

Comparative analysis of antibacterial activity of two therapeutically active plants



Microbiology

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ABSTRACT

Traditionally, the leaf extracts of Achyranthes aspera and seed extracts of Calophyllum inophyllum are used in treating wounds and infectious diseases. Antibacterial activity of these plant extracts prepared in different solvents such as water, ethanol and hexane is assessed by disc diffusion method against 6 human pathogenic bacteria such as Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella pneumoniae, Enterobacter aerogens, and Salmonella typhi. All the extracts of both plants showed a wide range of bactericidal activity with the zone of inhibition ranging from 11mm to 17mm in diameter. Maximum inhibition was observed in hexane extracts of these plant parts. This study could boost up the optimism of the scientists about the future of phytomedicine.

Introduction:

Global estimates indicate that 80% of about 4 billion population cannot afford the products of western pharmaceutical industry and have to rely upon the use of traditional medicines, which are mainly derived from plant materials (Brindha et al., 2008). This is due to the decline in the new antibacterial drugs in the pharmaceutical pipeline and the need of treatments for emerging infectious diseases caused by drug resistant bacteria.

Therefore, the exploration of medicinal herbs with a broad spectrum of therapeutic properties is in lead today. Herbal plants are used traditionally without any scientific knowledge since times immemorial. They can provide potential bioactive compounds to combat various diseases.

Traditional healers of Asia, South America and Africa commonly use *A. aspera* Linn. (Amaranthaceae) for the treatment of fever, cough, asthma, dysentery, hypertension, skin rash, nasal infection and diabetes. A decoction of the leaves is diuretic and the aqueous extract is given for pneumonia.

In European tradition, the seed oil of *C. inophyllum* (Clusiaceae) is used in treating itch and scabies, also to cure bad wounds and ulcers. The oil is anodyne and has been proven to have vulnerary and cicatrizing effects (Dweck and Meadows, 2002).

The present study is attempted to evaluate the antibacterial activity of the above mentioned plant extracts prepared in aqueous, ethanol, and hexane solvents against few pathogenic bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Enterobacter aerogens*, and *Salmonella typhi* in the aim of discovering an alternative antibacterial agents from natural sources.

Materials and Methods

Leaves of *A. aspera* and seeds of *C. inophyllum* were collected in and around Srirangam, Tiruchirappalli district and authenticated by herbal division of Srimad Andavan Arts and Science College. The leaves of *A. aspera* were dried in shade and powdered using a blender. The seeds of *C. inophyllum* were washed, dried and crushed into powder. The powders were stored in an airtight container. 100g of each powdered plant material was added to 1L of water, ethanol and hexane separately. Extracts were collected and filtered with a muslin cloth and then subjected to evaporation. Oven temperature was maintained at 45°C and stored at 4°C for further studies. Plant extracts prepared in these solvents were tested for antibacterial activity against *E. coli*, *P. aeruginosa*, *S. aureus*, *K. pneumoniae*, *E. aerogens* and *S. typhi*. This was carried out by disc diffusion method (Bauer et al., 1966) on Mueller Hinton agar plates. Discs were loaded with 1000µl of extracts. Antibiotic discs were used as positive control and solvent loaded discs as negative control. The zone of inhibition (in mm) was measured after 24 hours of incubation at 37°C.

Results and Discussion

Maximum inhibition of 17mm was observed in hexane extracts of *A. aspera* against *E. coli*, *S. aureus* and *S. typhi*. It is followed by *E. aerogens* (16mm), *P. aeruginosa* (15mm) and *K. pneumoniae*

(14mm). While the hexane extracts of *C. inophyllum* showed 17 mm of inhibition only against *S. aureus* which is followed by *P. aeruginosa* (16mm). Zone of inhibition of 15mm was observed against *E. aerogens*, *E. coli* and *K. pneumoniae*.

The ethanol extracts of *C. inophyllum* was found to have maximum bactericidal activity (16mm) against *P. aeruginosa* and *K. pneumoniae* followed by *E. aerogens* and *S. typhi* (15mm). While the utmost antibacterial activity of the ethanol extracts of *A. aspera* was against *S. typhi* (15mm) and followed by *E. aerogens*, *K. pneumoniae* and *E. coli* (14mm). These results are depicted in table 2. The best antibacterial activity of aqueous extracts of *A. aspera* and *C. inophyllum* with a zone of 14mm was against *S. typhi* and *S. aureus* correspondingly, which is indicated in Table 3. The above results represent the efficacy of these plants as excellent antibacterial sources.

Geetha et al., (2010) suggested similar results of bactericidal activity of *A. aspera*. The ethanol extract showed remarkable antibacterial activity against *S. aureus*, *E. coli*, *Vibrio sp.* and *Micrococcus sp.* compared to hexane and aqueous extracts. Ramesh Londonkar et al., (2011) have reported the bactericidal property of methanol extracts of *A. aspera* against *S. aureus*.

