan ol Extract Hole-Plate of the hole Escherichia colifrom the hol 200 mg/ml 3.125 mg/ml - [8] 9 Ocimum gratissimum Leaf Methan ol Extract Hole-Plate of the hole Escherichia colifrom the hol 200 mg/ml 3.125 mg/ml 14 100 mg/ml [13] 9 Ocimum gratissimum Leaf Methan ol Extract Hole-Plate of the hol Escherichia colifrom the hol 200 mg/ml 100 mg/ml 14 100 mg/ml [13] 9 Ocimum gratissimum Leaf Methan ol Extract Staphylococcus aureus -AICC 35391 200 mg/ml 16 100 mg/ml 13 13 9 Ocimum gratissimum Leaf Methan ol Extract Staphylococcus aureus -AICC 33591 200 mg/ml 7 10 100 mg/ml 16 100 mg/ml 13 125 mg/ml 16 125 mg/	0		Leai			Saimonena paraiypni		9 ± 0,1	
9 Ocimum gratissimum Leaf Methan olimits Hole-Plate agar disc diffusion Escherichia colifrom KFUPM Clinik Liss mg/ml 200 mg/ml 21 - 5.00 mg/ml 21 - 5.00 mg/ml 13.125 mg/ml - - 0.1 9 Ocimum gratissimum Leaf Methan oli Hole-Plate Diffusion Escherichia colifrom KFUPM Clinik Liss aureus 200 mg/ml 21 - 0.1 13.125 mg/ml - - 0.1 9 Ocimum gratissimum Leaf Methan oli Hole-Plate Diffusion Escherichia colifrom KFUPM Clinik Liss aureus - ATCC 33591 200 mg/ml 10 - 0.1 [13] 9 Ocimum gratissimum Leaf Methan oli agar disc Afficientic ATCC 33591 Salphylococcus aureus - ATCC 33591 200 mg/ml 16 - 150mg/ml 13 - 0.1 9 Ocimum gratissimum Leaf Methan oli agar disc Afficientic Afficientic ATCC 35921 Solong/ml 20 - 0.1 16 - 0.1 9 Solong/ml 16 - 0.1 10 - 0.1 16 - 0.1 10 - 0.1 16 - 0.1 10 - 0.1 9 Solong/ml 12 - 0.1 - 0.1 10 - 0.1 10 - 0.1 10 - 0.1 10 - 0.1 <td></td> <td>Duschieum</td> <td></td> <td></td> <td>ujjusion</td> <td></td> <td></td> <td>-</td> <td></td>		Duschieum			ujjusion			-	
9 Ocimum Leaf Methan agar disc diffusion Salar disc sugaris Salar signing				Linuer				-	
Image: Sector of the								-	
9 Ocimum Leaf Methan Agar disc Supplylococcus 50 mg/ml 7 ± 0.1 7 ± 0.1 12.5 mg/ml -									[8]
9 Ocimum Leaf Methan Object Staphylococcus aureus 200 mg/ml 7 ± 0.1 9 Ocimum Leaf Methan ol Hole-Plate Staphylococcus aureus 200 mg/ml 21 12.5 mg/ml - - - - - 100mg/ml 10 200 mg/ml 21 - 11.2.5 mg/ml - - - - 11.3 - - - - - 11.3 -						Pseudomonas			
9 Ocimum Leaf Methan Alge and set of the						vulgaris			
9 Ocimum gratissimum Leaf Methan ol Extract Alots Hole-Plate Diffusion Extract Escherichia colifrom KFUPM Clinik Method 200 mg/ml 12.5 mg/ml 6.25 mg/ml 12.5 mg/ml 3.125 mg/ml 21 1 Leaf Methan ol Extract Hole-Plate Diffusion Extract Escherichia colifrom KFUPM Clinik Method 200 mg/ml 21 1 150 mg/ml 14 100 mg/ml 16 133 1 00mg/ml 16 133 100 mg/ml 16 1 50 mg/ml 4 200 mg/ml 16 [13] 1 100mg/ml 10 50 mg/ml 16 [13] 1 100mg/ml 13 100 mg/ml 16 1 100 mg/ml 13 100 mg/ml 16 1 100 mg/ml 3 100 mg/ml 3 9 Ocimum gratissimum Leaf mgratissimum ol Extract Salmonella typhi Valgaris 50 mg/ml 7 ± 0.1 12.5 mg/ml - 9 Ocimum gratissimum								$7 \pm 0,1$	
9 Ocinum gratissimum Leaf Methan ol Extract Hole-Plate Hole-Plate biffusion Extract Staphylococcus aureus 3,125 mg/ml 20 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 3,125 mg/ml 8 ± 0,1 7 ± 0,1 6,25 mg/ml 4 200 mg/ml biffusion Extract Hole-Plate Diffusion Extract Escherichia colifrom Kinik 200 mg/ml 150mg/ml 21 14 100mg/ml 200 mg/ml biffusion Extract Hole-Plate Diffusion Extract Escherichia colifrom Kinik 200 mg/ml 1000mg/ml 16 150mg/ml [13] 9 Ocinum gratissimum Leaf Methan ol Extract agar disc diffusion C Staphylococcus aureus -ATCC 33591 200 mg/ml 200 mg/ml 16 150mg/ml [13] 9 Ocinum gratissimum Leaf agar disc diffusion C Staphylococcus aureus -ATCC 33591 50 mg/ml 7 ± 0,1 25 mg/ml [8] 9 Ocinum gratissimum Leaf Methan ol Extract agar disc diffusion C Stalmonella typhi C 50 mg/ml 25 mg/ml 7 ± 0,1 25 mg/ml [8] 9 Somg/ml - 20 mg/ml - 20 mg/ml <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>									
9 Ocimum gratissimum Leaf Methan ol Extract Age of the									
