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# Evaluation of Antimicrobial Activity of Cymbopogon flexuous Leaf Extract using Some Human Pathogenic Bacteria

***Sunidhi Kosle and Wasim Raja***
***Central Laboratory Facility, Chhattisgarh Council of Science and Technology, Raipur 492014 Chhattisgarh, India***

****Corresponding Author***
*Email Id: drwasimraja84@gmail.com*

## ABSTRACT

*The increasing prevalence of antibiotic-resistant human pathogens necessitates the exploration of alternative antimicrobial agents from natural sources. Cymbopogon flexuous (lemongrass), a perennial grass widely used in traditional medicine, has garnered attention for its potential antibacterial properties. This thesis investigates the antimicrobial activity of methanol and aqueous extracts of Cymbopogon flexuous leaves against several clinically significant human pathogenic bacteria, including Staphylococcus aureus, Escherichia coli, klebsiella pneumoniae, Bacillus, enterococcus, Streptococcus, Pseudomonas aeruginosa, and Proteus mirabilis. The study further highlights that the antimicrobial efficacy of Cymbopogon flexuous is attributable to its essential oil components, particularly citral, geraniol, and geranyl acetate, which have been previously reported to possess strong antibacterial and antifungal activities. The findings suggest that Cymbopogon flexuous leaf extracts, especially those obtained with methanol, have significant potential as natural antibacterial agents against both Gram-positive and Gram-negative bacteria, supporting their possible use in pharmaceutical and food safety applications. Further research is recommended to elucidate the mechanisms of action and assess the safety profile of these extracts for therapeutic use.*

## INTRODUCTION

lemongrass widely cultivated for its essential oils and medicinal uses. The plant's characteristic lemon-like aroma is attributed to its high citral content, a monoterpene compound known for its potent antimicrobial properties. The use of lemongrass in traditional remedies for treating infections and promoting health underscores its potential as a natural alternative to synthetic antibiotics. Lemon grass (*Cymbopogon Flexuous*) is a native aromatic tall sedge/grass (Rangari vinod, 2009).

Family (Poaceae / Gramineae) with diverse medicinal value and grown in many parts of tropical and subtropical south east Asia and Africa. It was grown in India a century back and now commercially cultivated in different parts of India. The oil has been found to possess bactericidal, anti-bacterial and anti-fungal properties, which is comparable to Penicillin in its effectiveness (Lutterodt et al., 1999). It has analgesic and antipyretic properties. The juice extracted from the lemon grass contains inhibitor of the promotion stage of carcinogenesis induced by cotton oil. It is an oral anti-tumor drug for the cancer and in combination with cyclodextrin and helps in increasing survival time (Parekh and Chanda, 2007; Oshiba et al., 1991).

*Cymbopogon* citratus is a great interest due to its commercially valuable essential oils and widely used in food technology as well as in traditional medicine. People now-a-days are more aware on health issue due to the emergence of new diseases. Treatment using plant-

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based medicine appears to be an alternative approach due to the adverse effects associated with the use of synthetic drugs (Mirghani et al., 2012). The ethanolic extracts of the leaves of Lemon grass showed potential antibacterial property against *Staphylococcus aureus*. Flavonoids and Tannins found in the extract are responsible for the activity (Danlmi et al., 2011).

Revathi et al., (2012) said that the combined the antimicrobial activity of volatile oils obtained from *Cymbopogon citratus* and *Ocimum sanctum* against *Staphylococcus aureus* (bacteria) and *Aspergillus niger* (fungi) by agar disc diffusion method and turbidometry method. The results showed that the maximum antimicrobial activity was shown by lemon grass oil than the ocimum oil. The mixture of these two oils shows maximum antimicrobial activity than the individual oils.

Chamdit and Siripermpool (2012) stated that the antimicrobial activity of clove and lemongrass oil against planktonic cells and biofilms of *Staphylococcus aureus.* They stated that these two oils efficiently kill the *S. aureus* with in the biofilm and is therefore an alternative method for its eradication.