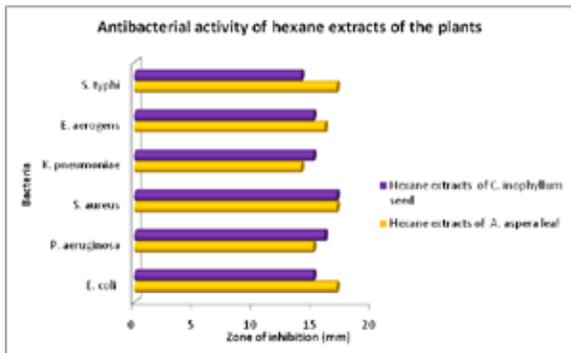
Likewise, Minh Hien Ha et al., (2009) stated that methanol and hexane extracts of *C. inophyllum* showed promising antibacterial activity against *S. aureus* and *P. aeruginosa*. Uma Shankar et al., (2010) indicated that the antibacterial activity of methanol extracts from stem barks of *C. inophyllum* showed significant antibacterial properties against Gram positive and Gram negative bacteria by agar dilution technique compared to chloroform extract. Saravanan et al., (2011) also proved the efficiency of various parts of *C. inophyllum* extracted in ethanol and ethyl acetate against gram positive and gram negative bacteria.

Conclusion

The plants used in the present study have a significant role since prehistoric era in treating wounds and diseases. The effectiveness of these plants has been analyzed against few human pathogenic bacteria and proved to be remarkable bactericidal agents. Among all, the hexane extracts of both plants showed a good range of antibacterial activity followed by ethanol and aqueous extracts. The results indicate the fact that phytoconstituents in plants are responsible for their bactericidal property. This study would encourage the scientists to discover an alternative medicine to treat human ailments.

Antibacterial activity of hexane extracts of both plants

Bacteria	Zone of inhibition (in mm)	
	Hexane extracts of A. aspera leaf	Hexane extracts of C. inophyllum seed
<i>E. coli</i>	17	15
<i>P. aeruginosa</i>	15	16
<i>S. aureus</i>	17	17
<i>K. pneumoniae</i>	14	15
<i>E. aerogens</i>	16	15
<i>S. typhi</i>	17	14

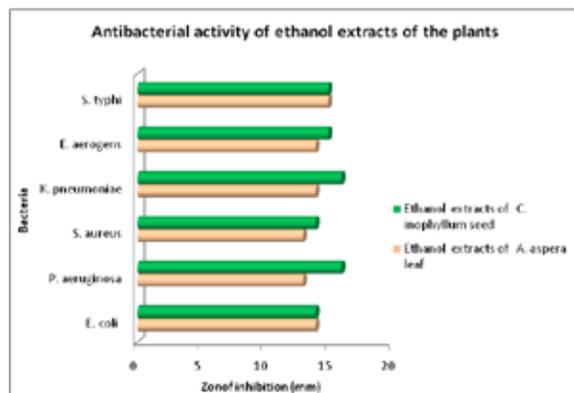
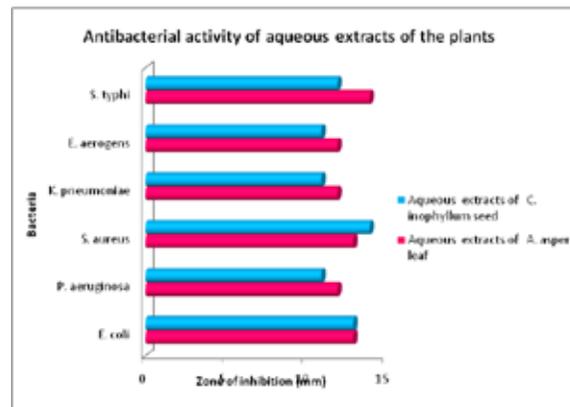


Antibacterial activity of aqueous extracts of both plants

Bacteria	Zone of inhibition (in mm)	
	Aqueous extracts of <i>A. aspera</i> leaf	Aqueous extracts of <i>C. inophyllum</i> seed
<i>E. coli</i>	13	13
<i>P. aeruginosa</i>	12	11
<i>S. aureus</i>	13	14
<i>K. pneumoniae</i>	12	11
<i>E. aerogens</i>	12	11
<i>S. typhi</i>	14	12

Antibacterial activity of ethanol extracts of both plants

Bacteria	Zone of inhibition (in mm)	
	Ethanol extracts of <i>A. aspera</i> leaf	Ethanol extracts of <i>C. inophyllum</i> seed
<i>E. coli</i>	14	14
<i>P. aeruginosa</i>	13	16
<i>S. aureus</i>	13	14
<i>K. pneumoniae</i>	14	16
<i>E. aerogens</i>	14	15
<i>S. typhi</i>	15	15



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