9 Ocimum gratissimum Leaf olim Methan bitsion Ager disc diffusion Salmonella typhi Salphylococcus aureus So mg/ml 25 mg/ml 3.125 mg/ml 7 ± 0,1 - - .25 mg/ml [13] 9 Ocimum gratissimum Leaf bitsion Methan bitsion Hole-Plate Diffusion Method Escherichia colifrom KFUPM Clinik 200 mg/ml 21 14 150mg/ml [13] 100mg/ml 10 50mg/ml 4 [13] [13] 100mg/ml 10 50mg/ml 16 [13] [13] 100mg/ml 10 50mg/ml 13 [100mg/ml 10 9 Ocimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 7 ± 0,1 [14] 9 Scimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 50 mg/ml 7 ± 0,1 100mg/ml 10 - 3,125 mg/ml - - 9 Solimonella typhi 10 - 3,125 mg/ml - 9 Solimonella typhi - - - -							3,125 mg/ml	-	
9 Ocimum gratissimum Leaf olim Methan bitsion Ager disc diffusion Salmonella typhi Salphylococcus aureus So mg/ml 25 mg/ml 3.125 mg/ml 7 ± 0,1 - - .25 mg/ml [13] 9 Ocimum gratissimum Leaf bitsion Methan bitsion Hole-Plate Diffusion Method Escherichia colifrom KFUPM Clinik 200 mg/ml 21 14 150mg/ml [13] 100mg/ml 10 50mg/ml 4 [13] [13] 100mg/ml 10 50mg/ml 16 [13] [13] 100mg/ml 10 50mg/ml 13 [100mg/ml 10 9 Ocimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 7 ± 0,1 [14] 9 Scimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 50 mg/ml 7 ± 0,1 100mg/ml 10 - 3,125 mg/ml - - 9 Solimonella typhi 10 - 3,125 mg/ml - 9 Solimonella typhi - - - -									
9 Ocimum gratissimum Leaf olim Methan bitsion Ager disc diffusion Salmonella typhi Salphylococcus aureus So mg/ml 25 mg/ml 3.125 mg/ml 7 ± 0,1 - - .25 mg/ml [13] 9 Ocimum gratissimum Leaf bitsion Methan bitsion Hole-Plate Diffusion Method Escherichia colifrom KFUPM Clinik 200 mg/ml 21 14 150mg/ml [13] 100mg/ml 10 50mg/ml 4 [13] [13] 100mg/ml 10 50mg/ml 16 [13] [13] 100mg/ml 10 50mg/ml 13 [100mg/ml 10 9 Ocimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 7 ± 0,1 [14] 9 Scimum gratissimum Leaf Methan ol agar disc Extract Salmonella typhi 50 mg/ml 7 ± 0,1 100mg/ml 10 - 3,125 mg/ml - - 9 Solimonella typhi 10 - 3,125 mg/ml - 9 Solimonella typhi - - - -						Stanhylococcus			
9 Ocimum gratissimum Leaf Methan ol Extract Allow Hole-Plate Diffusion Escherichia colifrom KFUPM Clinik 200 mg/ml 150mg/ml 21 150mg/ml 121 150mg/ml 14 100mg/ml 10 Extract Methan ol Extract Hole-Plate Diffusion Escherichia colifrom KFUPM Clinik 200 mg/ml 21 150mg/ml 14 100mg/ml 10 10 50mg/ml 16 13 [13] 10 Escherichia coli- ATCC 25922 200 mg/ml 16 150mg/ml [13] 9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salmonella typhi occus aureus -ATCC 33591 7 ± 0,1 20 mg/ml 7 ± 0,1 12 150mg/ml [8] 9 Ocimum gratissimum Leaf Methan ol Extract Salmonella typhi occus aureus -ATCC 33591 50 mg/ml 7 ± 0,1 125 mg/ml 7 ± 0,1 12,5 mg/ml [8]							50 mg/ml	8 ± 0.1	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$						uneus			
9 Ocimum gratissinum Leaf Leaf Methan ol Extract Hole-Plate Diffusion Method Excherichia colifrom KFUPM Clinik 200 mg/ml 150mg/ml 21 14 100mg/ml 14 100 10 50mg/ml 14 100 10 100 50mg/ml 16 130mg/ml [13] 9 Ocimum gratissinum Leaf Methan ol Hole-Plate Diffusion Excherichia colifrom KFUPM Clinik 200 mg/ml 16 150mg/ml [13] 9 Ocimum gratissinum Leaf Methan ol agar disc diffusion Salmonella typhi Salmonella typhi 50 mg/ml 7 ± 0.1 12,5 mg/ml 7 ± 0.1 7 ± 0.1 12,5 mg/ml 8 9 Nethan ol Extract Methan ol Agar disc diffusion Salmonella typhi 50 mg/ml 7 ± 0.1 12,5 mg/ml 1 1 100 mg/ml 9 12,5 mg/ml 7 ± 0.1 7 ± 0.1 1 1 1 1 1 1 1 1 1 1 1 1 1<									
9 Ocimum gratissimum Leaf Methan ol Extract Hole-Plate Diffusion Method Escherichia colifrom KFUPM Clinik 200 mg/ml 150mg/ml 21 14 100mg/ml 14 14 100mg/ml 16 13 100mg/ml [13] 9 Ocimum gratissimum Leaf Methan ol Extract Agar disc diffusion Salphylococcus aureus from KFUPM Klinik 200 mg/ml 14 100mg/ml 10 9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salphylococcus aureus -ATCC 33591 200 mg/ml 7 ± 0.1 100mg/ml 7 ± 0.1 125 mg/ml 7 ± 0.1 7 ± 0.1 125 mg/ml 7 ± 0.1 7 ± 0.1 9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salmonella typhi 20 mg/ml 7 ± 0.1 125 mg/ml 7 ± 0.1 7 ± 0.1 25 mg/ml 7 ± 0.1 7 ± 0.1								-	
