IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 11,Iss 11, 2022

ANTIBIOFILM ACTIVITY OF *JATROPHA MAHESHWARII*- AS AN ENDEMIC PLANT

R Rajalakshmi[1]
[1]Research scholar, Full-Time, (Reg. No. 20212232262023), PG & Research Department of Botany, V.O.Chidambaram college (Affiliated to ManonmaniamSundaranar University, Tirunelveli), Thoothukudi – 08.

A Doss[2*]
[2*]PG & Research Department of Botany, V.O.Chidambaram College, Thoothukudi – 08.

***Corresponding Author: A Doss**
***** PG & Research Department of Botany, V.O.Chidambaram College, Thoothukudi – 08.
Email.Id: androdoss@gmail.com

Abstract

Bacterial biofilms can harm humans in hospital environments, the food industry, and drinking water systems. The study aimed to examine the antibiofilm activity of *Jatropha maheshwarii* as an endemic plant. Biofilms were formed by *Staphylococcus aureus* and *Pseudomonas aeruginosa* on the surface of medical biomaterials. Moreover, time-dependent eradication of biofilms performed in polystyrene 96-well culture microplates was examined and expressed as minimal biofilm eradication concentration. The tested staphylococcus aureus formed the highest antibiofilm activity against biofilm at 77% in aqueous extract and the ethanol extract at 73% in different concentrations (µg/ml). The application of antibiofilm activity spans various fields, including medicine, the food industry, and environmental management.

Keywords: *Jatropha maheshwarii,* Antibiofilm activity, Gram-positive and Gram-negative bacteria

INTRODUCTION

Biofilms, which are self-produced matrices of various organic chemicals, provide a significant problem (Simões et al., 2010). Biofilms, which are frequently seen in several situations such as industrial and clinical settings, Food processing conditions and drinking water distribution systems, generally create a sticky gel comprised of polysaccharides, proteins, and other organic components on a moist surface (Kavanaugh & Ribbeck, 2012; Oral et al., 2010). According to Gilbert et al. (2011), biofilm-associated cells can attach permanently to a range of surfaces, such as living tissues and indwelling medical devices such as valves, prostheses, catheters, etc. A biofilm is a population of microorganisms adhered to a surface: within the biofilm, bacteria are cocooned in a self-produced extracellular matrix made up of extracellular polymeric substances that, along with carbohydrate-binding proteins, pili, flagella, other adhesive fibres, and extracellular Deoxyribonucleic Acid (DNA), serve as a stabilizing scaffold for the three-dimensional (3-D) biofilm structure. By shielding biofilm bacteria from innate immune responses and antibiotic therapies, the matrix facilitates close cell-to-cell communication and DNA exchange that aid in spreading virulence

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 11,Iss 11, 2022

factors and medication resistance. As a result, biofilm-forming microorganisms persist, causing chronic and resistant infections. Biofilm-forming pathogen infections can be disastrous, causing severe symptoms and, in many cases, death (Clinton & Carter, 2015; Fisher et al., 2010; Kostakioti et al., 2013).

Staphylococcus aureus, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, Klebsiella pneumoniae and Escherichia coli are some of the most prevalent biofilm-forming bacteria in clinical settings (Wolcott et al., 2010; Sanchez et al., 2013; Donlan et al., 2002). Human Pseudomonas aeruginosa is an opportunistic bacteria that has emerged as a significant source of nosocomial infections, including infections of artificial implants, contact lenses, and catheters for the urinary tract (Kipnis et al., 2006; Davey et al., 2003). (Davey et al., 2003). The Gram-positive bacterium Staphylococcus aureus develops on the addition; it can play a role in various illnesses such as meningitis, epidural abscesses, urinary tract infections, toxic shock syndrome, and septic thrombophlebitis (Gajd' acs, 2019). Asfar et al. (2014) found that bacteria protected by biofilm exopolysaccharides are up to 1,000 times more susceptible to antibiotics than cells in plankton, which has significant implications for therapy and dramatically complicates treatment options (Russell et al., 2008). Microbial biofilms are responsible for a wide range of issues in various medical, environmental, and industrial contexts. These issues include the colonization of artificial medical implants, fouling of ship hulls, and clogging of industrial piping (Costerton et al., 1999; Kumar & Anand, 1998), among many other issues. This study examined the antibacterial, anti-biofilm, anti-quorum sensing, and synergistic properties of 23 plant extracts.

