



Studies on Antibacterial Activities of *Cymbopogon citrates*

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Abstract:

Cymbopogon citratus is a perennial tropical grass is found in warm temperate and tropical climates around the world. Common names include Lemon grass. The plant possesses marked antibacterial and antifungal effects, as well as anti carcinogenic actions. Butanol extract of *Cymbopogon citrates* showed highest antimicrobial activity against all type of used microorganism. The all over data of antimicrobial activity showed that out of all 5 solvent extract, Butanol extract shows highest zone of inhibition from other. The analysis reflects that these solvent shows highest 24 mm zone of inhibition against *E. coli*.

In all over analysis Xylene extract of *Cymbopogon citrates* showed 2000 ug/ml MIC against *P. aeruginosa*. Lowest MIC in Acetone extract of *Cymbopogon citrates* showed by *P. vulgaris*-400 ug/ml whereas *K. terrigena* showed 800 ug/ml. The MIC increased in *S. typhimurium*, *P. mirabilis* and *S. aureus*-1000 ug/ml. In above analysis, 1200 ug/ml and 1500 ug/ml showed by *B. subtilis* and *E. coli* respectively whereas highest MIC shown by *P. aeruginosa*-2000 ug/ml. Butanol extract of *Cymbopogon citrus* showed most lowest MIC-300 ug/ml against *E. coli*. There was variation found in Methanol extract of *Cymbopogon citrus*, 400 ug/ml 600 ug/ml 800ug/ml, 1300 ug/ml, 1500 ug/ml shown by *S. aureus*, *K. terrigena*, *S. typhimurium*, *P. mirabilis* and *P. vulgaris*. *Cymbopogon citratus* showed antimicrobial activity against stomach diseases causing micro-organism. *Cymbopogon citrates* can be a good alternative for antibiotics.

Keywords:

Cymbopogon citrates, Antibacterial activity, enteric diseases.

Introduction:

The spread of drugs resistant pathogens is one of the most serious threats to successful treatment of microbial diseases. Throughout the ages essential oils and other extracts of plants have evoked interest as sources of natural products. They have been screened for their potential uses as alternative remedies for the treatment of many infectious diseases. The world Health Organization (WHO) noted that the majority of world's population depends on traditional medicine for primary healthcare. *Cymbopogon citratus* is a tall tropical grass that is part of the sugar cane family. It is tall perennial grass with slender sharp edge green leaves that have a pointed apex. It is native to warm temperate and tropical regions (Blessel *et al.*, 2002).

Cymbopogon citratus oil is used as a pesticide and preservative, it is used as an antifungal agent (Shadab *et al.*, 2001). It is used as perfumes in soap, creams, candles and detergents. *Cymbopogon citratus* tea can be used to treat fever, cold, cough and stomach upset (Leite *et al.*, 2000). The tea has





diuretic properties and water retention making it helpful in individual with high blood pressure. *Cymbopogon citratus* can be used in herbal medicine to treat nervous condition and inflammation. It can also be used to treat chest infections, sores, muscle cramps and headache (Leite *et al.*, 2000). Medicinal plants are very important to human beings in preserving our health (Bhagwati *et al.*, 2003). The use of antibiotics to control diseases produces adverse toxicity to the host organ, tissues and cells.

Fresh *Cymbopogon citratus* contains approximately 0.4% volatile oil. The oil contains 65% to 85% citral. Citral a key chemical found in *Cymbopogon citratus* is an ingredient in a variety of foods and beverages (including alcohol). The antibacterial properties of the essential oil have been studied. These activities are shown in two of the three main components of the oil identified through Chromatography and mass spectrometric methods.