9 Ocimum gratissimum Leaf ol Extract Methan ol Extract agar disc diffusion Salmonella typhi Salmonella typhi 200 mg/ml 150mg/ml 21 14 100mg/ml [13] 14 100mg/ml 9 Ocimum gratissimum Leaf Leaf Methan ol Extract agar disc Hole-Plate Diffusion Escherichia colifrom KFUPM Clinik 200 mg/ml 16 150mg/ml [13] 1000mg/ml 9 Somg/ml 16 150mg/ml [13] [13] 1000mg/ml 9 Somg/ml 4 [13] [13] 9 Ocimum gratissimum Leaf agar disc diffusion Salmonella typhi Salmonella typhi 50 mg/ml 7 ± 0,1 12,5 mg/ml 7 ± 0,1 7 ± 0,1 12,5 mg/ml [8] 9 Scimum gratissimum Leaf Methan ol Extract Agar disc diffusion Salmonella typhi Salmonella typhi 50 mg/ml 7 ± 0,1 12,5 mg/ml 7 ± 0,1 7 ± 0,1 12,5 mg/ml [8]								-	
9 Ocimum gratissimum Leaf l Methan l Agar disc l Salar disc l <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>									
9 Ocimum gratissimum Leaf l Methan l Agar disc l Salar disc l <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>									
9 Ocimum gratissimum Leaf Leaf Leaf Leaf Methad Leaf Aggar disc diffusion Staphylococcus aureus from KFUPM Klinik 100mg/ml 50mg/ml 100 4 9 Ocimum gratissimum Leaf Aggar disc diffusion aggar disc diffusion Staphylococcus aureus -ATCC 33591 200 mg/ml 150mg/ml 16 150mg/ml [13] 9 Ocimum gratissimum Leaf Methan ol Extract aggar disc diffusion Staphylococcus aureus -ATCC 33591 7 ± 0,1 200 mg/ml 7 ± 0,1 12 100mg/ml 7 ± 0,1 12,5 mg/ml 7 ± 0,1 7 ± 0,1 12,5 mg/ml [8] 9 Ocimum gratissimum Leaf Methan ol Extract Staphylococcus diffusion Staphylococcus aureus -ATCC 33591 7 ± 0,1 12,5 mg/ml 7 ± 0,1 12,5 mg/ml [8] 9 Ocimum gratissimum Leaf Methan ol Extract Klebsiella vulgaris 50 mg/ml - 12,5 mg/ml			Leaf						
9 Ocimum gratissimum Leaf bill Methan ol Extract agar disc diffusion Salmonella typhi of Klebsiella vulgaris 50 mg/ml 200 mg/ml 50 mg/ml 13 100mg/ml 9 7 ± 0.1 2.5 mg/ml 12 100mg/ml 9 7 ± 0.1 2.5 mg/ml 12 100mg/ml 9 [8]						KFUPM Clinik			
9 Ocimum gratissimum Leaf Leaf Leaf Leaf Methan ol Leaf agar disc diffusion Salmonella typhi Leaf Sol myml Leaf 16 150mg/ml Leaf 7 ± 0.1 200 mg/ml Leaf 7 ± 0.1 25 mg/ml Leaf [13] 9 Ocimum gratissimum Leaf Methan ol Extract agar disc Leaf Salmonella typhi Leaf Salmonella typhi Leaf 50 mg/ml Leaf 7 ± 0.1 25 mg/ml Leaf 7 ± 0.1 25 mg/ml Leaf [8] 9 Ocimum Gratissimum Leaf Methan ol Extract agar disc Leaf Salmonella typhi Leaf Solmonella typhi Leaf 50 mg/ml Leaf 7 ± 0.1 25 mg/ml Leaf [8] 9 Ocimum Gratissimum Leaf Methan ol Extract Agar disc Leaf Salmonella typhi Leaf Solmonella typhi Leaf 50 mg/ml Leaf 7 ± 0.1 25 mg/ml Leaf [8]				Extract	Method				
9 Ocimum gratissimum Leaf Leaf Leaf Leaf Leaf Leaf Leaf Leaf						C	50mg/ml	4	
9 Ocimum gratissimum Leaf Leaf Leaf agar disc diffusion Leaf Salmonella typhi ATCC 23922 50 mg/ml 200 mg/ml 200 mg/ml 13 100mg/ml 9 7 ± 0,1 25 mg/ml 9 9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salmonella typhi 25 mg/ml 20 7 ± 0,1 25 mg/ml 20 7 ± 0,1 25 mg/ml 20 7 ± 0,1 25 mg/ml 20 7 ± 0,1 25 mg/ml 20 8 9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salmonella typhi 25 mg/ml 25 mg/ml 20 mg/ml 25 mg/ml 1000mg/ml 25 mg/ml 20 mg/ml 25 mg/ml 20 mg/ml 25 mg/ml 20 mg/ml 1000mg/ml 20 mg/ml 20 mg/ml						Staphylococcus	200 mg/m^{1}	16	[12]
9 Ocimum gratissimum Leaf Lextract agar disc diffusion Salmonella typhi 200 mg/ml 20 150mg/ml 9 200 mg/ml 9 3 9 Ocimum gratissimum Leaf Lextract agar disc diffusion Salmonella typhi 50 mg/ml 7 ± 0.1 12.5 mg/ml 7 ± 0.1 25 mg/ml 7 ± 0.1 25 mg/ml 8 9 Ocimum gratissimum Leaf Lextract Methan ol Extract Salmonella typhi 50 mg/ml 7 ± 0.1 12.5 mg/ml 7 ± 0.1 7 ± 0.1 6.25 mg/ml 8 9 Ocimum gratissimum Leaf Lextract Methan ol Extract Salmonella typhi 50 mg/ml 7 ± 0.1 12.5 mg/ml 7 ± 0.1 7 ± 0.1 3.125 mg/ml 8 9 Ocimum gratissimum Leaf Lextract Methan ol Extract Salmonella typhi 50 mg/ml 7 ± 0.1 6.25 mg/ml 100 7 ± 0.1 25 mg/ml 7 ± 0.1 7 ± 0.1 25 mg/ml 100 7 ± 0.1 25 mg/ml 100 7 ± 0.1 25 mg/ml 100 7 ± 0.1 25 mg/ml 100 7 ± 0.1									[15]
