

Protective effect of *Lannea coromandelica* Houtt. Merrill. against three common pathogens

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ABSTRACT

Background: Ayurvedic text reports suggested *Lannea coromandelica* is used in various microbial origin disorders like dysentery, sore eyes and leprosy, genital wounds. **Objective:** The present study was designed to investigate the antimicrobial effect of *L. coromandelica* Houtt. Merrill. (Anacardiaceae) on microbes which cause female reproductive tract infection. **Materials and Methods:** Ethanolic and aqueous bark extract (Ext.) of *L. coromandelica* were screened against strains of *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Candida albicans*. Antimicrobial assay had been done with agar well diffusion method. **Results:** Ethanolic extracts [100% (16 mg), 75% (12 mg) and 50% (8 mg)] of *L. coromandelica* exhibited zone of inhibition (ZI) 19.21 mm, 18.45 mm, 16.41 mm and 18.12 mm, 17.35 mm, 16.35 mm against *S. aureus* and *S. pyogenes*, respectively. However, only 100% and 75% ethanolic extract showed (ZI-19.18 mm, 16.29 mm) activity against *C. albicans*. Nevertheless, aqueous extract (100%) showed higher antifungal activity (ZI-16.97 mm). Ciprofloxacin and amphotericin B were used as a standard drugs in the present study. **Conclusion:** The results demonstrated that *L. coromandelica* Houtt. Merrill. have antibacterial activity against *S. pyogenes*, *S. aureus* and antifungal property against *C. albicans*. Our findings corroborate the ethnobotanical use of *L. coromandelica* in traditional medicine system (Ayurveda) of India.

Key words: Agar well diffusion method, antibacterial, antifungal, ayurveda, *Candida albicans*, female reproductive tract infection, *Lannea coromandelica*, *Staphylococcus aureus*, *Streptococcus pyogenes*

INTRODUCTION

Reproductive tract infections (RTIs) are recognized as a serious global health problem with impact on women and men, their families, and communities. These infections have second rank after maternal morbidity and mortality as the cause of healthy life loss among women of reproductive age in developing countries.^[1] The estimate indicates that about 40% of women have RTI/STI at any given point of time in India.^[2] RTIs include endogenous

infections, iatrogenic infections, and sexually transmitted infections (STIs).^[3] If left untreated, RTIs can have severe consequences, including infertility, ectopic pregnancy, cervical cancer, menstrual disturbances, pregnancy loss, chronic pelvic pain, miscarriage, low birth weight babies, and increased risk of HIV transmission.^[4] Pathogenic organisms that are responsible for RTI's are *Gardnerella vaginalis*, *Mobiluncus* spp., *Mycoplasma* spp., *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Chlamydia trachomatis*, *Bacteroides*, *Neisseria gonorrhoeae*, *Klebsiella pneumoniae*, *Treponema pallidum*, *Mycoplasma hominis*, *Actinomyces israelii*, *Pseudomonas*, *Mobiluncus* spp. *Streptococcus* both hemolytic and anerobic pathogens, HPV and HSV viruses as a minimum. Besides bacteria, fungi *Candida albicans* and protozoa *Trichomonas vaginalis* are also responsible for RTI.

Present medical therapy for RTI comprises the use of systemic or topical antibiotic, antifungal, and antiprotozoal preparations. RTI being a disorder of multifactorial etiology, a single-line therapy is often inadequate and recurrence is a common complication. Nevertheless, these medications may temporarily reduce infection; they often disrupt the balance of genital bacterial flora (pathogenic vs. nonpathogenic) and often lead to recurrent infection. Therefore, as complementary to these medications (there

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are no large scale clinical studies to prove this point); herbal therapy is gaining popularity in women on account of its lesser side effects and restoration of the normal vaginal Flora.^[5-7]

L. coromandelica Hoult. Merrill. belongs to family Anacardiaceae known as *Jhingini* in Sanskrit and woder or Indian ash tree in English is located in tropical Asia. It is large deciduous tree, up to 15-20 m tall, thick trunk, leaves imparipinnate, 25-45-cm long, crowded at the end of branches, leaflets 3-7 pairs, elliptic oblong or ovate-elliptic, bark grey or whitish, exfoliating in irregular rounded plates, appearing when the tree is bare of leaves, yellowish green, crowded in cymose fascicles, fruit drupe, reniform, and red when ripe. Seed solitary, compressed, a mucilagenous gum, known as Jhingan gum, exudes from wounds and cracks in the bark, yellowish white when fresh, turning brown, and ultimately black on drying.