In the past, there have been reports on prevalence of infections caused by *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* and these organisms show resistant to most commonly used drugs. The anti microbial and the antibacterial activities have been reported on the methanolic extract of these plants (Babayi *et al.*, 2004; Mehraban *et al.*, 2005; Rogerio *et al.*, 2004). *Cymbopogon citratus* are used traditionally for the treatment of malaria and typhoid fever. Concentration prepared by the combination of the leaves and grass of these plants or the boiling of the individual plant leaves have been used in the treatment of ailments like typhoid fever, stomach ache etc. (Udeh *et al.*, 2001).

Cymbopogon citratus is an aromatic perennial tall grass with rhizomes and densely tufted fibrous root. It has short underground stems with ringed segments, coarse, green slightly leathery leaves in dense clusters. (Carlin, *et al.*, 1986). The plant is a native herb from India and cultivated in other tropical and subtropical countries. (Figueirinha, *et al.*, 2008) It is used as traditional folk medicine in the treatment of nervous, gastrointestinal disturbances fever and hypertension. (Borrelli, *et al.*, 2000, Melo, *et al.*, 2002). It is taken as tea to remedy digestive problems; diarrhea and stomach ache (Carlin, *et al.*, 1986). As a medicinal plant, *Cymbopogon citratus* has been considered a carminative and insect repellent. Studies on extracts from *Cymbopogon citratus* leaves have demonstrated anti-inflammatory, vasorelaxing, diuretic and valuable remedy in treating ringworm as a local application (Melo, *et al.*, 2001; Rennie, *et al.*, 2004).

Butanol extract exhibits high inhibitory activity against all the tested bacterial in order of sensitivity as *Staphylococcus aureus* > *Salmonella typhimurium* > *Bacillus aureus* > *Escherichia coli*, while aqueous extract was more active against *Salmonella typhi*, at the tested concentrations (Omotade I. Olyede, 2009). The antimicrobial activity of ethanolic extracts of *Cymbopogon*





citratus and *Polyaithia Longifolia*. were determined for the various organisms which ranged between 0.01 and 2.5 mg/ml, while the minimum bactericidal concentration (MIC) ranged between 0.02 and 2.5 mg/ml (Uzama Danlami et al., 2011).

Material and methods:

The *Cymbopogon citratus* was collected from Katol Dist. Nagpur (MS). The *Cymbopogon citratus* were separated and screened, washed in clean water and dried at room temperature. The dried leaves were milled to a powder and stored in the closed container in at room temperature. The extraction was done by using standard procedure (Uzama 2009).

Antimicrobial Activity Screening:

The antimicrobial study was determined by the paper disc diffusion (*Kirby and baur*) method by using Mueller- Hinton medium. A total of 8 microbial strains used to observe the antibacterial activity of *Cymbopogon citratus*. All the strains were procured from NCIM, Pune. Make their sub culturing in a nutrient agar slant and nutrient broth. Incubate them at 37°C.

The antimicrobial activity was determined by paper disc diffusion method using Mueller Hinton Agar plates previously inoculated with 18hr old Nutrient broth Culture (Macferl and standard method) for the bacteria as a test organism. Sterilized paper Disc (6mm) soaked in a known concentration of the crude extract (5000 microgram/ml per disc) in DMSO were applied over each of the culture plates previously seeded with bacteria.

Antibiotic Sensitivity Test:

A total of 5 antibiotics used against the all 8 bacterial strains followed by described procedure for comparison. Antibiotic sensitivity test will be performed by the commonly used agar diffusion method.

Minimum Inhibitory Concentration MIC:

The minimum inhibitory concentration was determined by incorporating various concentration of solution of extract on Mueller Hinton Agar. A positive control containing only the growth medium and extract was also set up. The minimum inhibition concentration was regarded as the lowest concentration of the extract that did not permit any visible growth of the organism. Minimum inhibitory concentration of the crude extracts was determined by using the paper disc soaked method in different concentration dispersed in extract of 10-2000 ug/ml. Allow it to incubate at 37°C for 24 hr. The minimum inhibitory concentration of each sample was determined by measuring the optical density in the spectrophotometer (620 nm) the lowest concentration that yielded no bacterial growth was taken as the minimum bactericidal concentration.