9 Ocimum gratissimum Leaf Lextract agar disc diffusion Salmonella typhi Salmonella typhi 50 mg/ml 200 mg/ml 50 mg/ml 3 7 ± 0,1 200 mg/ml 3 9 Ocimum gratissimum Leaf Lextract Methan ol Extract agar disc diffusion Salmonella typhi Salmonella typhi Component Component Lextract 7 ± 0,1 25 mg/ml 7 ± 0,1 25 mg/ml 7 ± 0,1 7 ± 0,1 25 mg/ml 7 ± 0,1 7 ± 0,1 25 mg/ml [8] 9 Ocimum gratissimum Leaf Lextract Methan ol Extract Salmonella typhi Lextract 50 mg/ml 25 mg/ml 7 ± 0,1 7 ± 0,1						KIIIIK			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$									
9 Ocimum gratissimum Leaf Methan ol Extract agar disc diffusion Salmonella typhi of N Salmonella typhi (Escherichia coli-	e onig ini		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$							200 mg/ml	20	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$								13	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$							50mg/ml	3	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						aureus –ATCC 33591	200		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$									
9Ocimum gratissimumLeaf N ol Extractagar disc diffusionSalmonella typhi50 mg/ml 25 mg/ml $7 \pm 0,1$ $7 \pm 0,1$ Salmonella typhi $25 mg/ml$ $-$ $3,125 mg/ml$ $-$ $12,5 mg/ml$ $7 \pm 0,1$ $3,125 mg/ml$ $7 \pm 0,1$ $7 \pm 0,1$ $7 \pm 0,1$ [8]							150mg/ml		
9Ocimum gratissimumLeaf Methan ol Extractagar disc diffusionSalmonella typhi50 mg/ml $25 mg/ml$ $7 \pm 0,1$ $25 mg/ml$ $7 \pm 0,1$ $7 \pm 0,1$ $12,5 mg/ml$ $7 \pm 0,1$ $12,5 mg/ml$ $7 \pm 0,1$ $12,5 mg/ml$ $7 \pm 0,1$ $-$ $3,125 mg/ml$ $7 \pm 0,1$ $-$ $25 mg/ml$ $7 \pm 0,1$ $-$ $25 mg/ml$ $7 \pm 0,1$ $-$ $12,5 mg/ml$ $7 \pm 0,1$ $-$ $12,5 mg/ml$ $7 \pm 0,1$ $-$ $6,25 mg/ml$ $7 \pm 0,1$ $-$ $12,5 mg/ml$ $7 \pm 0,1$									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$							50mg/mi	3	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	9	Ocimum	Leaf		agar disc	Salmonella typhi	50 mg/ml	$7 \pm 0,1$	
$ \begin{vmatrix} ol \\ Extract \end{vmatrix} $ $ \begin{vmatrix} l & 2,5 \text{ mg/ml} & 7 \pm 0,1 \\ 6,25 \text{ mg/ml} & - \\ 3,125 \text{ mg/ml} & - \\ 3,125 \text{ mg/ml} & - \\ 25 \text{ mg/ml} & - \\ 12,5 \text{ mg/ml} & - \\ 12,5 \text{ mg/ml} & - \\ 6,25 \text{ mg/ml} & - \\ 6,25 \text{ mg/ml} & 7 \pm 0,1 \\ 3,125 \text{ mg/ml} & 7 \pm 0,1 \\ 3,125 \text{ mg/ml} & 7 \pm 0,1 \\ 3,125 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5$				Methan			25 mg/ml		
$ \begin{bmatrix} Extract \\ Figure \\ Figure$							12,5 mg/ml	$7\pm0,1$	
$ \left \begin{array}{c c c c c c c c c c c c c c c c c c c $				Extract				-	
$\frac{vulgaris}{12,5 \text{ mg/ml}} = \frac{50 \text{ mg/ml}}{12,5 \text{ mg/ml}} = \frac{1}{12,5 \text{ mg/ml}} = $							3,125 mg/ml	-	
$Klebsiella vulgaris = \begin{bmatrix} 25 \text{ mg/ml} & - \\ 12,5 \text{ mg/ml} & - \\ 6,25 \text{ mg/ml} & 7 \pm 0,1 \\ 3,125 \text{ mg/ml} & 7 \pm 0,1 \\ 25 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \end{bmatrix}$							50 ()		[8]
$Klebsiella vulgaris = \begin{bmatrix} 12,5 \text{ mg/ml} & - \\ 6,25 \text{ mg/ml} & 7 \pm 0,1 \\ 3,125 \text{ mg/ml} & 7 \pm 0,1 \\ 50 \text{ mg/ml} & 7 \pm 0,1 \\ 25 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \\ 12,5 \text{ mg/ml} & 7 \pm 0,1 \end{bmatrix}$						vulgaris		-	
Klebsiella vulgaris $6,25 \text{ mg/ml}$ $7 \pm 0,1$ 50 mg/ml $7 \pm 0,1$ $12,5 \text{ mg/ml}$ $7 \pm 0,1$								-	
Klebsiella vulgaris $3,125 \text{ mg/ml}$ $7 \pm 0,1$ 50 mg/ml $7 \pm 0,1$ 25 mg/ml $7 \pm 0,1$ 12,5 mg/ml $7 \pm 0,1$ 12,5 mg/ml $7 \pm 0,1$							12,3 mg/m1	- 7 ± 0 1	
Klebsiella vulgaris 50 mg/ml 7 ± 0.1 25 mg/ml 7 ± 0.1 12.5 mg/ml 7 ± 0.1 12.5 mg/ml 7 ± 0.1									
$ \begin{array}{ c c c c c c } 50 & mg/ml & 7 \pm 0,1 \\ 25 & mg/ml & 7 \pm 0,1 \\ 12,5 & mg/ml & 7 \pm 0,1 \\ \end{array} $						Klebsiella vuloaris	3,123 mg/m	/ ± 0,1	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						meosicila vargaris	50 mg/ml	7 ± 0.1	
$12,5 \text{ mg/ml}$ $7 \pm 0,1$									
	1								
6,25 mg/ml $7 \pm 0,1$									