Furthermore, various part of plant contains polyphenols and flavonoids. Polyphenols include tannins like ellagic acid and Gallic acid. Some flavonoids like quercetin, kaempferol, isoquercetin, and gums and mucilage which on hydrolysis gives Arabino-3, 6-galactan containing D-galactose, L-arabinose, 4-O-methyl uronic acids, L-rhamnose and Proteins. Additionally, some sterols have been isolated including β -Sitosterol. In addition to that some other flavonols like physicion, leucocyanidine, and leucodelphinidin have been isolated.^[8]

L. coromandelica have been documented for its potential as anti-inflammatory^[9] anti-microbial,^[10,11] hypotensive,^[12] wound healing,^[11] and aphrodisiac activities. The plant also illustrated its beneficial effect on ulcerative stomatitis, dyspepsia, general debility, gout, cholera, diarrhoea, dysentery,^[13] sore eyes, leprosy, sprains and bruises,^[14] elephantiasis,^[15] eruptions, snakebite, stomach ache, and vaginal trouble.^[16-18] Moreover, the plant gum is given in sprains,^[19] asthma and as a cordial to women during lactation.^[20,21]

However, its potential in RTI is not explore yet. Therefore, the present study was design to investigate the role of ehtanolic and aqueous bark extract of *L. coromandelica* in RTI.

MATERIALS AND METHODS

Plant material

Bark of *L. coromandelica* Hoult. Merrill. was collected from forest of Rawatbhata near Kota, Rajasthan. The sample specimen of *L. coromandelica* was identified and authenticated by Dr. P. M. Padhye, Scientist "E" and Head of office, Botanical Survey of India, Jodhpur Rajasthan, letter no. BSI/AZC/I/120/2/2011-12/Tech. (Pl.Id.)/501 dt. 08.12.2011.

The bark was shades dried under room temperature for 1 month, and coarsely powdered by using mixer grinder and were packed separately in air-tight containers.

Extraction of plant material

The bark powder was subjected to continuous extraction in a Soxhlet apparatus. Two different solvents ethanol and distilled water were used for extraction. For each extraction 10-g powder was packed in soxhlet apparatus separately with 100 ml of ethanol and 100 ml of distilled water. The solvent was heated to boil on heating mantle and was subjected to extraction for 12 h. Each extract was filtered through a sterilized Whatman filter paper and the filtered extracts were concentrated to a dry mass by concentrating on rota evaporator, and keeping it in dessicator. Percentage yield for ethanolic and aqueous extract were found to be 10.44% and 14.58%, respectively. It was then autoclaved at 121°C and 15 lbs pressure and then stored at 4°C.

Microbial strains

The micro-organisms used for antimicrobial screening were selected which are common in female genital tract infection. Two bacteria *S. pyogenes* (MTCC 1928), *S. aureus* (MTCC 3160), and fungi *C. albicans* (MTCC 183) were selected. These organisms were procured from Institute of Microbial Technology (IMTECH-CSIR), Chandigarh, India. The microorganisms were sub-cultured on the specific media recommended for different microorganisms such as Nutrient agar for both bacteria and Sabouraud Dextrose Agar (SDA) for *C. albicans*.

Chemicals

Ciprofloxacin (CDH, New Delhi) and Amphotericin B was obtained from Bio basic Inc. Yeast extract, Beef extract, Peptone, Dextrose (Himedia, Mumbai, India), Agar, and Ethanol (S.D. Fine, Mumbai India) were procured for the present study. All the chemicals used in the present study were of analytical grade.