Jatropha belongs to the family Euphorbiaceae and is distributed in India at 13 sp (Abdul Kader, 2014). It is widely distributed in the red clay soils of the southeast coast of Tamil Nadu (Kanyakumari, Thoothukudi, and Tirunelveli), India, and it is related to the petroplant *Jatropha curcas*. It is commonly known as 'Athalai' (Ahmedullah& Nayar, 1986), 'Vel-thali' (Ben et al., 2014), and 'Kattamannaku' (Maria et al., 2014) in Tamil. It is an evergreen shrub that is 200cm in size with a thick stem and dark green leaves with ovate-lanceolate. The aerial parts of this plant have some traditional medicinal properties, and it is used by natives as an insecticide to treat ringworms, eczema, and rheumatism (Ben et al., 2014). Maria Sumathi and Uthayakumari, 2014 found a light green viscid fluid (latex) in the aerial part of the stem, and the rural folk use it for curing numerous ailments like skin diseases, tooth infections, and haemorrhages.

The current study's objective was to assess the anti-biofilm activity of a crude extract from the plant *Jatropha maheshwarii* against microbial infections that are clinically significant.

MATERIALS AND METHODS

Collection of plant

The aerial parts of *Jatropha maheshwarii* were obtained from Periyathalai (Lat. 8.33690N Long. 77.97240E), Tuticorin District, Tamil Nadu. Typical flora verified the sample. After thoroughly washing the samples with distilled water, they were allowed to air in the shade for two weeks. The dried leaves were finely blended using a mechanical blender before being stored in an airtight container.

Microbial pathogens

Bacterial strains of *Echerichia coli, Psuedomonas aeruginosa, Staphylococcus aureus, Salmonella typhii, and Bacillus sp.* originated from the Department of Microbiology at Bharathidasan University in Trichy, Tamil Nadu, and India. The gained cultures were kept on a nutrient agar medium.

Extract Preparation

Ten grams of plant powder were blended with 100 millilitres of distilled water at room temperature (28^0 C). Following 48 hours of agitation, the material was filtered using Whatman No. 1. Use filter paper. The filtrate was collected and used for future investigation. The exact process was used to make the ethanol extract.

Anti-biofilm activity

Fungal and bacterial cultures were grown on a 96-well polystyrene microtiter plate. The autoclave has been utilized to dissolve and sterilize media with a Thermo Magnetic Stirrer. To culture bacteria, 20 µL was applied to each well of a sterile 96-well polystyrene microtiter plate at varied stock solution concentrations (12, 14, 16 µg/mL, and 80 µL nutrient broth) and incubated at 37ºC for 24 hours (Brambilla et al., 2017).

RESULT AND DISCUSSION

Antibiofilm activity

The capacity to prevent biofilms from forming and spreading is known as antibiofilm activity. In this study, we looked at the antibiofilm properties of plant extracts from *Jatropha maheshwarii*. The aqueous and ethanol extracts are done on five bacterial strains of gram-negative and positive bacteria. The antibiofilm activity data are shown in Table 1 and Figure 1 for aqueous activity and Table 2 and Figure 2 for ethanol activity. There was also a control with nutritional broth (no bacterial culture). The formula utilized to calculate the biofilm development of extracts in bacteria (OD CONTROL - OD SAMPLE) ×100 was applied to five different concentrations of biofilm activity. A value greater than one indicates strong biofilm formation (no inhibition), 0.5 indicates moderate biofilm formation (less inhibition), and less than 0.5 indicates weak biofilm formation (potent inhibition). All plant extracts demonstrated considerable biofilm suppression against selected bacterial strains. As a combination of *Staphylococcus aureus* and *Pseudomonas aeringosa*, whose biofilm development was severely disturbed by all of the plant extracts, suggesting that the plant extracts are significantly active in inhibiting biofilm forms firmly. All plant extracts severely disturbed the biofilm produced by these bacteria. According to Kuyucuklu and Eryıldız (2021), using molecules and plant extracts to prevent or decrease biofilm formation has become a potential therapy option in recent years. Khan et al. (2017) found that both *Mirabilis jalapa* and *Ajuga bracteosa* extracts had moderate (+++) and mild (++++) effects on pellicle inhibition against the tested P. aeruginosa strains. Pattiyathanee et al. (2009) investigated curcumin's effect on Helicobacter pylori biofilm both qualitatively and quantitatively using the pellicle test and crystal violet staining, indicating that it could be used as a supplementary medicine to treat H. pylori biofilm-related infections. According to Quave et al. (2008), ten different plants prevented *S. aureus* biofilm from forming. R. officinalis, one of these plants, prevented the production of biofilms at 8 µg/ml. Differences in antibacterial activity among plant species may be caused by