Result and discussion:





In the present study a total of five solvents used for extraction of *Cymbopogon citrates* against 8 bacterial strains. All the obtained extracts apply for the antimicrobial activity which was compared with antibiotic susceptibility.

The methanol extract showed, 16 mm zone of inhibition against *E. coli*, simultaneously it showed 17 mm, 14 mm, 12 mm, 13 mm, 14 mm and 16 mm zone of inhibition against *S. aureus*, *B. subtilis*, *P. vulgaris*, *K. terrigena*, *P. mirabilis*, *P. aeruginosa* and *S. typhimurium* respectively. The data showed that Methanol extract showed highest zone of inhibition against *S. aureus* (17 mm)(Fig.1).The analysis reflects that these solvent shows highest 24 mm zone of inhibition among all against *E. coli*. It indicates that, these extract can be used to controlling enteric infection.

Butanol extract of *Cymbopogon citratus* shows highest Zone of inhibition against *E.coli* (24). It means *E. coli* shows strong sensitivity against the Butanol extract of *Cymbopogon citratus*. In the present study all 8 bacterial strains were also assessed for Antimicrobial Sensitivity and Resistance pattern for comparison, simultaneously the findings were indicated that *E.coli* showed Highest Sensitivity against Ofloxacin. Whereas, *B. subtilis* showed significant resistance towards Ofloxacin.

Out of all the organisms, 3 organisms showed an intermediate sensitivity against Ciprofloxacin, kanamycin, Levofloxacin are, *P. vulgaris*, *K. terrigena*, *S. aureus*. It means that these bacteria growth get moderately inhibited and affected by Ciprofloxacin, Kanamycin, Levofloxacin Remaining all bacteria shows sensitivity against respective antibiotics.

Minimum Inhibitory Concentration (ug/ml):-

The highest minimum inhibitory concentration Shown by the Ethyl Ether extract was (2000ug/ml) against *S. aureus*, *P. aeruginosa*. Xylene extract of *Cymbopogon citrates* showed intermediate MIC. 1000, 1300, 1200 1500 and 2000 ug/ml were obtained against *E. coli*, *S.aureus*, *K. terrigena*, *P. mirabilis* and *S. typhimurium*, *P. vulgaris*, *B. subtilis* respectively. In all over analysis Xylene extract of *Cymbopogon citrates* showed 2000 ug/ml against *P. aeruginosa*.

Acetone extract given Lowest MIC, against *P. vulgaris* (400 ug/ml) whereas *K. terrigena* showed 800 ug/ml. The MIC increased in *S. typhimurium*, *P. mirabilis* and *S. aureus* -1000 ug/ml. In above analysis, *B. subtilis* and *E. coli* showed 1200 ug/ml and 1500 ug/ml MIC respectively whereas highest MIC shown by *P.aeruginosa*-2000 ug/ml.

Butanol extract of *Cymbopogon citrus* showed most lowest MIC-300 ug/ml by *E. coli* and 400 ug/ml showed by *B. subtilis*, *S. typhimurium*, 600 ug/ml shown by *K. terrigena* whereas *S. aureus* and *P. aeruginosa* showed 800 ug/ml. Highest MIC showed by *P. mirabilis*-1200 ug/ml. Also another highest





inhibitory concentration shown by the Acetone extract was 2000 ug/ml against *P. aeruginosa*. IT means that *P. aeruginosa* is less sensitive with Acetone extract of Cymbopogon citrates. Lowest inhibitory concentration shown by Butanol extract was (300 ug/ml) against *E. coli*. It means that *E. coli* is more sensitive with Butanol extract of Cymbopogon citrates.