Antimicrobial assay

In vitro antibacterial activity and antifungal activity of aqueous and ethanol extract were assessed by the agar well diffusion method.^[22] In this method, pure isolate of each microbe was subcultured on the recommended specific media for each microorganism at 35-37°C for 25 h. Inoculums of each test organisms were spread on the specific media to achieve a confluent growth. The agar plates were allowed to dry and wells of 6 mm were made with a sterile cork borer in the inoculated agar plates. Then mother stocks of sample 200 mg/ml were prepared and then further dilutions of 100% (200 mg/ml), 75% (150 mg/ml), and 50% (100 mg/ml) were prepared. An 80- μ l volume of each dilution of each extract 100% (16 mg), 75% (12 mg), and 50% (8 mg) was propelled directly into

the wells (in triplicates) of the inoculated specific media agar plates for each test organism. The plates were then incubated at 37°C in an incubator for 16-18 h (for antifungal activity the plates were incubated for 22-24 h).

Ciprofloxacin was used as standard for antibacterial (stock 10 µg/ml) and amphotericin B for antifungal (stock 10 µg/ml). After incubation period, each plate was examined. The diameters of the zones of complete inhibition (as judged by the unaided eye) are measured, including the diameter of the disc. Zones were measured to the nearest whole millimeter, using sliding calipers. This was held on the back of the inverted Petri plate. The experiments were performed in triplicates and the mean values of the diameter of inhibition zones with standard deviation were calculated.

RESULTS AND DISCUSSION

The results of antimicrobial activity of the ethanolic and aqueous extracts of *L. coromandelica* on three microbes (two bacteria and one fungi) by agar well diffusion method have been shown in Tables 1 and 2.

Activity against *S. aureus*

From the evaluation of data, it is evident that ethanolic extract has higher antibacterial activity against *S. aureus*. One hundred percent, 75%, 50% concentrations have 124.97%, 119.98%, 106.72% activity, respectively, [with the mean diameter of the zone of inhibition (ZI) being 19.21 mm,

18.45 mm, 16.41 mm] as compared with control drug i.e., 100% (Ciprofloxacin, zone of inhibition 15.37 mm) [Figure 1]. While aqueous extract has higher activity only in 100% concentration i.e., 126.38% (ZI-19.76 mm) as compared with control drug (ZI-15.64 mm). However, 75%, 50% concentrations showed sensitivity 92.92% and 79.45% (ZI-14.53 mm and 12.42 mm), respectively.

Activity against *S. pyogens*

Analysis of agar well plates showed that ethanolic extract has higher activity against *S. pyogens*. 100%, 75%, 50%, concentrations have 117.09%, 112.08%, 105.66% (with the mean diameter of the zone of inhibition being 18.12 mm, 17.35 mm, 16.35 mm) activity, respectively, as compared with control drug (ZI-15.48 mm) and aqueous extract have higher activity only in 100%, 75% concentration i.e., 119.97%, 101.93% (ZI-19.18 mm, 16.29 mm), respectively, while 50% concentration showed 84.34% (ZI-13.48 mm) activity [Figure 2].

Activity against *C. albicans*

From the data present in Tables 1 and 2 it was concluded that only 100% concentration (ZI 16.97 mm) of aqueous extract was higher than the control (Amphotericin-B, with the mean diameter being 14.17 mm), and in 75%, 50% concentrations showed 93.48%, 76.88% (ZI-13.25 mm, 10.89 mm) activity. However, ethanolic extract showed lesser activity as compared with control drug i.e., 95.58%, 80.02%, 66.24% (ZI-13.20 mm, 11.05 mm, 9.15 mm), respectively for 100%, 75%, and 50% concentrations [Figure 3].