Antibacterial Activity of Plant Family Lamiaceae: A Review

						3,125 mg/ml	-	
1	Ocimum	Leaf	Methan	agar disc	Salmonella typhi	50 mg/ml	$7 \pm 0,1$	
0	Sanctum		ol	diffusion	~	25 mg/ml	$7 \pm 0,1$	
			Extract			12,5 mg/ml	$7\pm0,1$	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
					Salmonella paratyphi	50 (1		
						50 mg/ml	-	
						25 mg/ml	$8 \pm 0,9$	101
						12,5 mg/ml	-	[8]
						6,25 mg/ml 3,125 mg/ml	-	
					Pseudomonas	5,125 mg/m	-	
					vulgaris			
					0.00	50 mg/ml	11 ± 0.5	
						25 mg/ml	$9 \pm 0,7$	
						12,5 mg/ml	$7 \pm 0,1$	
						6,25 mg/ml	$7 \pm 0,1$	
						3,125 mg/ml	$7 \pm 0,1$	
					Streptococcus aureus			
						50 mg/ml	-	
						25 mg/ml	7 ± 0.1	
						12,5 mg/ml	$7 \pm 0,1$	
					C	6,25 mg/ml	-	
					Staphylococcus aureus	3,125 mg/ml	-	
					aureus			
						50 mg/ml	7 ± 0.1	
						25 mg/ml	$7 \pm 0,1$ $7 \pm 0,1$	
						12,5 mg/ml	$7 \pm 0,1$ $7 \pm 0,1$	
						6,25 mg/ml	-	
					Klebsiella vulgaris	3,125 mg/ml	-	
						-, - 8		
						50 mg/ml	$7 \pm 0,1$	
						25 mg/ml	$7 \pm 0,1$	
						12,5 mg/ml	$7 \pm 0,1$	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
			E 1 1			1.07		
		Leaf	Ethanol Extract	agar well-	Actinobacillusactino	1%	9	
			Extract	diffusion	mycetemcomitans	2% 3%	10 10	
						5% 4%	10	
						5%	12	[14]
						6%	22	[14]
						7%	20	
						8%	20	
						9%	21	
						10%	21	
1	Ocimumobovatu	Leaf	Ethanol	The disk diffusion			8	
1	т		Extract	Method	Escherichia coli	1 mg/ml	14	
						2 mg/ml		
								[15]
					Staphylococcusaureu	1 mg/ml	12	
					<i>S</i> .	2 mg/ml	18	
					D 1	1 / •		
					Pseudomonas sp	1 mg/ml	9 16	
						2 mg/ml	16	
					Proteus sp	1 mg/ml	7	
					i roteus sp	2 mg/ml	13	
						2 mg/m	15	
1	OcimumTenuiflo	Leaf	Ethanol	disc diffusion	Escherichia coli	10%	-	ł
2	rum L	Loui	Extract	method	Lienen en a con	20%	_	[16]
-						40%		1-21
						70%	17	
							19	
					a 1 1	5 (1		1
1 3	Pogostemoncabl	Leaf		disk diffusion	Staphylococcus	5 mg/ml	$10,33 \pm$	

DOI: 10.9790/3008-1706015061

Antibacterial Activity of Plant Family Lamiaceae: A Review

	Extract	MRSA	5mg/ml		
		Streptococcus	5 mg/ml	11,67 ± 1,53	[17]
		pyogenes		10,33 ± 1.15	
	Ekstrak Water				
		Staphylococcus aureus.	1 mg/ml	0	
		MRSA	1 mg/ml	8,33 ± 1,53	
		Streptococcus pyogenes	1 mg/ml	0	

The following are the results of a review of the antibacterial activity of the *Lamiaceae* family including plant species, plant parts used, methods used, test bacteria used, concentrations used, the resulting inhibition zones and references from reviewed journals.

IV. Discussion

1. Anisomelesmalabarica

The methanol leaf extract of *Anisomeles malabarica* has antibacterial activity against *Salmonella typhi*, *Salmonella paratyphi*, *Pseudomonas vulgaris*, *Streptococcus aureus*, *Staphylococcus aureus*, and *Klebsiella vulgaris*. The test was done using agar disc diffusion. The contents tested in *Anisomeles malabarica* in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml.⁸

2. Coleusaromaticus

Methanol leaf extract of *Coleus aromaticus* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Pseudomonas vulgaris, Streptococcus aureus, Staphylococcus aureus,* and *Klebsiella vulgaris.* The test was done using agar disc diffusion. The content tested *Coleus aromaticus* in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in *Salmonella typhi*, namely at a concentration of 50 mg/ml with an inhibition zone of 7 ± 0.1 mm. *Salmonella paratyphi* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.4 mm. *Klebsiella vulgaris* bacteria at a concentration of 3.125 mg/ml - 50 mg/ml with an inhibition zone of 7 ± 0.1 each. mm.⁸

