



Evaluation of Antimicrobial Activity of *Sida cordifolia* Leaf Extract

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Authors' contributions

This work was carried out in collaboration among all authors. Author DV designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ST and JT managed the analyses of the study. Author MMM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Objective: The objective of the study was to evaluate in-vitro efficacy of antibacterial, and antifungal activities of chloroform extract of leaf of *Sida cordifolia* L. against some human pathogenic bacterial and fungal strains. *S. cordifolia* (*Malvaceae*) is used as anti-rheumatic, analgesic, antipyretic, anti-asthmatic, nasal decongestant, antiviral, laxative, diuretic, aphrodisiac, hypoglycemic, hepatoprotective and in the treatment of Parkinson disease.

Methodology: Chloroform extract of *S.cordifolia* was used for antimicrobial screening. Antibacterial activity was tested against pathogenic bacterial strains *Escherichia coli* and *Staphylococcus aureus*. Also antifungal activity was tested against one human pathogenic fungal strain i.e. *Candida albicans*. Antibacterial and antifungal activities of *S. cordifolia* extract was carried out by using disc diffusion method.

Results: Chloroform extract of *S. cordifolia* showed the largest zone of inhibition (10mm) against *S. aureus* at 50µgm/mL and no zone of inhibition against *E.coli* at 50µgm/ml. Chloroform extract has shown more potent antibacterial activity against *S.aureus*. Chloroform extract was

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found to be more effective against human pathogenic fungus *C. albicans*. The zone of inhibition of chloroform extract was 10mm. The phytochemical screening demonstrated the presence of different types of compounds like alkaloids, tannins and phenolic compounds which may contribute for the anti-microbial action of this plant.

Conclusions: The results concludes that chloroform extract of *S. cordifolia* leaf possess antimicrobial activity.

Keywords: *Sida cordifolia*, antibacterial activity, antifungal activity, *Escherichia coli*, *Staphylococcus aureus*, *Candida albicans* .

1. INTRODUCTION

Antibiotics are one of our most important weapons in fighting bacterial infections and have greatly benefited the health-related quality of human life since their introduction. However, over the past few decades, these health benefits are under threat as many commonly used antibiotics have become less effective against certain illnesses not, only because many of them produce toxic reactions, but also due to emergence of drug-resistant bacteria. It is essential to investigate newer drugs with lesser resistance. Drugs derived from natural sources play a significant role in the prevention and treatment of human diseases. In many developing countries, traditional medicine is one of the primary healthcare systems [1-4]. Herbs are widely exploited in the traditional medicine and their curative potentials are well documented [5,6]. About 61% of new drugs developed between 1981 and 2002 were based on natural products and they have been very successful, especially in the areas of infectious disease and cancer [7,8]. Recent trends, however, show that the discovery rate of active novel chemical entities is declining [9]. Natural products of higher plants may give a new source of antimicrobial agents with possibly novel mechanisms of action [10,11]. The effects of plant extracts on bacteria have been studied by a very large number of researchers in different parts of the world.[12] Much work has been done on ethno medicinal plants in India[13]. Plants are rich in a wide variety of secondary metabolites such as tannins, terpenoids, alkaloids, flavonoids, glycosides, etc., which have been found *in vitro* to have antimicrobial properties [14,15]. The chemical evaluation of *Sida cordifolia* shows the presence of Ephedrine, Pseudoephedrine, Sterculic, malvalic and coronaric acid, Fatty acids, Saponine, Betaphenethylamine, Hypaphorine, Ecdysterone, Indole alkaloides, Palmitic, stearic and β – sitosterol. Herbal medicines have been known to man for centuries. Therapeutic efficacy of many indigenous plants for several disorders

has been described by practitioners of traditional medicine [16]. Antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world. The World Health Organization estimates that plant extracts or their active constituents are used as folk medicine in traditional therapies of 80% of the world's population[17]. The harmful microorganisms can be controlled with drugs and these results in the emergence of multiple drug-resistant bacteria and it has created alarming clinical situations in the treatment of infections. The pharmacological industries have produced a number of new antibiotics; resistance to these drugs by microorganisms has increased. In general, bacteria have the genetic ability to transmit and acquire resistance to synthetic drugs which are utilized as therapeutic agents[18]. Therefore, there is need to search new infection-fighting strategies to control microbial infections. The aim of this study was to evaluate the antimicrobial activity of *S. cordifolia* used in Ayurveda and traditional medicinal system for treatment of manifestations caused by microorganisms.