Table 1: Zone of inhibition of aqueous ext. of *Lannea coromandelica* on microbes

| Aqueous extract | | | | |
|------------------------------|----------|----------|----------|--------------------------|
| <i>Staphylococcus aureus</i> | 100% | 75% | 50% | Control (ciprofloxacin) |
| 1. | 19.79 | 14.53 | 12.45 | 15.16 |
| 2. | 19.68 | 14.48 | 12.32 | 16.14 |
| 3. | 19.83 | 14.59 | 12.51 | 15.62 |
| Mean | 19.76667 | 14.53333 | 12.42667 | 15.64 |
| SD | 0.077675 | 0.055076 | 0.097125 | 0.490306 |
| <i>Streptococcus pyogens</i> | 100% | 75% | 50% | Control (ciprofloxacin) |
| 1. | 19.15 | 16.13 | 13.55 | 15.82 |
| 2. | 19.27 | 16.35 | 13.42 | 16.02 |
| 3. | 19.12 | 16.41 | 13.48 | 16.12 |
| Mean | 19.18 | 16.29667 | 13.48333 | 15.98667 |
| SD | 0.079373 | 0.147422 | 0.065064 | 0.152753 |
| <i>Candida albicans</i> | 100% | 75% | 50% | Control (Amphoterecin B) |
| 1. | 16.78 | 13.32 | 11.82 | 14.26 |
| 2. | 16.89 | 12.97 | 10.73 | 14.23 |
| 3. | 17.24 | 13.46 | 10.14 | 14.03 |
| Mean | 16.97 | 13.25 | 10.89667 | 14.17333 |
| SD | 0.240208 | 0.252389 | 0.852311 | 0.125033 |

SD=Standard deviation

Table 2: Zone of inhibition of Ethanolic ext. of *Lannea coromandelica* on microbes

| Ethanolic extract | | | | |
|------------------------------|----------|----------|----------|--------------------------|
| <i>Staphylococcus aureus</i> | 100% | 75% | 50% | Control (ciprofloxacin) |
| 1. | 19.15 | 18.43 | 16.45 | 15.17 |
| 2. | 19.26 | 18.53 | 16.41 | 15.24 |
| 3. | 19.24 | 18.39 | 16.37 | 15.72 |
| Mean | 19.21667 | 18.45 | 16.41 | 15.37667 |
| SD | 0.058595 | 0.072111 | 0.04 | 0.299388 |
| <i>Streptococcus pyogens</i> | 100% | 75% | 50% | Control (ciprofloxacin) |
| 1. | 18.02 | 17.44 | 16.34 | 15.34 |
| 2. | 18.21 | 17.36 | 16.46 | 15.28 |
| 3. | 18.15 | 17.25 | 16.27 | 15.82 |
| Mean | 18.12667 | 17.35 | 16.35667 | 15.48 |
| SD | 0.097125 | 0.095394 | 0.09609 | 0.295973 |
| <i>Candida albicans</i> | 100% | 75% | 50% | Control (Amphoterecin B) |
| 1. | 15.62 | 12.73 | 9.83 | 14.16 |
| 2. | 12.14 | 10.62 | 8.96 | 13.24 |
| 3. | 11.86 | 9.82 | 8.67 | 14.05 |
| Mean | 13.20667 | 11.05667 | 9.153333 | 13.81667 |
| SD | 2.094692 | 1.503341 | 0.603683 | 0.502427 |

SD=Standard deviation

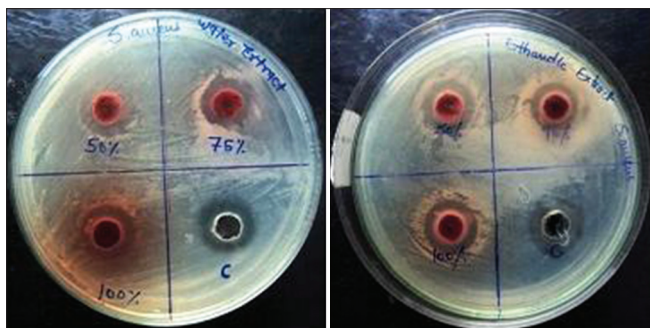


Figure 1: Zone of inhibition of *Lannea coromandelica* against *Staphylococcus aureus*

