Evaluation of Phytochemical Screening and Antibacterial Activity of *Latana Camara* Linn. Extract Used As Antibacterial Finish on Fabrics

Naseera S M[1]*, Dr. Prabha R[2]

[1] *Research Scholar, Department of Textiles and Clothing, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India.*
naseera.smn@gmail.com, https://orcid.org/0009-0006-7839-2288

[2] *Assistant Professor (SG), Department of Textiles and Clothing, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India.*
https://orcid.org/0000-0002-9184-8204

Abstract: The aim of the research was to evaluate the antibacterial activity of a crude extract from Latana camara L. on different types of fabric samples made of cotton, bamboo, and bamboo cotton. Lantana camara L. is a well-known weed and a popular ornamental garden plant that is widely utilized in traditional medicine all over the world. Acetate, ethanol, methanol, and petroleum ether were used as solvents to make the leaves crude extract. *Escherichia coli* and *Staphylococcus aureus* were used as test organisms for the crude extract's anti-bacterial activity, which was also used for phytochemical analysis. According to a phytochemical study, *Latana camara* L. extract contained alkaloids, flavonoids, phenol and tannin. As measured by inhibitory zones ranging from 09mm to 24mm, plant methanol extract demonstrated good antibacterial activity against test organism. Antibacterial activity of fabrics (cotton, bamboo and bamboo cotton) finished with plant extract revealed inhibitory zones excellent ranging from 23mm to 28mm against Escherichia coli and Staphylococcus aureus. The present findings imply the potential antibacterial activity of the plant. L. camara aids in the relief of inflammatory conditions and to be developed into standardized, safe, and affordable biomedical products and use as functional finish for home textiles.

Keywords: Antibacterial activity, Phytochemical constituent*, Latana camara* L., Cotton, Bamboo and Bamboo cotton.

1. INTRODUCTION

A flowering ornamental plant in the Verbenaceae family is called *Lantana camara* Linn*. Lantana camara* Linn.is also known as West Indian lantana, wild sage, Surinam tea plant, and Spanish flag. Before 19th century in India L. camara was probably introduced [1]. The *Lantana camara* L. as described by Linnaeus and the name *Lantana camara* L. likely originates from the old Latin name of it contains some similarities with the genus Viburnum in terms of the leaves and blooms. Lantana is largely indigenous to subtropical and tropical America, with a few species also occurring in tropical Asia and Africa. [2]. It is a prominent invasive plant that is reportedly native to tropical and subtropical regions [3]. Traditional healers have utilized L. camara extract for generations to treat gastrointestinal, inflammatory, dermatological, rheumatic, high blood pressure, feverish, cancers, chicken pox, tumours and headache conditions [4-6]. As well as carminative purposes, it is used to treat conditions including lungs diseases, antispasmodic, antiemetic effects, analgesic, antimalarial, antifungal, and antitumoral properties [7]. Lantana oil is used to treat skin rashes, itches, and wounds as an antibacterial. The widely used name for the species of plant camara, was likely derived from the West Indian region [8]. L. camara is a short, upright or sub scandent, robust shrub and stem are thick, recurved leaves, and strong aroma. L. camara may extend out to a width of 2.5 meters and reach heights of 1 to 3 meters. L. camara is woody, straggly shrub that blooms in a variety of hues, including red, pink, white, yellow, and violet. Typically, the stems and branches are covered in spines or prickles. The leaves are rough structure on both sides, elliptical and about 3 to 8 cm length and width 3 to 6 cm [9]. It has been found that various varieties of lantana contain a wide range of concentrations of phytochemicals [10]. The presence of saponins, tannins, flavonoids are higher content in L. camara leaves (reported by Harborne, 1998) [11]. The phytochemical analysis of L. camara leaves extract showed presence of alkaloids, terpenoids (reported by Roghini and Vijayalakshmi, 2018) [12]. Antibacterial

activity of fabrics (cotton, bamboo and bamboo cotton) finished with plant extract revealed inhibitory zones against microorganism [13]. In the present study, the antibacterial activity of L. camara extract against microorganisms is evaluated together with its phytochemical screening and use as functional finishes on different types of fabric for antibacterial activity.

2. MATERIALS AND METHODS

Selection of Plant source and Fabric

Latana camara L. used in this study, collected from different regions of Yercaud hill station in the Salem district of Tamil Nadu, India's southernmost state. The Department of Agricultural and Farmer's Welfare, Agriculture Officer in Karur, Tamil Nadu, authenticated and confirmed the plant specimen. Plant was selected based on their medicinal and pharmacological properties from the literature. The Taxonomy of the plant illustrated in Table 1 and Figure 1. Fabrics are selected for the present research was presented in Table 2 and Figure 2. All fabrics were procured from Yuvaraj Bit Looms, Pallipalayam, Erode district, Tamil Nadu, India.