Ewanishi et al., (2012) stated that the cold maceration and agar diffusion technique were employed to assess phytochemical properties and the antimicrobial potency of Journal of Pharmacognosy and Phytochemistry *Cymbopogon citratus* (lemongrass) against selected microbial pathogens using hexane, chloroform and methanol as extracting solvents. Antimicrobial property of lemongrass (*Cymbopogon citratus*) oil against pathogenic bacteria isolated from pet turtles (De Silva et al., 2017) lemongrass oil is used to control the turtle borne pathogens.

The lemongrass oil and citral may change the activities of drug metabolizing enzymes and reduce oxidative stress in the liver (Chinen-chun et al., 2018). The antimicrobial activity of many plants has been reported by many researchers (Reddy et al., 2001; Atleb and Erdourul 2003). However, the studies of antimicrobial activities of lemongrass are very limited towards the pathogenic bacteria and fungi. Therefore, we have plants to carry out evaluation and antimicrobial effect

## MATERIAL AND METHODS

### Collection of Cymbopogon flexuous

The experimental plant species, C. *flexuous* was purchased from the local herbal market. The plant was authenticated and the voucher specimen was deposit in the herbarium of central laboratory facility, Chhattisgarh council of science and technology, Raipur.

### Preparation of Plant Powder

Fresh Cymbopogon flexuous plat were washed thoroughly in tap water followed by distill water and were then shade dried until all the water content was lost completely. Dried plants were crushed and powdered using blender. Fine powder was obtained after sieving and stored in airtight container until further use.

### Preparation of Experimental Plant Extract

The plant powder was extracted with methanol solvent with an increasing polarity. The successive extraction was done by a cold maceration process for seven days with regular agitation. After seven days of cold maceration process it was filtered through sterile muslin

cloth and the solvent was evaporated using Soxhlet apparatus. The residues obtained after evaporation were stored at -20° C until used for experimentation.

**Test Microorganism**

To evaluate the antimicrobial activity of *c. flexuous* extracts, six species/ strains of microorganisms were selected, namely *Pseudomonas G-ve, E. coli, klebsiella pneumoniae, proteus mirabilis, staphylococcus G+ve, Enterococcus.* All these bacterial strains were collected from clinical lab and sub cultured in nutrient agar medium and used for antimicrobial susceptibility test.

**Antimicrobial Assay**

The potential activity of c. flexuous extract was studied through agar well diffusion method. the sterile petri dishes were filled with 25ml of agar and allowed the agar to get solidified. Prior to streaking the plates with bacterial culture, 5mm diameters wells were punched in the medium using a sterile borer. After the agar gets solidified the bacterial cultures were inoculated by spreading in the petri plates using sterile cotton swabs. Then 0.1 ml of plant extract in peptone water was directly applied to the well made on the surface of agar contain bacterial lawn. Positive control was maintained with different antibiotics and wells containing solvent alone was maintained as negative control. The inoculated plates were incubated overnight at 37° C for allowing the bacterial growth and the diameter of zone of inhibition was measured in mm.

## RESULTS

The results show that *C. flexuous* extract exhibit maximum zones of inhibition in methanol. It was observed that the *C. flexuous* extract exhibited maximum zone of inhibition against *E. coli, P. pneumoniae, P. mirabilis, Staphylococcus, Enterococcus, Pseudomonas aeruginosa.* Analyze data in the present work suggested that antibacterial activity of C. flexuous plant leaf extracts showed good results for gram-positive and gram-negative organisms. DPPH scavenging activity was highly elicited by the extract of *C. citratus*. chloroform, methanol and water extracts of *C. flexuous* leaves effectively decreased the extent of DNA damage.