3. Coleus blumei

The methanol leaf extract of *Coleus blumei* has antibacterial activity against *Staphylococcus aureus* and *Streptococcus mitis*. Extraction was carried out by filtering to obtain the particle-free extract. The antibacterial screening was done by the disc diffusion method. The contents tested in *Coleus blumei* in this study were flavonoids, terpenoids, tannins, and saponins. The blank discs were impregnated with *Coleus blumei* extract at a concentration of 100 mg/ml. The results showed that the zones produced, the highest, by *Staphylococcus aureus* of 14.56 ± 0.444 mm, and the bacteria *Streptococcus mitis* of 13 ± 0.726 .⁹

4. Coleus antropurpureus

Ethanol leaf extract of male mayana leaves (*Coleus atropurpureus* benth) is able to work as an antibacterial for *Streptococcus* Sp and *Pseudomonas* Sp.mayanaleaves that have been dried and then macerated using polar solvent ethanol. The extracts tested by the well method were 100%, 80%, 60%, 40%, and 20%. The contents tested in male mayana leaves (*Coleus atropurpureus* benth) in this study were essential oils, tannins, flavonoids, and eugenol. The test was carried out to observe the presence or absence of the inhibition zone of the ethanol extract of male mayana leaves (*Coleus atropurpureus benth*) against *Streptococcus* sp. and *Pseudomonas* sp. after 24 hours of incubation. The results showed that the polar extract of male mayana leaves (*Coleus atropurpureus benth*) against streptococcus sp. and *Pseudomonas* sp. after 24 hours of incubation.

atropurpureus benth) with concentrations of 100%, 80%, 60%, 40%, and 20% could inhibit the growth of *Streptococcus* sp. with the respective averages of 12.8mm, 11.17mm, 8.67mm, 3.17mm and 2mm while *Pseudomonas* sp with each of the mean inhibition zone diameters of 12.17mm, 10.67mm, 9.5mm, 7.17 and 5.17mm.¹⁰

The ethanol leaf extract of the leaves of *Coleus atropurpureus* Benth also has antibacterial activity against *Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa*. Extraction was carried out by maceration using 96% ethanol as solvent. Antibacterial activity testing using agar diffusion method (modified Kirby and Bauer diffusion) by means of wells. The contents tested in the leaves of *Coleus atropurpureus* Benth in this study were flavonoids, polyphenols, saponins, alkaloids, and essential oils. The results of the antibacterial activity were analyzed using the One way ANOVA, followed by Duncan's test. ANOVA data showed that the extract concentrations of 5%, 10%, 20%, 40%, and 80% had the activity of inhibiting the growth of the test bacteria. Effective concentrations to inhibit *S. aureus* were at extract concentrations of 20%, 40%, and 80%, for E. coli bacteria at extract concentrations of 10%, 20%, 40%, and 80%, while for *P. aeruginosa* at extract concentrations of 40 % and 80%. The increase in the concentration of the mayana leaf extract showed the larger the diameter of the inhibition zone for bacterial growth ¹¹

5. Hyptis suaveolens

Methanol leaf extract of *Hyptis suaveolens* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus,* and *Klebsiella vulgaris* bacteria. The test was done using agar disc diffusion. The contents tested in Hyptis suaveolens in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in *Salmonella typhi*, namely at a concentration of 50 mg/ml with an inhibition zone of 8 ± 0.1 mm. *Salmonella paratyphi* bacteria at a concentration of 50 mg/ml with an inhibition zone of 7 ± 0.1 mm and Klebsiella vulgaris bacteria at a concentration of 12.5 mg/ml - 50 mg/ml - 50 mg/ml with an inhibition zone of 7 ± 0.1 mm. ⁸

6. Leucasaspera

Methanol extract of roots, flowers, stems, and leaves of *Leucas aspera* has antibacterial activity against *Escherichia coli*, *Streptococcus aureus*, *Salmonella Choleraesuis*, *Salmonella typhimurium*, *Shigella Flexneri*, *Pseudomonas aeruginosa*. Extracts were made by grinding all parts of the plant (roots, flowers, leaves, and stems) into a powder using a grinder, and then filtered. The dried plant extracts were then redissolved in 80% (v/v) methanol to obtain a solution containing 2 mg/ml of extract each, which was then used for testing. The test was carried out using the Disk Diffusion Technique with a concentration used of 100 mg/ml. The contents tested in roots, flowers, stems, and leaves of Leucas asp*era in this study were triterpenes, sterols, and phenolics*.¹²

Methanol leaf extract *Leucas aspera* also has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus, and Klebsiella vulgaris.* The test was done using agar disc diffusion. The contents tested in *Leucas aspera* in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in Salmonella typhi with concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml, which was 7 ± 0.1 . *Salmonella paratyphi* bacteria with a concentration of 50 mg/ml is 8 ± 0.9 . *Staphylococcus aureus* bacteria with a concentration of 50 mg/ml is 8 ± 0.9 . *Staphylococcus aureus* bacteria with a concentration of 50 mg/ml is 8 ± 0.9 . *Staphylococcus aureus* bacteria with a concentration of 50 mg/ml is 8 ± 0.9 .