S. cordifolia is a small, erect, downy shrub. The leaves of the plant are chordate-oblong or ovate- oblong and fruits with a pair of awns on each carpel. Roots of the plant which constitute a drug are 5-15 cm long with few lateral roots of smaller size. The tap roots are generally branched at the tip. The outer surface of the root is off to grayish yellow. It is almost odourless with slightly bitter taste.[19] *S. cordifolia* is a highly reputable medicinal herb in the Ayurveda and other traditional systems of medicine in India and various other countries. In the Ayurvedic system of medicine it is used as antirheumatic, analgesic, antipyretic, antiasthmatic, nasal decongestant, antiviral, laxative, diuretic, aphrodisiac, hypoglycaemic, hepatoprotective and in the treatment of Parkinson disease. The chemical composition of this herb comprises of alkaloids, flavonoids, phytoecdysteroids, sterols and fatty acids.

Leaves are demulcent and febrifuge, used in dysentery [20-29].

2. MATERIALS AND METHODS

2.1 Collection and Authentication

S. cordifolia was collected from in and around Palakkad, Kerala, India. The plant was identified and authenticated by the taxonomist Dr Kanakamany.M.T professor and Head, Office of AICRP on Medicinal and Aromatic Plants, Thrissur, Kerala. The authenticated specimen was deposited in the Department of Pharmacognosy, Sanjo College of Pharmaceutical studies, Palakkad, the authentication specimen number is SCOPS/P.COG/005/2019. The leaves were dried in room temperature for 2 months. Dried specimen was powdered using mechanical grinder and passed through 60 mesh sieve to get the powder of desired coarseness. Powdered material was preserved in an air tight container.

2.2 Extraction of Plant Material

The extract was prepared by weighing 1kg of the dried powdered leaf was subjected to hot successive continuous extraction with different solvents as per the polarity, petroleum ether, benzene, Hexane, chloroform, ethanol and finally with aqueous. The extracts were filtered in each step using Whatman filter paper. The filtrate was concentrated using a rotary evaporator at low temperature (40-45°C) and pressure. These extracts used for screening of antimicrobial activity.

2.3 Methods [30-35]

2.3.1 Strain, culture media and sterile discs

Chloroform extract of *S. cordifolia* was evaluated for anti-bacterial and antifungal activity against to *E. coli*, *S. aureus* and *C. albicans*. Microbial cultures procured from government medical college from Tiruchirappalli, Tamil Nadu. Media used for microbial test was potato dextrose agar and Muller-Hinton agar media obtained from Himedia Pvt. Bombay, India. Sterile discs used for antimicrobial activity procured from Himedia Pvt. Bombay, India.

2.3.2 Antibacterial activity

Antibacterial activity of Chloroform extract was studied by using disc diffusion method. *E. coli*, *S. aureus*, inoculums were prepared by using

nutrient broth media. Double strength sterile Mueller hinton agar media were prepared by autoclaving 7.6 gm in 100mL. Inoculate the test microorganisms on the Mueller hinton agar plates by using sterile cotton swabs. Chloroform extract of *S. cordifolia* was placed on sterile discs. Discs were dried aseptically under laminar air flow to remove solvents. Dried discs were placed on the surface of culture inoculated Mueller hinton agar plates and plates were incubated at 37°C for 24hr. Antibacterial activity was evaluated by using Hi media zone reader.

2.3.3 Antifungal activity

Antifungal activity of chloroform extract of *S. cordifolia* was studied by using disc diffusion method. *C. albicans*, inoculum was prepared by using potato dextrose broth. Potato dextrose agar media was prepared by autoclaving 3.9 gm. in 100mL. Inoculate the test microorganisms on the Potato dextrose agar plates by using sterile cotton swabs. Chloroform extract of *S. cordifolia* was placed on sterile discs. Discs were dried aseptically under laminar air flow to remove solvent. Dried discs were placed on the surface of culture inoculated potato dextrose agar plates and plates were incubated at room temperature for 48hr. Antifungal activity was evaluated by using Hi media zone reader.