Sr. No.	Antibiotics Used	Concentrations
1	Ciprofloxacin	5 mcg
2	Ofloxacin	5 mcg
3	Levofloxacin	5 mcg
4	Kanamycin	30 mcg
5	Norfloxacin	10 mcg

Sr	Starins	Methanol Extract	Butanol Extract	Acetone Extract	Xylene Extract	Ethyl Ether Extract
1.	<i>E. coli</i>	16	24	12	13	12
2.	<i>S. aureus</i>	17	15	14	12	11
3.	<i>B. subtilis</i>	14	17	13	11	13
4.	<i>P. vulgaris</i>	12	14	17	14	14
5.	<i>K. terrigena</i>	15	16	15	12	12
6.	<i>P. mirabilis</i>	13	12	14	13	11
7.	<i>P. aeruginosa</i>	14	15	11	11	12
8.	<i>S. typhimurium</i>	16	17	14	14	11

Sr. no	MO's	Methanol Extract	Butanol Extract	Acetone Extract	Xylene Extract	Ethyl Ether Extract
1.	<i>E. coli</i>	600	300	1500	1300	1500
2.	<i>S. aureus</i>	400	800	1000	1500	2000
3.	<i>B. subtilis</i>	1000	400	1200	1000	1200
4.	<i>P. vulgaris</i>	1500	1000	400	1000	1000
5.	<i>K. terrigena</i>	800	600	800	1500	1500
6.	<i>P. mirabilis</i>	1300	1200	1000	1200	2000
7.	<i>P. aeruginosa</i>	1000	800	2000	2000	1500
8.	<i>S. typhimurium</i>	600	400	1000	1000	2000

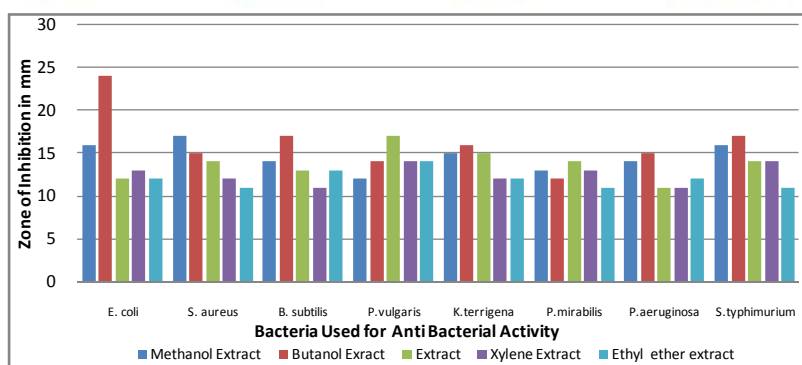


Figure 1: Anti Bacterial activity of Cymbopogon citratus



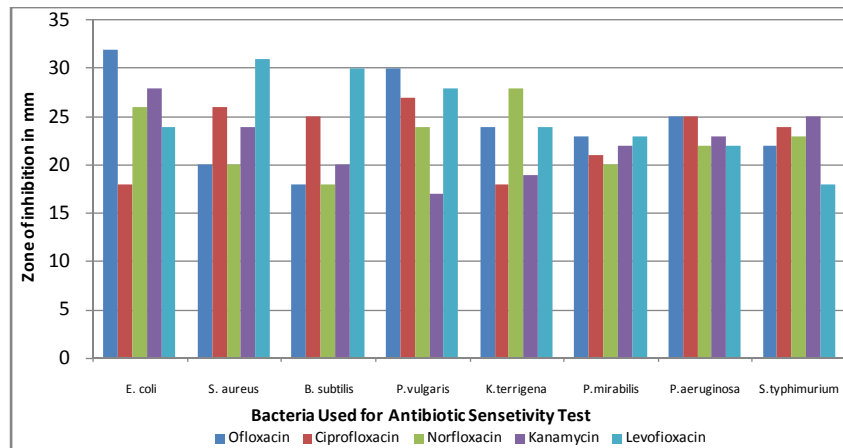


Figure 2:- Antibiotic sensitivity pattern.