Table 1. Taxonomy of Plant source

Order	Lamiales
Family	Verbenaceae
Genus	Lantana
Species	*Lantana camara* Linn.
Plant part	Leaves

Figure 1. *Latana camara* L. plant

Table 2. Types of Fabrics

S. No	Fabrics	Nomenclature
1	Cotton	F1
2	Bamboo	F2
3	Bamboo Cotton	F3

Figure 2. Types of fabric samples

Preparation of crude extract

The plant leaves were well cleaned with distilled water, then dried in the shade at 40°C ambient temperature until all water moisture vaporized. They were then thoroughly dried for the grinding mill and pulverized into a fine powder. The powdered of leaves was valued, keep in sealed container which mean impermeable to passage of air, stored for further process. The component of the plant was over-dried for 24 hours at 50°C in ordered, individual aluminium trays to attain water vaporization below 10%. Prior to utilizing the Soxhlet Extractor equipment, the dried pieces of plant material were sieved through a metal sieve that produced a perfectly fine powder and kept at room temperature.

Extraction of powdered plant

The Soxhlet concept is an infusion-based method of extracting chemicals from plant. In this extraction technique, a porous bag made of cellulose, a robust filter paper, was used to hold finely powdered plant powder. This bag was introduced into the device. For this study, the Soxhlet Extraction infusion technique was used. The solvent used for extraction was heated, evaporated into a thimble compartment, and then condensed and emptied into a condenser on top. This procedure is continued up to the siphon arm, at which point the liquid content are discharged into bottom flask and continuous the process again. Plant powder was set in a thimble and extracted using a Soxhlet apparatus throughout a duration of six hours at a temperature of 60 °C, progressively increases in intensity, preaching a maximum of 100ºC. Through a side arm tube, an extraction proceeds in a flask with a circular bottom and in the heating mantle below. The plant was extracted using a similar process independently and represented in figure 3.

Figure 3. *Latana camara* L. extraction solvents

(M-Methanol, E-Ethanol, A-Acetate, PE- Petroleum ether)

Qualitative Phytochemical Screening

Evaluate the extraction for presence of alkaloid, terpenoids, steroids, phenols and flavonoids which are bioactive compound [11].

Test method for Alkaloids: 1ml of the material was dissolved in 10ml of methanol, and 2ml of that solution was filtered through 1% hydrochloric acid solution. Six dragendroff drops and one millilitres of filtrate were added to this mixture. Precipitate that is cream-colored and brownish-red represented the presence of complex alkaloids.

Test method for Flavonoids: With the added of few drops of NaOH and 1ml of extract, a pale-yellow colour that indicates the presence of flavonoids first appeared.

Test method for Terpenoids: C4H6O3 and con. H2SO4 were added to 2ml of plant material extract. Terpenoids presence shows the blue-green rings to develop in the formula.

Test method for Phenol: Mix 1ml of the extract with 5ml of distilled water in a test tubehe solution oscillated well, and a steady persistent foam was seen. Three drops of phenol combined with foaming and vigorously shaken afterward show which enduring blue colour.

Test method for Tannin: 10ml of distilled water with 1ml of extract. Filtering the mixture produced 2 ml of filtrate, combined with 2 ml of FeCl3. Blue-black precipitate is the result, and tannins were seen to be present.

Antibacterial screening of individual plant using agar well diffusion method

Authentic Bacterial strains are (*Escherichia coli, Staphylococcus aureus)* utilized in the study were obtained from Gram Positives, Research and Development Laboratory, Coimbatore. Bacterial strains (microorganism) are selected for the present research was presented in Table 3.