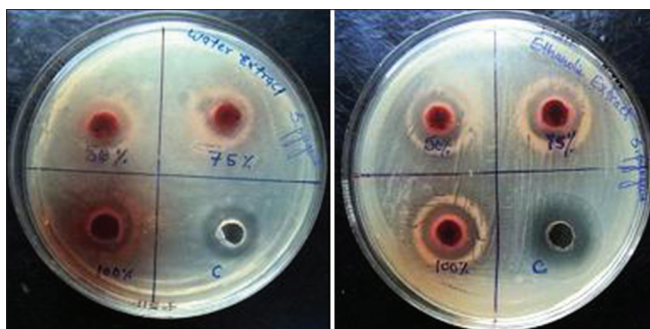


Figure 2: Zone of inhibition of *Lannea coromandelica* against *Streptococcus pyogenes*

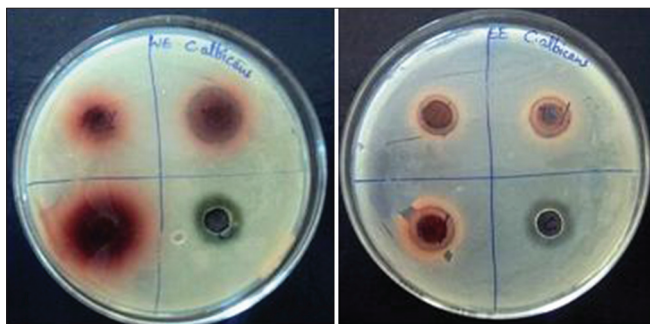


Figure 3: Zone of inhibition of *Lannea coromandelica* against *Candida albicans*

The preliminary phytochemical analysis revealed the presence of flavonoids, triterpenoids, phenols, gallic tannins, coumarins in *L. coromandelica*.^[23-25] The major active ingredient responsible for antimicrobial activity of *L. coromandelica* is flavonoids, the major group of phenolic compounds reported for their antimicrobial,^[26] while coumarins reported for antibacterial^[27] and antifungal.^[28]

CONCLUSIONS

Based on our findings, it is concluded that *L. coromandelica* bark extracts have immense potential as antimicrobial and antifungal compounds against microorganisms and they can be used in the treatment of female RTI caused by microorganisms. Ethanolic bark extract

showed stronger activity against all the tested bacterial strains. However, aqueous extract demonstrated higher antifungal activity. Therefore, *L. coromandelica* can be selected for further analysis. It can be used to discover bioactive natural products that may serve as leads in the development of new antimicrobials that address unmet therapeutic needs.