**Table-4 the study of antimicrobial activity of Cymbopogon flexuous Extracts using Disk Diffusion Method**

| Bacteria name | Percentage of Inhibition | | | |
|---|---|---|---|---|
| | 25% | 50% | 75% | 100% |
| Pseudomonas G-ve | 8.80 | 3.30 | 5.70 | 7.70 |
| E.coli G-ve | 3.30 | 5.70 | 3.30 | 5.70 |
| Klebsiella pneumoniae G-ve | 9.10 | 7.70 | 7.70 | 3.30 |
| Proteus Mirabilis G-ve | 5.78 | 5.70 | 2.80 | 5.70 |
| staphylococcus G+ve | 8.80 | 5.70 | 3.30 | 4.70 |
| Enterococcus G+ve | 9.10 | 5.70 | 5.70 | 7.70 |

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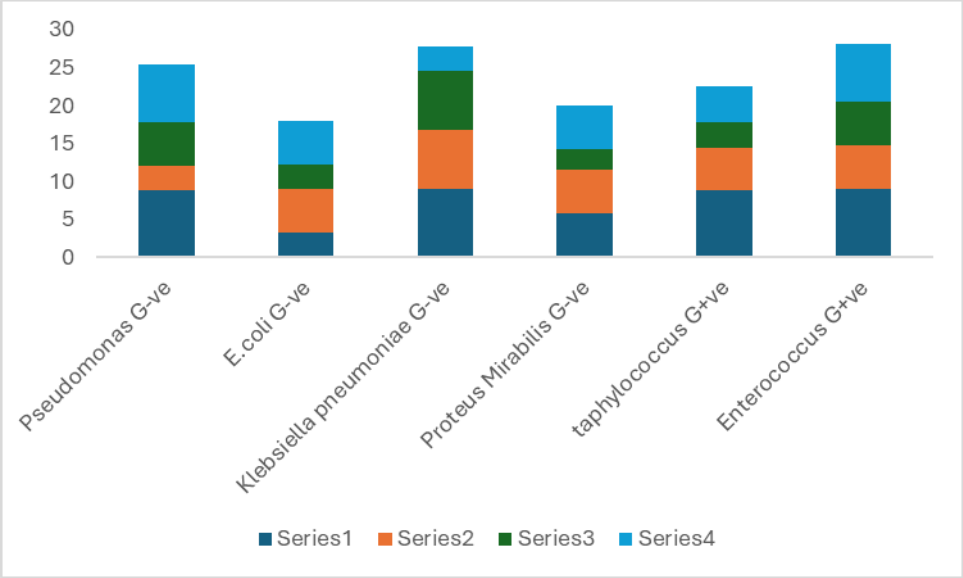


*Graph representing the inhibition of bacteria.*

## DISCUSSIONS

The *C. flexuous* plant, popularly known as lemongrass is widely used as a medicinal and condimentar plant. Cymbopogon flexuous essential oil and leaf extracts have been tested against several clinically relevant bacteria such as *Staphylococcus aureus. Salmonella Typhimurium, Escherichia coli, Listeria monocytogenes, Pseudomonas aeruginosa, Proteus mirabilis, Bacillus subtilis, and Streptococcus pyogenes.* This use is not random, this plant has compounds that confer biological properties, antioxidant and antimicrobial, as it is the case of EOs, secondary plant metabolites that are addressed in some studies (Rota et al., 2008; Sharma et al., 2009; Xiaofeng et al., 2018) and especially in this research, which describes results on its constitution and antibacterial activity. EO production is dependent on the early growth stages of leaf and inflorescence, respectively (Singh et al., 1989). The aqueous extracts also displayed antibacterial activity, though generally at higher MIC values compared to methanol extracts. In addition to inhibiting planktonic bacterial growth, *C. flexuous* essential oil significantly reduced biofilm formation, especially for S. aureus and P. aeruginosa, which is crucial since biofilms are often more resistant to conventional antibiotics.

## CONCLUSION

*Cymbopogon flexuous* (lemongrass) leaf extract demonstrates significant antimicrobial activity against various human pathogenic bacteria. The results show that C. flexuous extract exhibit ed maximum zones of inhibition in methanol it was observed that the C. flexuous extract exhibited maximum zones of inhibition *against E. coli, P. pneumoniae, P. mirabilis, Staphylococcus, Enterococcus, pseudomonas aeruginosa.* Analyzed data in the present work suggested that antibacterial activity of *C. flexuous* plant leaf extract showed good results for gram positive and gram-negative organisms. DPPH scavenging activity of highly elicited by the extract of *C. flexuous*. chloroform, methanol and water extract of *C. flexuous* leaves effectively decreased the extent of DNA damage. The antimicrobial effects are attributed mainly to the presence of bioactive compounds such as geranial and neural, which disrupt bacterial cell walls and membranes, leading to cell death. Additionally, Cymbopogon flexuous extracts exhibit antibiofilm properties, significantly reducing biofilm biomass and viability for pathogens like *S. aureus and P. aeruginosa.*

