

Comparative studies of bactericidal activity of stem and leaf extracts of *Adulsa (Justicia adhatoda L.)* & *Turmeric (Curcuma longa L.)* against human pathogens

Varsha M. Chaudhari

Department of Microbiology, P.S.G.V.P.M's S. I. Patil Arts, G.B. Patel Science and
STKVS Commerce College, Shahada-425 409 (India)

Email: varsharaj2913@gmail.com

Abstract

Medicinal plants are very important because of presence of the high content of various bioactive principles and useful for the production of valuable and useful bio-products (e.g., food, cosmetics, medicines, biostimulants, biopesticides, and feed). Stem and leaf are the most important parts of medicinal plants having antimicrobial constituents. The present work was conducted to determine the bactericidal activity of stem and leaf extract of some important medicinal plants collected from the local area against some human throat pathogenic strains like *Klebsiella pneumoniae*, *Streptococcus* spp, *Staphylococcus aureus*, and *Escherichia coli*. Leaf and stem parts of the medicinal plants like *Adulsa (Justicia adhatoda)*, and *Turmeric (Curcuma longa L.)* were extracted in different solvents like Ethanol, Methanol, Chloroform and water. In vitro antibacterial activity was performed by the agar disc diffusion method. The most sensitive Gram-positive bacteria was found to be *Staphylococcus aureus* to the leaves extract of *Adulsa* while the most sensitive Gram-negative bacteria was *Klebsiella Pnuemoniae* and *Escherichia coli* while no inhibition was found with *Streptococcus* spp.

Key words : Antimicrobial activity, *Adulsa (Justicia adhatoda)*, and *Turmeric (Curcuma longa L.)*, Agar disc diffusion method.

Medicinal plants have been used in healthcare since time immemorial. From the ancient time healing with medicinal plants is considered as one of the best treatment. In Ayurveda plant extracts were used for the treatment of various diseases. Medicinal plants represent a rich source of antimicrobial agents. Number of countries used medicinal plants in

medicines and a source of many potent and powerful drugs. Different parts of medicinal plants like roots, stem, leaves and flowers are used as raw drugs and they possess varied medicinal properties^{6,8}. Medicinal plants are believed to be important source of new chemical substances with potential therapeutic effects⁷. For the treatment of various diseases,

including asthma, gastrointestinal symptoms, skin disorders, respiratory and urinary problems, and hepatic and cardiovascular disease medicinal plants were used traditionally^{9,10}. The medicinal value of plants like antimicrobial, anti-cancer, anti-inflammatory, anti-diabetic, antioxidant, anti-diuretic and etc. mainly depends on the secondary metabolites and the most important bioactive compounds of plants are alkaloids, saponins, flavonoids, tannins, sterols and phenolic compounds^{4,5}. Thus these plants synthesize a diverse array of biologically active compounds^{2,3}. Plant-based antimicrobial compounds have great therapeutic potential as they have lesser side effects as compared with synthetic drugs and also little chance of developing of resistance. According to the World Health Organization (WHO), medicinal plants would be the best source to obtain a variety of drugs¹¹.

Therefore present study has been carried out to study the antimicrobial activity of some medicinal plants collected from Shahada region against *Klebsiella pneumoniae*, *Streptococcus* spp, *Staphylococcus aureus*, and *Escherichia coli* by agar disc diffusion method.

Plant collection :

The fresh and healthy leaves of the medicinal plants namely Adulsa (*Justicia adhatoda* L.), Turmeric (*Curcuma longa* L.), were collected from various areas of Shahada-Nandurbar District, Maharashtra and they all were identified and authenticated after critical examination in laboratory. Leaves and stem part of the plants were used to study its antimicrobial activity.

Preparation of plant extract :

Fresh matured leaves and stems (25 gm) of the collected medicinal plants were washed thoroughly with sterile distilled water and dried under shade. Plant samples were cut into small pieces and crushed in a mortar with 15 ml of sterilized Distilled Water, Ethanol, Methanol and Dimethyl Sulphoxide respectively. The extract was centrifuged in sterile centrifuge tubes to remove broken tissues and supernatant was transferred into sterile test tubes to study its antibacterial activity.

The antibacterial activity of each plant extract was evaluated using strains of Gram-positive and strains of Gram-negative bacteria. The bacterial strains used for the study of antimicrobial activity were *Klebsiella pneumoniae*, *Streptococcus* spp, *Staphylococcus aureus*, and *Escherichia coli*. The pure culture of each bacterial strain was suspended in nutrient broth and incubated for 24 h at 37°C. Sterile Nutrient agar (NA) medium was used for testing the antibacterial activity.

Determination of antibacterial activity :

The antimicrobial activity of two different medicinal plants parts-leaf extract and stem extract was determined by the agar disc diffusion method¹. 0.1 ml of the freshly grown culture of test organisms were aseptically introduced and spread on the surface of sterile Nutrient agar plates. For the agar disc diffusion method, sterile filter paper discs (6mm) were soaked in each medicinal plant extract prepared in sterile distilled water, ethanol, methanol, and dimethyl sulphoxide and placed at the surface of nutrient agar plates previously

inoculated with the different test organisms. Control of the same solvent with the paper disc was kept as a positive control and the paper disc soaked in Distilled water was used as a negative control. Plates were incubated at 37°C for 24-48 hours. Antibacterial activity was evaluated by measuring the diameter of the zone of inhibition against the tested bacterial pathogens.