Table 3. Selected Bacterial strains

S. No	Microorganisms	Nomenclature
1	*Escherichia coli*	*A*
2	*Staphylococcus aureus*	*B*

Microorganism are maintained at temperature range for microorganisms of 4°C. The antibacterial activity of crude extract was assessed against test organisms using the well diffusion technique. Test cultures of *Staphylococcus aureus* and *Escherichia coli* were introduced into a sterile nutritive broth that had been made to support the growth for one to two days. The Nutrient broth media composition of distilled water 1liter, 0.5g/l of beef extract, yeast extract 1g/l, peptone 2.5g/l and sodium chloride 2.5g/l and final pH – 7.0 ± 0.3[20]. Mueller-Hinton Agar plates contain a casein acid hydrolysate (17.5 g/L), beef extract (2 g/L), starch (1.5 g/L), and 17.0 g/L of agar. Final pH should be adjusted at 7.3 ± 0.3[21]. Staphylococcus aureus and Escherichia coli inoculum suspensions secreted in separate layers across the agar surface to a degree of around 0.1%. Each plate of agar surface, where 6mm wells cut out of it and kept under sterile conditions and 20µl of each plant extract fractions were loaded into the well. Each plate was incubated for 24hours at 37ºC. The antibacterial activity was assessed around the well, in the zone of inhibition, and on the inoculated NA plates. Measure the inhibitory clear zones and note them in millimetre.

Method of Finishing

Preparation of fabric: Each desized piece of fabric was cut into a 10 cm by 10 cm piece. distinct pre-treatments for each of the three fabrics. The materials were pre-soaked for 20 minutes at 70°C in ordinary fresh water. The cleaned textiles were carefully washed in flowing water that was heated to 50 degrees Celsius to remove any surface dirt and other contaminants. The materials were all dried at room temperature and gently squeezed by hand. Extra starchy-like substances were eliminated from the fabric's surface and interstices using a non-ionic detergent (sodium lauryl sulphate - 1% (10g/L)). A typical washing machine was used for the washing, which took 10 minutes at a low speed. Fabrics that had been washed were laid out in the sun for 120 minutes. All types of fabrics were finished separately with plant extract. Finished fabric samples was assessed to against different types of functional parameters. For

further study, finished samples were disinfected using UV light in a laminar air flow chamber for 30 minutes. The images of finished fabrics were presented (Figure 4).

Figure 4. Plant extract finished fabric samples

Using the EN ISO 20645 test method, plant extract finished fabrics were tested for antibacterial activity. Escherichia coli and Staphylococcus aureus, the two bacterial cultures, were examined on each test specimen (swatch), which were all divided into 20mm-diameter pieces. Both test organisms were maintained on Nutrient Agar slants in a microbiology lab. the media make-up of nourishing broth. All of the inoculation broth tubes were incubated at 37°C for 12 to 24 hours to produce turbid bacterial growth. A sterile 4mm inoculating loop was used to cover the Mueller-Hinton agar (MHA) plate surface and the middle of the petri dish, and it included one loop of each test bacterial culture (Escherichia coli and Staphylococcus aureus). After the test bacteria had been swabbed, each test fabric swatch (finished fabric and unfinished control fabric) was put on the opposing sides of each MHA plate. All test swatches were subjected to the same procedure. The zone of inhibition for each type of fabric specimen was measured in mm, and the results were reported.

3. RESULTS AND DISCUSSION

The phytochemical analysis of *Latana camara* L. was result in Table 4. The best solvent to get high levels of phytochemical contents, high levels is methanol. The presence of bioactive substances in the plant, such as alkaloids, terpenoids, steroids, phenols, and flavonoids. The presence of alkaloids, flavonoids, phenol and tannins was screened into the crude methanolic extractive of leaves of *Latana camara* L. result are exhibit presences of the bioactive compounds are confirm their medicinal plant properties.

Table 4. Phytochemical Screening of methanol extract

Plant source	Phytochemical Analysis				
	Alkaloids	**Flavonoids**	**Terpenoids**	**Phenol**	**Tannin**
***Latana camara* L.**	**+**	**+**	-	**+**	**+**

Key: + Indicate Present, - Indicates Absent

Antibacterial Assay

Antibacterial screening of methanol extract of the plant demonstrated the strongest antibacterial activity against microorganism among the five different solvent extracts. *Latana camara* L. extract had an inhibitory zone against E. coli and S. aureus of around 08mm and 17mm, respectively (Tables 5, 6 and Fig. 5, 6). Table 5 & 6 the antibacterial screening assay of the crude extract of plant against the tested organism. The solvents extract of the plant showed significant against *Escherichia coli and Staphylococcus aureus.* The plant is best antibacterial in the methanolic extract compared with acetone, ethanol and pet ether. The result perform that indicates the plant leaves have antibacterial activity.