7. Mentha arvensis linn

Methanol leaf extract of Mentha arvensis has antibacterial activity against Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus, and Klebsiella vulgaris bacteria. The test was done using agar disc diffusion. The contents tested in Mentha arvensis Linn in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in Salmonella typhi, with a concentration of 50 mg/ml of 8 ± 0.9 mm. Pseudomonas vulgaris bacteria at a concentration of 50 mg/ml with an inhibition zone of 7 ± 1.0

mm. Streptococcus aureus bacteria at concentrations of 50 mg/ml and 25 mg/ml with an inhibition zone of 7 \pm 1.0 mm. *Klebsiella vulgaris* bacteria at concentrations of 50 mg/ml and 25 mg/ml with an inhibition zone of 7 \pm 1.0 mm.⁸

8. Ocimum bascilicum

Methanol leaf extract of *Ocimum bacilicum* has antibacterial activity *against* Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus, and Klebsiella vulgaris bacteria. The test was done using agar disc diffusion. The contents tested in Ocimum bascilicum in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by Salmonella paratyphi at a concentration of 50 mg/ml with an inhibition zone of 9 ± 1.0 mm. Pseudomonas vulgaris bacteria at concentration of 50 mg/ml and 25 mg/ml with an inhibition zone of 8 ± 0.1 mm.⁸

Methanol leaf extract of *Ocimum bacilicum* (Linn) also has antibacterial activity against *Escherichia coli* bacteria from KFUPM Clinic, *Staphylococcus aureus* from KFUPM Clinic, *Escherichia coli*-ATCC 25922 and *Staphylococcus aureus*-ATCC 33591. with the hole-plate diffusion method. Extracts were made by drying and grinding then soaked in 1.25 - 1.5 liters of 95% ethanol for 5 days at room temperature. Then filtered and dried. The dry extract was stored in a sterile glass vial at 20oC until being used. Antibacterial activity testing was carried out using the Hole-Plate Diffusion Method. The concentration used was 50 mg/ml - 200 mg/ml. The results showed the highest zone of inhibition in Escherichia coli bacteria from KFUPM Clinic at a concentration of 150 mg/ml of 21 mm. *Staphylococcus aureus* bacteria at a concentration of 200 mg/ml of 20 mm. *Staphylococcus aureus*-ATCC 33591 bacteria at a concentration of 200 mg/ml of 16 mm. ¹³

9. Ocimum gratissimum

Methanol leaf extract of *Ocimum gratissimum* has antibacterial activity *against* Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus, and Klebsiella vulgaris bacteria. The test was done using agar disc diffusion. The contents tested were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by Salmonella typhi with concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml of 7 ± 0.1 mm. *Pseudomonas vulgaris* bacteria at concentrations of 6.25 mg/ml and 3.125 mg/ml of 7 ± 0.1 mm and Klebsiella vulgaris bacteria on Salmonella typhi.⁸

10. Ocimum sanctum

Methanol leaf extract of *Ocimum Sanctusm* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris*. The test was done using agar disc diffusion. The contents tested in Ocimum Sanctum in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by *Salmonella typhi* at concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml of 7 ± 0.1 mm.⁸

Methanol leaf extract of *Ocimum sanctum* also has antibacterial activity against the *Actinobacillus actinomycetemcomitans* bacteria. Extracts were made by drying and milling and then macerating with 100% ethanol. Then filtered to get a clear filtrate. The obtained filtrate was reduced at a low temperature of less than 60oCto obtain a solid residue of Ocimum sanctum (Linn.) extract. From 300 grams of *Ocimum sanctum* (Linn.) powder dissolved in 1 liter of ethanol, 18 grams of extract (residue) were obtained so that the yield was 6% w/v. Antibacterial activity was tested by agar well-diffusion method at a concentration of 1% - 10%. The contents tested in *Ocimum sanctum* in this study were ursolic acid, rosmarinic acid, and oleanolic acid. The results showed that the highest inhibition zone was found at a concentration of 6%, which was 22 mm.¹⁴

11. Ocimum obovatum

Methanol leaf extract of *Ocimum obovatum* has antibacterial activity against *Escherichia coli, Staphylococcus aureus, Klebsiella* sp, *Pseudomonas* sp, *Prote*us sp. The process of making extracts is done by drying, and milling. Leaf powder (250 gm) was extracted using a Soxhlet apparatus with ethanol as a solvent. The resulting

extract was filtered, concentrated to dryness under reduced pressure in a rotary evaporator, and stored at 4°C for further use. The contents tested in Ocimum obovatum in this study were carbohydrates, phenols, flavonoids, tannins, saponins, fixed oil and fats, glycosides, and terpenoids. O. *obovatum* extract was tested against *Escherichia coli* (MTCC40), *Staphylococcus aureus* (MTCC 3160), and *Klebsiella pneumoniae* bacteria. The test method used was the disk diffusion method. The concentration used is 2 mg/ml. The inhibition zone produced was the highest in *Staphylococcus aureus* with an inhibition zone of 18 mm.¹⁵

12. Ocimumtenuiflorum L

The ethanol leaf extract of *Ocimum tenuiflorum* L has antibacterial activity against *Escherichia coli*. This research was conducted experimentally in a laboratory with the disk diffusion method (disc method). The contents tested in the leaves of *Ocimum tenuiflorum* L in this study were flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins. The results showed that the ethanolic extract of the leaves of ruku-ruku (*Ocimum tenuiflorum* L) could inhibit the growth of *Escherichia coli* at a concentration of 40% and 70% with inhibition zones of 17 mm and 19 mm, respectively, while at concentrations of 10% and 20% there was no inhibition zone (0 mm). From the amount of inhibition zone obtained at concentrations of 40% and 70%, it can be stated that the ethanol extract of ruku-ruku (Ocimum tenuiflorum L.) leaves effectively inhibits the growth of *Escherichia coli* bacteria with a strong category.¹⁶

13. Pogostemoncablin

Water and ethanol leaf extract of *Pogostemon cablin* has antibacterial activity against *Staphylococcus aureus*, MRSA, *and Streptococcus pyogenes*. The test was done with the disk diffusion method at a concentration of 5 mg/ml. The content tested in the leaves of *Pogostemon cablin* in this study was phenolic. The inhibition zone was calculated by measuring the diameter of the inhibition area. Three different fixed directions were taken in triplicate, and their average value was calculated. The concentration used was 5 mg/ml. The inhibition zone in the ethanol extract against *Staphylococcus aureus* bacteria at 10.33 ± 2.52 mm, MRSA at 11.67 ± 1.53 , *Streptococcus pyogenes* bacteria at 10.33 ± 1.15 . The inhibition zone on the water was only found on MRSA at $8.33 \times 11.67 \pm 1.53$.