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## REFERENCES

1) Atleb, Erdourul OT. Antimicrobial activities of various medicinal and commercial plant extract. Turk. J Biol. 2003; 27:157-162.
2) Chamdit S, Siripermpool P. Antimicrobial effect of clove and lemongrass oil against planktonic cells and biofilms of Staphyloccus aureus. Mahidol. Pharm. Sci. 2012; 39(2):28-36.
3) Chinen-chun Li, Hsiang-Fu Yu, Chun-hua chang, Yun-ta liu, Hsien-tsung yao. Effects of lemon grass oil and citral on hepatic drug metabolizing enzymes, oxidative stress and
4) Danlami U, Rebecca A, Machan DB, Asuquo TS. Comparative study on the Antimicrobial activities of the Ethanolic extracts of Lemon grass and Polyalthia longifolia. J Appl. Pharm. Sci. 2011; 01(09):174-176.
5) De silva BCJ, Won-Gi jung, Sabrina hossain, SHMP wimalasena, HNKS Pathirana Gang-joon Heo. Antimicrobial property of lemongrass (Cymbopogon citrates) oil against pathogenic bacteria isolated from pet tutrtles. Lab. Anim. res. 2017; 33(2):84-91
6) Ewansiha JU, Garba SA, Mawak JD, Oyewole OA. Antimicrobial Activity of Cymbopogon citratus (lemon grass) and its Phytochemical Properties. Frontiers in Sci. 2012; 2(6):214-220.
7) Lutterodt GD, Ismail A, Basheer RH, Baharudin HM. Antimicrobial effects of Psidium guajava extracts as one mechanism of its antidiarrhoeal action. Malay. J Med. Sci. 1999; 6(2):17-20.
8) Mirghani MES, Liyana Y, Parveen J. Bioactivity analysis of lemongrass (Cymbopogon citratus) essential oil. In. Food Res. J. 2012; 19(2):569-575.
9) Oshiba S, Imai H, Tamada T. Oral antitumour drug for lung cancer. Europe. Pat, 1991, 393-973.
10) Parekh J, Chanda S. In vitro screening of antibacterial activity of aqueous and alcoholic extracts of various Indian plant species against selected pathogens from Enterobacteriaceae. Afr. J Microbiol. Res. 2007; 1(6):92 99.
11) Rangari vinod D. Pharmacognosy and phytochemistry, carrier publications. 2009; 1(2):380-381.
12) Reddy PS, Jamil k, Madhusudhan. Anti-bacterial activity of isolates from piper longum and taxas baccata. Pharma. Biol. 2001; 39:236-238.
13) Revathi K, Ashok kumar CK, Thamizhvanan K. Combined antimicrobial activity of lemongrass oil and Tulasi oil. In J Preclinical and Pharm. Res. 2012; 3(2):79 81.
14) Rota CM, Herrera A, Martínez RM, Sotomayor JA & Jordán MJ (2008) Antimicrobial activity and chemical composition of *Thymus vulgaris*, *Thymus zygis* and *Thymus hyemalis* essential oils. Food Control, 19:681-687.
15) Sharma PR, Mondhe DM, Muthiah S, Pal HC, Shahi AK & Saxena AK (2009) Anticancer activity of essential oil from *Cymbopogon flexuous* Chemical-Biological Interactions, 179:160-168.
16) Singh N, Luthra R & Sangwan RS (1989) Effect of leaf position and age on the essential quantity and quality in lemongrass (*Cymbopogon flexuous* Stapf.). Planta Medica, 55:254-256.
17) Xiaofeng Z, Guo Y, Guo L, Jiang H & Ji Q (2018) *In Vitro* Evaluation of Antioxidant and Antimicrobial Activities of *Melaleuca alternifolia* Essential Oil. BioMed Research International, p.01-08.