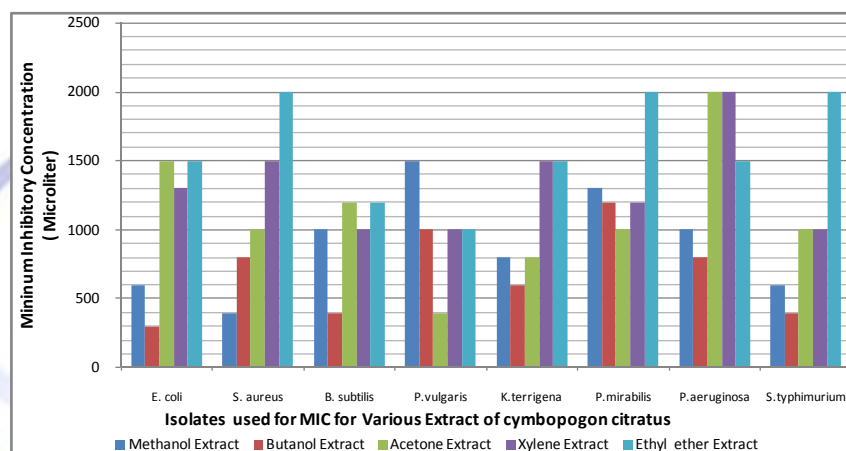


Figure 3:- Minimum Inhibitory concentrations

Conclusion:

Butanol extract of *Cymbopogon citratus* showed highest antimicrobial activity against all type of used microorganism. The same extract showed maximum antimicrobial activity against *E. coli* besides these all the extracts. The lemon grass showed low antimicrobial activity against used gram positive bacteria as compared to gram negative bacteria. Study analysis also concluded that the butanol extract showed highest minimum inhibitory concentration (300 ug/ml) against *E. coli*. Hence it can be recommended as remedies for enteric infection and can be used for remedies for water born disease. *Cymbopogon citratus* showed antimicrobial activity against stomach diseases causing micro-organism. *Cymbopogon citratus* can be a good alternative for antibiotics.



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References:

Babayai, (2004): Mehraban 2005, Rogeorio .,4(7):685-688.

Bhagwati U., (2004): Utilization of medicinal plants by rural women of Kulu, Indian J. Trad. K . 45; 366-3702 (2). 243-252.

Borrelli F. and Izzo A. A., (2000): The plant kingdom as a source of antiulcer remedies. *Phytother.Res.*, 14(8): 581-591.

Bleasel N., Tate B. and Rademaker M., (2002) Allergic contact dermatitis following exposure to essential oils august,Australas. J. Dermatol.43 (3): 211-3.

Carlin E., Contar J. de, D. P. and Silva-Filho., (1986): pharmacology of lemon grass (*Cymbopogon citrates Stapf*)

Leite J. R., Seabra Mde L. and Maluf E., (1986): *Pharmacology of Cymbopogon citratus (Cymbopogon Citratus Stapf). III. Assessment of eventual toxic, Hypnotic and anxiolytic effects on humans* July. *J Ethnopharmacol* 17 (1): 75-83.

Melo, S.F., Soaress S.F., Coasta R. F., Silva C.R, Oliveira, M.B.N., Bezerra R.J.A., Caldeira De Araujo A. and Bernardo-Fillo M., (2001) :Effect of Cymbopogon citrates against the stannous choride oxidative damage in Escherichia coli. *Mutat. Res.*, 496,33-38.

Shadab, Q., Hanif, and Chaudhary, F.M., (1992): Antifungal avtivity by lemon grass essential oils. *Pak. J.Sci. Ind. Res.* 35, 246-249.

Udeh Herken E. E., (2009) : Antioxidant activity, Phenolic content of essential oils and extracts of some medicinal. 12(1): 198-202.

Uzama D., Amadu R. and David B. M., (2011): Comparative study on antimicrobial activities of the Ethanolic extracts of lemon grass and Polyaltia longifolia. *journal of applied pharmaceutical science* 01(09):174-176.