Table 5. Antibacterial Screening of *Latana camara* L. using agar well diffusion method (Against E. coli)

Plant Types	Zone of Inhibition against *E. coli* (in mm)				
	Water	Acetone	Ethanol	Pet Ether	Methanol
Latana camara L.	-	-	08	-	16

Table 6. Antibacterial screening of *Latana camara* L. using agar well diffusion method (Against *S. aureus*)

Plant Types	Zone of Inhibition against *S. aureus* (in mm)				
	Water	Acetone	Ethanol	Pet Ether	Methanol
Latana camara L.	-	-	10	-	17

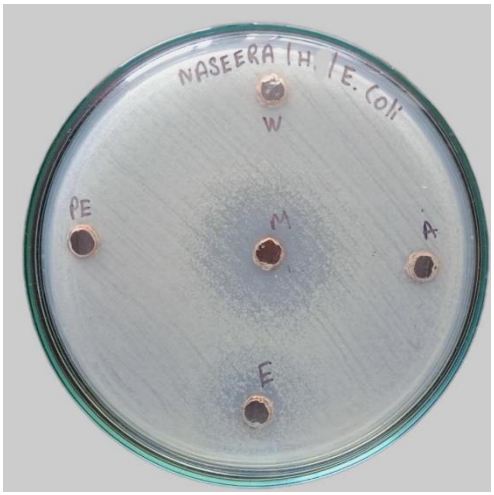

Figure 5. Antibacterial Screening of *Latana camara* L. against *E. coli*

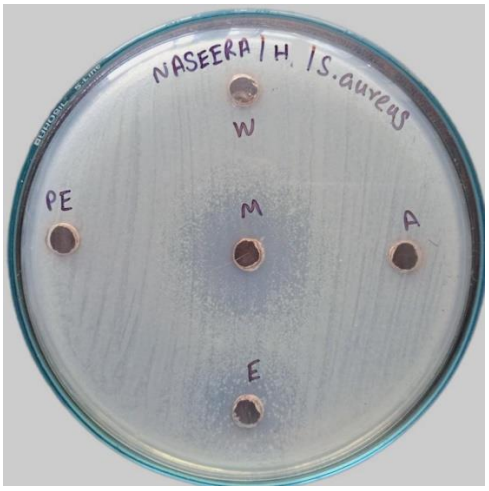

Figure 6. Antibacterial Screening of Latana camara L. against *S. aureus*

From the literature source at present, the reason of the herbal extract's significant shows antibacterial effects. Several research that we found while searching made reference to the importance of phytochemical components and other biological compounds that are contributing to antibacterial abilities, anticancer qualities, etc. The findings demonstrated that Gram-Negative and Gram-Positive bacteria were both severely inhibited and turned into safe, affordable, and reliable plant products, as well as a potential source of novel compounds for broad-spectrum antibacterial medications.

Antibacterial activity of plant extract finished fabrics

The plant extract treated fabric samples (cotton, bamboo and bamboo cotton), showed good antibacterial inhibitory zones (table 7). Cotton samples finished showed inhibitory zone of about 28mm and 30mm against *Escherichia coli* and *Staphylococcus aureus* respectively. Bamboo samples showed inhibitory zone of about 30mm and 30mm and bamboo cotton samples revealed antibacterial activity of 27mm and 28mm against respective test bacteria (Figure 7 and Figure 8).

Table 7. Antibacterial activity of *Latana camara* L. extract finished fabrics

Selected plant	Zone of Inhibition (in mm)					
	F1 (Cotton)		F2 (Bamboo)		F3 (Bamboo cotton)	
	***A* (*E. coli*)**	***B* (*S. aureus*)**	***A* (*E. coli*)**	***B* (*S. aureus*)**	***A* (*E. coli*)**	***B* (*S. aureus*)**
Latana camara L.	28	30	30	30	28	29

Figure 7. Antibacterial activity of *Latana camara* L. extract finished fabrics against *Escherichia coli*

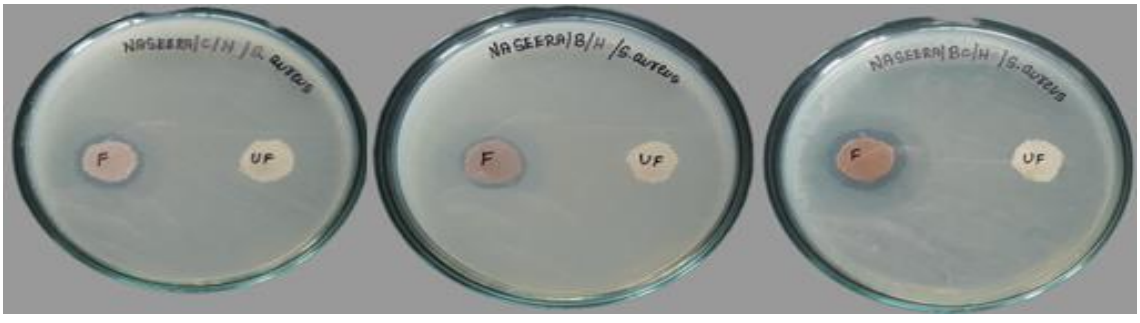

Figure 8. Antibacterial activity of *Latana camara* L. extract finished fabrics against *Staphylococcus aureus*