V.Conclusion

Based on the results of the analyzed literature data, it can be concluded that plants from the *Lamiaceae* family can be used as antibacterial agents. The results of the analysis showed that 13 types of plants from the Lamiaceae have antibacterial activity, namely *Anisomeles malabarica, Coleus aromaticus, Coleus blumei, Coleus atropurpureus Benth, Hyptis suaveolens, Leucas aspera, Mentha arvensis Linn, Ocimum bascilicum, Ocimum gratissimum, Ocimum sanctum, Ocimum obovatum, Ocimum tenuiflorum L, and Pogostemon cablin. The most widely used part of the plant is the leaf.*

References

- Anggraini E, Primiani CN, dan Widiyanto J. Kajian Observasi Tanaman Famili Lamiaceae. Prosiding Seminar Nasional Simbiosis II, Madiun, 30 September 2017.
- [2]. Wahid A, Sampe J, Rahayu E, Rupa D dan Zulfadli. Justifikasi Ekstrak Tanaman Lamiaceae Sebagai Prospek Obat.Ekotonia: Jurnal Penelitian Biologi, Botani, Zoologi
- [3]. Suthar AB and Patel SR. (2014). A Taxonomic Study of Lamiaceae (Mint Family) in Rajpipla (Gujarat, India). World Applied Sciences Journal. 2014. 32 (5):766-768, 2014 ISSN 1818-4952. India: IDOSI Publications.
- [4]. Tambaru E, Masniawati A dan Tummuk R. Jenis Tumbuhan Liar Familia Lamiaceae Berkhasiat Obat di Hutan Kota Universitas Hasanuddin Tamalanrea Makassar. Bioma : Jurnal Biologi Makassar, 2019. 4(1) : 77-87.
- [5]. Gailea RAA. Brutawinata R, Pitopang dan Kusuma IW. The Use of Various Plant Types As Medicines by Local Community in the Enclave of the Lore-LinduNational Park of Central Sulawesi, Indonesia. Global Journal of Research on Medicinal Plant & Indigenous SMedicine. 2016. 5(1); 29-40.
- [6]. Raja RR. Medicinally potential plants of Labiatae (Lamiaceae) Family: An overview. Res J Med Plant. 2012. 1-11.
- [7]. Surahmaida dan Umarudin. Aplikasi Miana, Kemangi dan Kumis Kucing sebagai Pestisida Nabati. Graniti. 2019.
- [8]. Britto AJD, Sebastian SR dan Mary R.Antibacterial Activity Of Selected Species of Lamiaceae against human pathogens. Indian Journalof Natural Products and Resources Vol. 3(3), September 2012, pp. 334-342.
- [9]. Bismelah NA, Ahmad R, Kassim ZHM, Ismail NH. *Coleus blumei* extract as a potential Antibacterial Oral Rinse. IOP Conf. Series: Earth and Environmental Science. (2019) 269.
- [10]. Muljono P, Fatimawati dan Manampiring AE. Uji aktivitas antibakteri ekstrak daun mayana jantan (*Coleus atropurpureus Benth*) terhadap pertumbuhan bakteri *Streptococcus* Sp. dan *Pseudomonas* Sp. Jurnal e-Biomedik (eBm). 2016. 4 (1).
- [11]. Mpila DA, Fatimawali, Wiyono WI. Uji Aktivitas Antibakteri Ekstrak EtanolDaun Mayana (Coleus Atropurpureus L. Benth.) Terhadap Staphylococcus aureus, E. coli, dan Pseudomonas aeruginosa secara In-Vitro. Program StudiFarmasi FMIPA UNSRAT Manado. 2015.
- [12]. [Chew AL, Jessica JJA, Sasidharan S. Antioxidant and antibacterial Activity Of Different Parts Of Leucas Aspera. Asisan Pac J Trop Biomed. 2012; 2(3): 176-180.
- [13]. Khalil A. Antimicrobial Activity Of Athanolic Extracts Of Ocimum Basilium Laef From Saudi Arabia. Biotechnology. 2013.12(1); 61 – 64.

- [14]. Eswar P, Devaraj CG& Agarwal P. Anti-microbial Activity of Tulsi {Ocimum Sanctum (Linn.)} Extract on a Periodontal Pathin Human Dental Plaque: An Invitro Study. Journal of Clinical and Diagnostic Research. 2016; 10(3): 53 - 56.
- Naidoo Y, Sadashiya CT, Naidoo G dan Raghu K. Antibacterial, Antioxidantand Phytochemical Properties of The Ethanolic extract [15]. of Ocimum obovatum E.Mey. ex Benth. Indian Journal of Traditional Knowledge. 2016. 15(1). 57-61. R Andalia dan Fitri W.Efektivitas Ekstrak Etanol Daun Ruku-Ruku (*Ocimum Tenuiflorum L*) Terhadap Daya Hambat Bakteri
- [16]. Escherichia Coli.Serambi Saintia. Jurnal Sains dan Aplikasi. 2021. 9 (1).
- Dechayont B, Ruamdee P, Poonnaimuang S, Mokmued K, and Chunthorng-Orn J.Antioxidant and Antimicrobial Activities of *Pogostemon cablin* (Blanco) Benth. Hindawi. Journal of Botany. 2017. Article ID 8310275, 6 pages. [17].

HelinTelaumbanua, et. al. "Antibacterial Activity of Plant Family Lamiaceae: A Review." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS), 17(6), (2022): pp. 50-61. _____/