The present work was carried out to investigate the antimicrobial activity of some medicinal plants against some human pathogenic microorganisms. Two Gram Positive organisms

like *Staphylococcus aureus*, and *Streptococcus* spp, and two Gram Negative organisms like *E. coli* and *Klebsiella pneumoniae* were selected for this study. The antimicrobial activity of leaf extract and stem extract were observed against these selected pathogens. Results obtained are revealed in the following table indicating that Adulsa (*Justicia adhatoda* L.) leaves and turmeric (*Curcuma longa* L.) stem extracts showed better antimicrobial activity as compared with leaf extract of turmeric and stem extracts of adulsa plants. The maximum activity was observed against *Staphylococcus aureus* and *E.coli* spp.

Table-1. Antimicrobial activity of Leaf and stem extract of medicinal plants against human pathogens

S.N.	Medicinal Plant	Organisms	Zone of inhibition (Diameter in mm)	
			Leaf extract	Stem extract
1	Adulsa (<i>Justicia adhatoda</i> L.)	<i>S. aureus</i>	15	8.0
		<i>Streptococcus</i> spp.	9.0	5.7
		<i>E. coli</i>	6.1	6.3
		<i>K. pneumoniae</i>	8.3	7.5
2	Turmeric (<i>Curcuma longa</i> L.)	<i>S. aureus</i>	8.3	12.5
		<i>Streptococcus</i> spp.	8.0	8.2
		<i>E. coli</i>	9.6	11.2
		<i>K. pneumoniae</i>	10.0	11.7

ND= Not detected

Results obtained revealed in Table-1 showed that maximum zone of growth inhibition(12mm) was observed with leaf extract of Adulsa (*Justicia adhatoda* L.), plant against *Staphylococcus aureus* when methanol was used as a solvent for extraction, followed by a 9.0mm zone of inhibition with *Streptococcus* spp. While a very less zone of growth inhibition (6.1mm) was observed with *E. coli*. Leaf extract of Adulsa was

found to be more effective in antimicrobial properties as compared with stem extract of the Adulsa plant.

Results obtained with the Turmeric (*Curcuma longa* L.) plant revealed that the stem extract of the plant was found to be most effective against *Klebsiella pneumoniae* (11.7mm) as compared to leaf extract with the zone of growth inhibition found as (10.0

mm) followed by a zone of growth inhibition (9.6 mm) against *E. coli*.

The antimicrobial activity of medicinal plants may be due to the presence of important phytochemical constituents in plants that inhibited the growth of pathogenic microbes. Results obtained with different solvents used for extraction also revealed that as compared to aqueous extract of the plant, an extract in dimethyl sulphoxide has better antimicrobial activity comparable with ethanol and methanol extract of leaf and stem.

The medicinal plant extract has been effectively used as a promising alternative to synthetic drugs in recent medicine. Antimicrobial activity of medicinal plants Adulsa (*Justicia adhatoda*), Turmeric (*Curcuma longa* L.), were studied against four different pathogenic bacteria. Results obtained revealed that Adulsa and Turmeric were found to be most effective against microbes. Methanol extracts of all plants have shown antimicrobial activity against pathogens.

References :

1. Anonymous, (1996). Pharmacopiea of India. (The Indian Pharmacopiea), 3rd Edn., Govt. of India, New Delhi, Ministry of Health and Family Welfare.
2. Bajguz, A. (2007). *Plant Physiol. Biochem* 45: 95–107. d
3. Cushnie, T. P. T., B. Cushnie, and A. J. Lamb, (2014). *Int. J. Antim. Agents* 44: 377–386. doi: 10.1016/j.ijantimicag.2014.06.001
4. Djeussi D.E., J.A.K. Noumedem and J.A. Seukep (2013) *BMC Complementary and Alternative Medicine*, 13(164).
5. Duraipandiyan V., M. Ayyanar, and S. Ignacimuthu, (2006) *BMC Complementary and Alternative Medicine*, 6(35).
6. Iwu M.W., A.R. Duncan and C. O. Okunji, “New antimicrobials of plant origin in. Perspectives on new crops and new uses,” in *Plant Breeding Reviews*, J. Janick, Ed., ASHS Press, Alexandria, Virginia, 1999.
7. Niyas Ahamed M. I., J. Madhusudhanan, S. D. K. Shri Devi, Beulah S. Violet, Zoyeb Mohamed Zia and Vino Udappusamy (2021) *Annals of R.S.C.B.*, 25(4): 17072-17077.
8. Srinivasan D., S. Nathan, T. Suresh, and O. Perumalaswamy (1996) *Journal of Ethnopharmacology* 74: 217-220.
9. Tian, X. R., G. T. Feng, Z. Q. Ma, N. Xie, J. Zhang, and X. Zhang, *et al.* (2014). *Phytochem. Lett.* 10: 168–172.
10. Van Wyk, B. E., and M. Wink, (2004). “Medicinal Plants of the World” Pretoria: Briza Publications.
11. World Health Organization (2002) *World Health Organization, WHO Traditional Medicine Strategy*, Geneva.