4. CONCLUSION

In the current study, *Latana camara* L. phytochemical examination finds out the presence of alkaloids, flavonoids, phenol and tannin. In terms of inhibitory zones ranging from 08mm to 17mm, Escherichia coli and Staphylococcus aureus responded effectively to a methanol extract of *Latana camara* L. leaves. *Escherichia coli* and *Staphylococcus aureus* were well inhibited by fabrics treated with Latana camara L. extract of leaves, with excellent inhibitory zones of 29 to 30 mm. *Latana camara* L. is used in a variety of medical and health applications, as well as in the development of economical biomedical products and beneficial finishes for textile products used in everyday life.

Author's contribution: The authors have confirmed contribution to study conception, design, data collection, analysis, interpretation of results and manuscript preparation.

Acknowledgment: The authors thankful to Avinashilingam Institute for Home Science and Higher Education for Women for supporting in this research work.

Conflict of interest: No potential conflict of interest was reported by the authors.

5. REFERENCE

[1] Ganesh T, Saikatsen, Thilagam G, Loganatham T, Raja Chakraborty. (2010). Pharmacognostic and anti hyperglycemic evaluation of lantana camara (L) var. aculeate leaves in alloxan-induced hyperglycemic rats. Int J Res Pharm., 1(3), pp 247-252.

[2] Om P. Sharma, Harinder Paul S. Makkar, Rajinder K. Dawra. (1988). A review of the noxious plant Lantana camara. Toxicon,26(11), pp 975-987.

[3] Ghisalberti, E. L. (2000). Lantana camara L. (Verbenaceae). Fitoterapia 71, pp 467–486.

[4] Hernández, T., Canales, M., Avila, J. G., Duran, A., Caballero, J, Romo de Vivar, A., et al. (2003). Ethnobotany and antibacterial activity of some plants used in traditional medicine of zapotitlán de las Salinas, Puebla (México). J. Ethnopharmacol. 88, pp 181–188.

[5] Mahdi-Pour, B., Jothy, S. L., Latha, L. Y., Chen, Y., and Sasidharan, S. (2012). Antioxidant activity of methanol extracts of different parts of Lantana camara. Asian Pac. J. Trop Biomed. 2, 960–965.

[6] Naz, R. & Bano, A. (2013). Phytochemical screening, antioxidants and antimicrobial potential of Lantana camara in different solvents. Asian Pac. J. Trop. Dis. 3, pp 480–486.

[7] Ravinder KK, Daizy R, Batish HP, Singh, Kuldip SD. (2000). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8, pp1501–1510.

[8] Juanita T. Barre, Bruce F. Bowden, John C. Coll, Joanna De Jesus, Victoria E. De La Fuente, Gerardo C. Janairo, Consolacion Y. Ragasa. (1997). A bioactive triterpene from Lantana camara. Phytochemistry, 45 (2), pp 321-324.

[9] Sastri BN. The wealth of India. (1962). CSIR New Delhi, India.

[10] Sharma, O. P., Jagdish, V., and Sharma, P. D. (1991). Comparison of lantadenes content and toxicity of different variety of the lantana plant. J. Chem. Ecol. 17, pp 2283–2291.

[11] Harborne, J. B. (1998). Textbook of Phytochemical Methods. A Guide to Modern Techniques of Plant Analysis, 5th Edn. London; New York, NY: Chapman and Hall Ltd.

[12] Roghini, R., and Vijayalakshmi, K. (2018). Phytochemical screening, quantitative analysis of flavonoids and minerals in ethanolic extract of Citrus paradise. Int. J. Pharm. Sci. Res. 9, pp 4859–486.

[13] Mohanty S K, Panda D, Panda S, Hemalatha J, Sriharsha D V and Ashwini M. (2023). Evaluation of Antimicrobial Potential of a Gel loaded with Silver Nanoparticles of Argemone mexicana for Topical Application. Int. J. of Membrane Science and Tech., 10(4), pp 2312-2321.

DOI: https://doi.org/10.15379/ijmst.v10i2.2822