3. RESULTS

The results (Table 1) illustrated that Chloroform extract of *S. cordifolia* showed the largest zone of inhibition of about 10mm against *S.aureus* at 50 µgm/mL and resistance against *E.coli* at 50 µgm/mL. Chloroform extract has shown more potent antibacterial activity against *S.aureus*. The phytochemical screening demonstrated the presence of different types of compounds like alkaloids, tannins and phenolic compounds which may contribute for the anti-bacterial action of this plant.

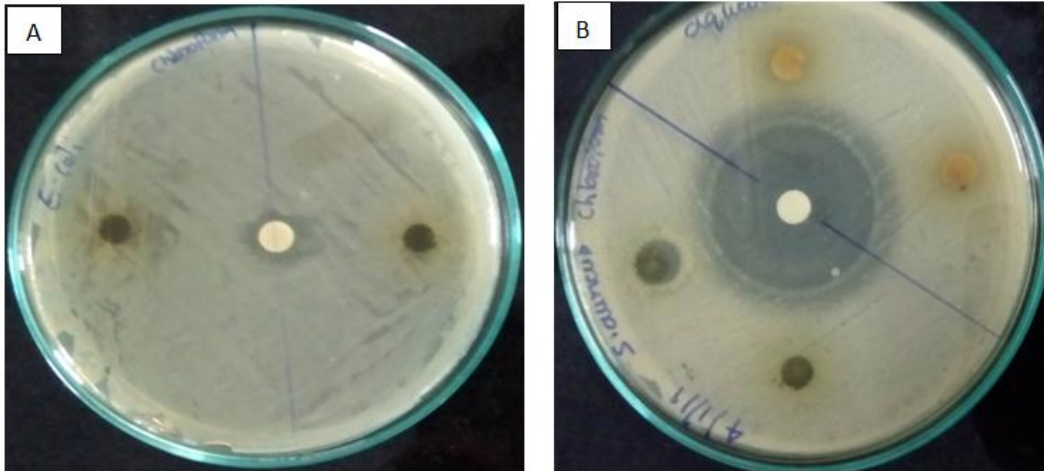
3.1 Antifungal Activity of *S. cordifolia* Leaf

Antifungal activity of chloroform extract was studied by using disc diffusion method.

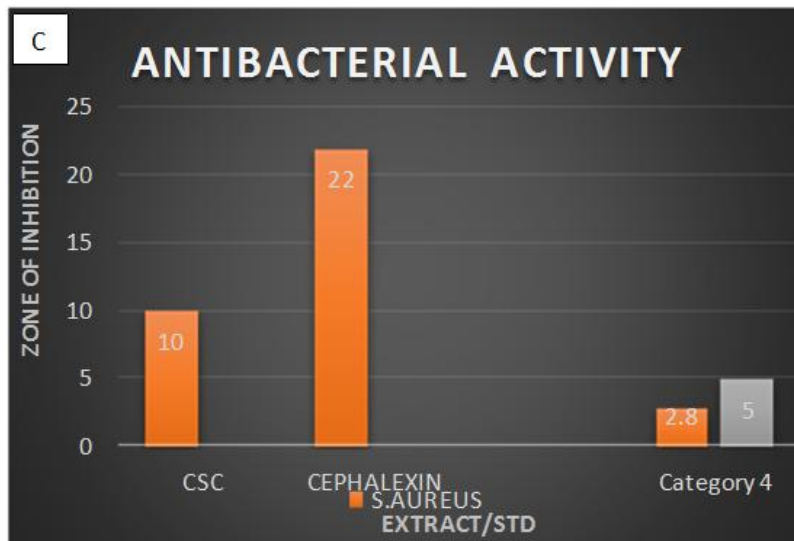
The above results clearly demonstrates that chloroform extract of *S. cordifolia* had more potent antifungal activity against *C. albicans* The zone of inhibition chloroform extract was 10 mm. The phytochemical screening demonstrated the presence of different types of compounds like

Table 1. Antibacterial activity of *S. cordifolia*

S.NO	Extract/Standard drug	Zone of Inhibition (mm)	
		<i>E. coli</i> (n=6)	<i>S. aureus</i> (n=6)
1	Chloroform	R	10±5
2	Cephalexin	7±5	22±5



**A: Chloroform extract not showing activity against to human pathogenic *E. coli*
 B: Chloroform extract showing activity against to human pathogenic *S. aureus***