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REFERENCES

- Jindal N, Aggarwal A, Gill P, Sabharwal B, Sheevani BB. Community-based study of reproductive tract infections, including sexually transmitted infections, among the rural population of Punjab, India. *Indian J Community Med* 2009;34:359-61.
- National AIDS Control Organization, Ministry of Health and Family Welfare; Government of India. National Guidelines on Prevention, Management and Control of Reproductive Tract Infections including Sexually Transmitted Infections. 2007. Available from: http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---ilo_aids/documents/legaldocument/wcms_117313.pdf [Last updated on 2013 Jan 15; Last cited on 2012 Jan 23].
- Muula A, Geubbels E. Epidemiology of reproductive tract infections (RTIs) in Malawi. *Malawi Med J* 2006;18:175-88.
- Rabiu KA, Adewumi AA, Akinlusi FM, Akinola OI. Female reproductive tract infections: Understandings and care seeking behaviour among women of reproductive age in Lagos, Nigeria. *BMC Women's Health* 2010;10:8.
- Boskey ER. Alternative therapies for bacterial vaginosis: A literature review and acceptability survey. *Altern Ther Health Med* 2005;11:38-43.
- Van Kessel K, Assefi N, Marrazzo J, Eckert L. Common complementary and alternative therapies for yeast vaginitis and bacterial vaginosis: A systematic review. *Obstet Gynecol Surv* 2003;58:351-8.
- Neri A, Rabinerson D, Kaplan B. Bacterial vaginosis: Drugs versus alternative treatment. *Obstet Gynecol Surv* 1994;49:809-13.
- Reddy AK, Joy JM, Kumar A. *Lannea coromandelica*: The researcher's tree. *J Pharm Res* 2011;4:577-9.
- Saravanan S, Dhasarathan P, Indira V, Venkataraman R. Screening of anti inflammatory potential of chosen medicinal plants using swiss albino mice. *Aust J Basic Appl Sci* 2010;4:6065-8.
- Basuri TS, Patil C, Dhal NK. *In vitro* evaluation of antibacterial activity of crude ethanolic extract of *Lannea coromandelica*. *J Pharm Res* 2011;4:1246-7.
- Sathish R, Mohd HA, Natarajan K, Lalitha KG. Evaluation of wound healing and antimicrobial activity of *Lannea coromandelica* (Houtt) Merrill. *J Pharm Res* 2010;3:1225-8.
- Singh S, Singh GB. Hypotensive activity of *lannea coromandelica* bark extract. *Phytother Res* 1996;10:429-30.
- Jain SK, Tarafder CR. Medicinal plants-lore of the sandal-A revival of PO Boddington's work. *Econ Bot* 1970;24:241-78.
- Kirtikar KR, Basu BD. In: Mhaskar KS, E-Blatter, Caius JF, editor. *Indian Medicinal Plants*. Vol. 3. New Delhi: Sri Satguru Publications; 2000. p. 933-6.

15. Shah GL, Yadav SS, Badri N. Medicinal plants from Dahanu forest division in Maharashtra state. J Econ Tax Bot 1983;4:141-51.
16. Shastri K, Chaturvedi G. Charaka Samhita: Vidyotini commentary. Varanasi: Chaukhambha Bharti Academy; 2004.
17. Yadava T, Narayana R. Sushruta Samhita. 7th ed. Varanasi: Chaukhambha Orientalia; Sutra sthana Chapter 38 Shloka no. 14, 2002.
18. Sharma S. Ashtanga Sangraha: Shashilekha Commentary. 2nd ed. Varanasi: Chaukhambha Sanskrit Office; Sutra sthana Chapter 16, Shloka no. 18-19, 2008.
19. Kunte AM, Shastri KR. Ashtanga Hridaya: Sarvanga Sundara and Ayurveda Rasayana commentary. Varanasi: Chaukhambha Surbharti Prakashan; Uttar sthana Chapter 40, Shloka no. 52 2007.
20. Anonymous, Medicinal Plants of India. Vol. 2. New Delhi: ICMR; 1987. p. 129-33.
21. Anonymous, The Wealth of India. Vol. 4. New Delhi: NISCAIR Press; 2005. p. 27-9.
22. Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. Am J Clin Pathol 1966;45:493-6.
23. Krishnaiah PV, Ratnam KV, Venkata RR. Preliminary Phytochemical evaluation of certain anticancer crude drugs used by adivasis of rayalaseema region, Andhra Pradesh, India. Ethn Bot Leaflets 2008;12:693-7.
24. Islam MT, Tahara S. Dihydroflavonols from *Lannea coromandelica*. Phytochemistry 2000;54:901-7.
25. Sankara SS, Nair AG. Angiospermae dicotyledonae anacardiaceae polyphenols of *lannea coromandelica*. Phytochemistry 1971;10:1939-40.
26. Toda M, Okubo S, Ohnishi R, Shimamura T. Antibacterial and bactericidal activity of Japanese green tea. Nippon Saikingaku Zasshi 1989;44:669-72.
27. Fernandez MA, Garcia MD, Saenz MT. Antibacterial activity of the phenolic acids fraction of *Scrophularia frutescens* and *S. sambusifolia*. J Ethnopharmacol 1996;53:11-4.
28. Hoult JR, Paya M. Pharmacological and biochemical actions of simple Coumarins: Natural products with therapeutic potential. Gen Pharmacol 1996;27:713-22.

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