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 11,Iss 11, 2022

factors such as soil type and harvest time, which can influence the plant's chemical composition (Correa Jr, 1991). Pre-formed biofilms of *S. aureus*, MRSA, *E. coli*, and C. albicans were suppressed by P. granatum and ellagic acid, one of its ingredients (Bakkiyaraj et al., 2013).

Table 1: Antibiofilm activity of aqueous extract from *Jatropha maheshwarii*

S.no	Name Of The Bacteria	Control	8µg/ml	4 µg/ml	2 µg/ml	1 µg/ml	0.5 µg/ml
1	*E.Coli*	0.176	13%	6%	5%	2%	13%
2	*Bacillus*	0.227	27%	22%	8%	10%	16%
3	*Staphylococcus aureus*	0.117	35%	10%	17%	14%	77%
4	*Pseudomonas aeruginosa*	0.176	13%	57%	6%	28%	7%
5	*Salmonella typhii*	0.271	8%	26%	7%	5%	11%

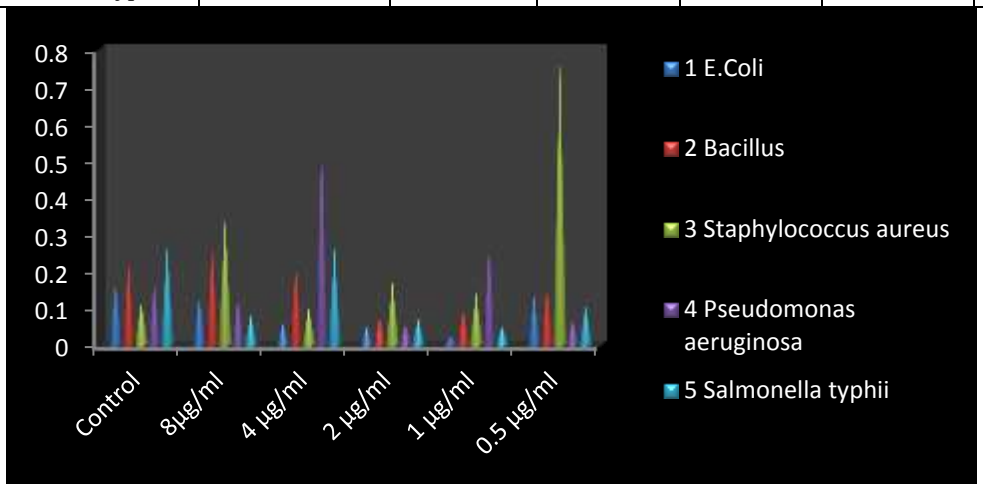

Figure 1:Antibiofilm activity of aqueous extrat from *Jatropha maheshwarii*

Table 2: Antibiofilm activity of Ethanol extract from *Jatropha maheshwarii*

S.no	Name of the bacteria	Control	8µg/ml	4 µg/ml	2 µg/ml	1 µg/ml	0.5 µg/ml
1	*E.Coli*	0.117	30%	17%	43%	36%	6%
2	*Bacillus*	0.132	44%	13%	13%	35%	3%
3	*Staphylococcus aureus*	0.237	18%	3%	20%	27%	8%
4	*Pseudomonas aeruginosa*	0.166	73%	34%	3%	24%	2%
5	*Salmonella typhii*	0.129	11%	7%	13%	23%	7%

ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 11,Iss 11, 2022

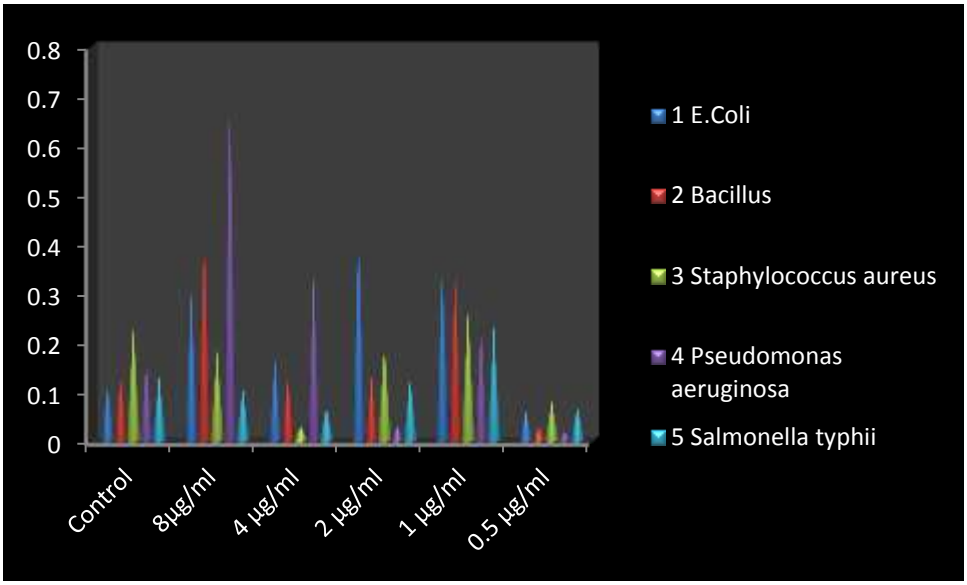

Figure 2: Antibiofilm activity of ethanol extract from *Jatropha maheshwarii*

CONCLUSION

The study's findings indicate that most plant extracts have antibiofilm efficacy because they can prevent the beginning stage of biofilm development and subsequent growth. While most extracts could prevent cell attachment, it was more challenging to stop the formation of a preexisting biofilm. To incorporate them as alternatives in the control of biofilms, isolating and identifying the ingredients that show antibiofilm capabilities may be necessary.

REFERENCE

1. Brambilla L.Z., Endo E.H., Cortez D.A., Dias B.P. Anti-biofilm activity against Staphylococcus aureus MRSA and MSSA of neolignans and extract of Piper regnellii. Revista Brasileira de Farmacognosia. 27, 112, 2017.
2. Kuyucuklu G., Eryıldız C. Effect of N-acetylcystein on Antibiofilm Efficiency of Antibiotics in Staphylococci Isolates. MikrobiyolojiBulteni. 55 (2), 125, 2021.
3. Khan I., Khan U., Khan W., Subhan M., Nawaz M.A., Pervez S., Khan K., Jan A.K., Ahmad S. Antibacterial and antibiofilm potential of leaves extracts of Mirabilis jalapa L. and Ajuga bracteosa wall. against Pseudomonas aeruginosa. Pure and Applied Biology (PAB). 6 (2), 605, 2017
4. Pattiyathanee P., Vilaichone R.-K., Chaichanawongsaroj N. Effect of curcumin on Helicobacter pylori biofilm formation. African Journal of Biotechnology. 8 (19), 2009
5. Correa Junior, C., Ming, L.C., Schefer, M.C. 1991. Cultivo de plantasmedicinais, condimentaresaromáticas. Curitiba: Copyright Emater-Parana, Brazil
6. Bakkiyaraj, D., Nandhini, J.R., Malathy, B., Pandian, S.K. 2013. The anti-biofilm potential of pomegranate (Punica granatum L.) extract against human bacterial and fungal pathogens. Biofouling. 29, 929-937.
7. Clinton, A., Carter, T., 2015. Chronic wound biofilms: pathogenesis and potential therapies. Lab. Med. 46, 277–284. https://doi.org/10.1309/lmbnswkui4jpn7so.