C: Graphical representation of Antribacterial activity of Cephalexin

Fig. 1. Antibacterial activity of *S. cordifolia*

Table 2. Antifungal activity of *S. cordifolia* leaf

S.NO	Extract/Standard drug	Zone of Inhibition (mm)
		<i>C. albicans</i> (n=6)
1	Chloroform	10±5
2	Clotrimazole	15±5

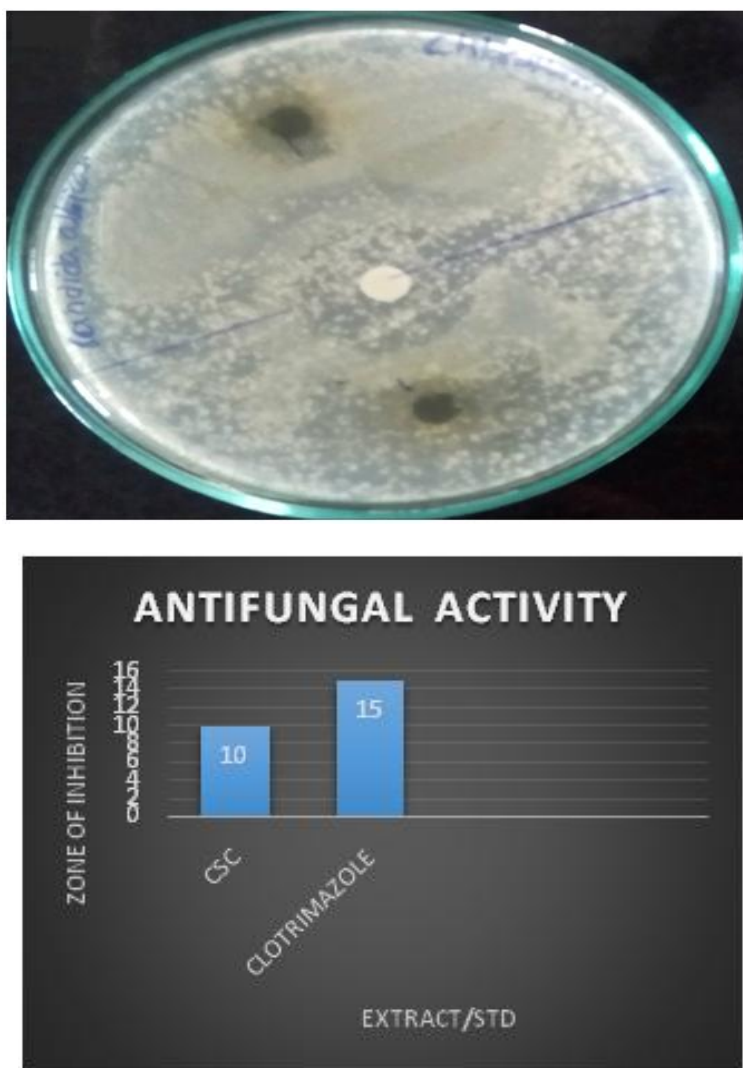


Fig. 2. Antifungal activity of *S. cordifolia* leaf

alkaloids, tannins and phenolic compounds which may contribute for the anti-fungal action of this plant.

4. DISCUSSION

Antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world. The World Health Organization estimates that plant extract or their active constituents are used as folk medicine in traditional therapies of 80% of the world's population. The appearance of multi drug resistant strain of many pathogens is a severe threat and makes chemotherapy more difficult. Furthermore, the current price of most of the chemotherapeutic agents is intolerable to the

public particularly in developing countries like India[36]. Therefore attempts must be directed towards the development of effective natural, non-toxic drug for treatment. Therefore the present work was carried out to explore the antimicrobial property of *S. cordifolia*. In the present work, the extract obtained from *S. cordifolia* show strong activity against *S. aureus* and *C. albicans*. The results were compared with standard antibiotic drugs. The above results show that the activity of chloroform extract of *S. cordifolia* shows significant antibacterial and antifungal activities. Results show that plant rich in tannin and phenolic compounds have been shown to possess antimicrobial activities against a number of microorganisms.

5. CONCLUSION

The present study justified the claimed uses of leaves in the traditional system of medicine to treat various infectious disease caused by the microbes. However, further studies are needed to better evaluate the potential effectiveness of the crude extracts as the antimicrobial agents. The present results will form the basis for selection of plant species for further investigation in the potential discovery of new natural bioactive compounds. Further studies which aimed at the isolation and structure elucidation of antimicrobial active constituents from the plant have been initiated.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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