8. Fisher, T.K., Wolcott, R., Wolk, D.M., Bharara, M., Kimbriel, H.R., Armstrong, D.G., 2010. Diabetic foot infections: a need for innovative assessments. Int. J. Low. Extrem. Wounds 9, 31–36. https://doi.org/10.1177/1534734610363459
9. Kostakioti, M., Hadjifrangiskou, M., Hultgren, S.J., 2013. Bacterial biofilms: development, dispersal, and therapeutic strategies in the dawn of the postantibiotic era. Cold Spring Harb Perspect Med 3, a10306. https://doi.org/10.1101// cshperspect.a010306.
10. Kipnis E, Sawa T, Wiwnwr-Kronish J. Targeting mechanisms of Pseudomonas aeruginosa pathogenesis, Med Mal Infect. 2006; 36:78-91.
11. Davey ME, Caiazza NC, O'Toole GA. Rhamnolipid surfactant production affects biofilm architecture in Pseudomonas aeruginosa PAO1, Journal of Bacteriology. 2003; 185:027-1036.
12. E. R. Gilbert, C. M. Cox, P. M. Williams et al., 2011 "Eimeria species and genetic background influence the serum protein profile of broilers with coccidiosis," PLoS ONE, vol. 6, no. 1, Article ID e14636.
13. P. Asfar, F. Meziani, J.-F. Hamel et al., 2014 "High versus low bloodpressure target in patients with septic shock," The New England Journal of Medicine, vol. 370, no. 17, pp. 1583–1593.
14. J. A. Russell, K. R. Walley, J. Singer et al., 2008. "Vasopressin versus norepinephrine infusion in patients with septic shock," The New England Journal of Medicine, vol. 358, no. 9, pp. 877–887.
15. Gajdacs, ´ M., 2019. The continuing threat of methicillin-resistant Staphylococcus aureus. Antibiotics 8, 52. https://doi.org/10.3390/antibiotics8020052.
16. Costerton, J. W., Stewart, P. S., & Greenberg, E. P. (1999). Bacterial biofilms: a common cause of persistent infections. Science, 284(5418), 1318- 1322
17. Kumar, C. G., & Anand, S. (1998). Significance of microbial biofilms in food industry: a review. International journal of food microbiology, 42(1), 9-27.
18. Simões, Manuel, Lúcia C. Simões, Maria J. Vieira. A review of current and emergent biofilm control strategies. LWT-Food Science and Technology. 2010; 43(4):573- 583. Available:https://www.sciencedirect.com/sc ience/article/pii/S0023643809003430
19. Wolcott RD, et al. 2010. Chronic wounds and the medical biofilm paradigm. Journal of wound care.2010;19(2):45-53.
Available:https://www.magonlinelibrary.co m/doi/abs/10.12968/jowc.2010.19.2.46966
20. Sanchez, Carlos J, et al. 2013. Biofilm formation by clinical isolates and the implications in chronic infections. BMC infectious diseases. 2013;13(1):1-12.
Available:https://bmcinfectdis.biomedcentr al.com/articles/10.1186/1471-2334-13-47
21. Donlan, Rodney M, J. William Costerton 2002. Biofilms: survival mechanisms of clinically relevant microorganisms. Clinical microbiology reviews. 2002;15(2):167-193.
Available:https://journals.asm.org/doi/abs/1 0.1128/CMR.15.2.167-193.2002
22. Nicole L. Kavanaugh and Katharina Ribbeck 2012. Selected Antimicrobial Essential Oils Eradicate Pseudomonas spp. and Staphylococcus aureus Biofilms. Applied and Environmental Microbiology, Volume 78 Number 11, Pp. 4057– 4061, DOI: 10.1128/AEM.07499-11
23. N. B. Oral, L. Vatansever, B. D. Aydın, Ç. Sezer, A. Güven, M. Gülmez, K. Hüsnü et al., 2010. Effect of oregano essential oil on biofilms formed by staphylococci and *Escherichia coli*. KafkasÜniversitesiVeterinerFakültesiDergisi, 2010, Vol. 16, No. Supplement A, S23-S29 ref. 26

ISSN PRINT 2319 1775 Online 2320 7876
Journal Volume 11,Iss 11, 2022

24. Abdul Kader S 2014, Taxonomical Studies on Jatropha maheshwarii Subram. Nayar (Euphorbiaceae) – A medicinal under shrub endemic to south Tamil Nadu. JETB, 38(2): 335 – 339.
25. Ahmedullah M, Nayar M.P (1986). Endemic plants of the Indian region, Controller Publication. Botanical Survey of India, Calcutta. 176-177.
26. Maria Sumathi B, Uthayakumari F (2014). GC MS Analysis of Leaves of *Jatropha maheshwarii*Subram. & Nayar. Sci Res Rep. 4(1): 24-30.
27. Ben C. P, Sivanadanam V, and Gnanasekaran G (2014). Comparative phytochemical screening and antimicrobial efficacy studies on two endemic species - *Jatropha maheshwarii* Subr. & Nayar and *Jatropha villosa* Wight. J PharmacogPhytochem. 3(4): 213-219.