



ANTIBACTERIAL ACTIVITY OF *Cardiospermum helicacabum*

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ABSTRACT

The Present Study deals with the antibacterial activity of Acetone, Ethanol, Methanol extract of the leaves and seeds of *Cardiospermum helicacabum* using well diffusion method against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*. The plant extracts to be tested were prepared with various concentrations viz., 15µl, 30µl, 45µl and 60µl. *Cardiospermum helicacabum* leaves extracts showed maximum antibacterial activity against all the pathogenic microorganisms tested followed by seeds extracts. *Staphylococcus aureus* were found to be more susceptible against *Cardiospermum helicacabum* leaves and seed extracts tested followed by *E. coli* and *P. aeruginosa*.

Key Words: Antibacterial activity, Plant extract, *Cardiospermum helicacabum* and Pathogens.

INTRODUCTION

India has a rich heritage of knowledge on plant based drugs both for use in preventive and curative medicine. A country like India is very much suited for development of drugs from medicinal plant. Because of its vast and wide variations in soil and climate, the Indian sub – continent is suitable for cultivation of large number of medicinal and aromatic plant which can be used as raw materials for pharmaceutical, perfumery, cosmetics, flavour and food and agrochemical industries. A large number of these plants grow wild and exploited especially for use in indigenous pharmaceutical houses. Some of these plants produce valuable drugs which have high export potential. (Rathish *et al.*, 2005).

Cardiospermum helicacabum is one of the perennial climber widely distributed in tropical and subtropical regions. It is present all across the plains of Africa, America, Bangladesh, India, Malasia, Asia and Pakistan. In rural south India, this plant has been harvested and sold in urban and local market as green vegetables providing a source of revenue for low income families. *Cardiospermum helicacabum* is commonly known as Balloon vine, heart vine, heart pea or love in a puff. *Cardiospermum* is a combination of the latin word. Cardio meaning heart and sperm meaning seed and refers to the white heart shaped pattern of the seed, (Brown, 1954).

The major chemical constituents of *Cardiospermum helicacabum* have been reported to contain various phytochemical such as saponin, alkaloids, terpenoids, flavanoids, tannin, cardiac glycosides and steroids. Saponins are responsible for numerous pharmacological properties. (Estrads Katselis *et al.*, 2000). Alkaloid which is one of largest group of phytochemical in plant has amazing effort on humans and this has led to the development of powerful pain killer medications (Raffauf *et al.*, 1996). *Cardiospermum helicacabum* was used to treat various diseases such as skin diseases (rashes, itching, skin irritation etc.) dandruff, rheumatoid arthritis, gastrointestinal disease, respiratory tract diseases, urogenital diseases. Fresh leaf juice is given for asthma patients and it can also reduce obesity. The leaves also are used as one of the ingredients in a medicine for abnormal suppression of menstrual cycle. Leaves boiled in oil such as castor oil are applied over rheumatic pain swelling and tumors of varies kinds. (Hussian *et al.*, 2013). *Cardiospermum helicacabum* has been used in the treatment of rheumatism, nervous diseases, stiffness of the limbs and snake bite. Young leaves can be cooked as vegetables (Pieroni *et al.*, 2002). The whole plant is used for many purposes such as diaphoretic, diuretic, emetic laxative refrigerant, stomachic and sudorific fold medicine. The leaves are used in the treatment of rheumatism, chronic bronchitis, and stiffness of limbs and snakebite.

Cardiospermum helicacabum showed a broad spectrum of pharmacological activities including anti-inflammatory, anti- diabetic, antibacterial, anti viral, anti-diarrheal, antioxidant and nephroprotective properties (Abbirami *et al.*, 2022).

MATERIALS AND METHODS

COLLECTION OF PATHOGENIC MICROORGANISMS

The pathogenic microorganisms chosen for the present study were obtained from the Sri Vinayaga Diagnostic centre, Semmandalam, Cuddalore.

The pathogenic microorganisms obtained are

- a) *Staphylococcus aureus*
- b) *Pseudomonas aeruginosa*
- c) *Escherichia coli*

The microorganisms were maintained on nutrient agar slants at 4°C

COLLECTION OF PLANT MATERIALS

Sufficient quantities of *Cardiospermum helicacabum* plant were collected in and around the regions of Cuddalore District, Tamil Nadu. Specimens were cleaned of adhering soil/ dust in the field by shaking and quick rinsing with tap water. Plants were placed in paper bag and transferred to the laboratory.

Healthy plant materials like leaves and seeds were washed thoroughly with tap water, and shade dried individually at room temperature for two weeks. Then the leaves and roots were powdered by using electric blender and sieved the powders individually using nylon Siever in order to remove plant Fibers. Collect the powders separately in screw-cap bottles and stored for further use.

EXTRACTION OF PLANT

SOLVENT EXTRACTION

In the present study, the fresh leaves and seeds were used to evaluate their antibacterial activity. Plant extracts were prepared by soxhlet extraction method. The leaves and seeds were air dried in room temperature for 15 days. The fully dried plant materials were powdered and weighed. The powdered leaves and roots (15 gm) used to soxhlet extraction of different solvents such as Acetone, Methanol and Ethanol. The plant extract were evaporated and dissolved in DMSO.

IN VITRO ANTIBACTERIAL ASSAY

The Well diffusion method was employed for determining antibacterial activity of *Cardiospermum helicacabum* leaves and seeds extracts. The Muller Hinton agar medium was prepared and autoclaving at 121°C at 15lbs pressure for 15 minutes. After sterilization, the media was transferred into sterile Petri dishes and then allowed to solidify. Then 0.1 ml of test organism was taken from the stock (broth). The sterile cotton swab were dipped in the broth and swabbed over the surface of Muller Hinton agar. The cultures were allowed to dry for 5 minutes. The plant extracts to be tested were prepared with various concentrations viz., 15µl, 30µl, 45µl and 60µl. The plates are incubated at 37°C for 18- 24 h at the diameter of “zone of inhibition” will measure and expressed in mm.

RESULT AND DISCUSSION

TABLE – 1

Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Staphylococcus aureus*

Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 µl	30 µl	45 µl	60 µl
<i>Cardiospermum helicacabum</i>	Leaves	Acetone	10	10	11	12
		Ethanol	12	15	16	17
		Methanol	12	13	13	13

TABLE – 2

Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Staphylococcus aureus*

Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 µl	30 µl	45 µl	60 µl
<i>Cardiospermum helicacabum</i>	Seeds	Acetone	10	12	12	-
		Ethanol	10	12	15	16
		Methanol	11	13	15	15

TABLE – 3

Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Pseudomonas aeruginosa*

Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 µl	30 µl	45 µl	60 µl
<i>Cardiospermum helicacabum</i>	Leaves	Acetone	-	10	11	11
		Ethanol	10	11	12	12
		Methanol	8	9	10	12

TABLE – 4

Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Pseudomonas aeruginosa*

Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 µl	30 µl	45 µl	60 µl
<i>Cardiospermum helicacabum</i>	Seed	Acetone	10	10	11	-
		Ethanol	10	11	12	14
		Methanol	-	12	12	13

TABLE – 5

Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Escherichia coli*

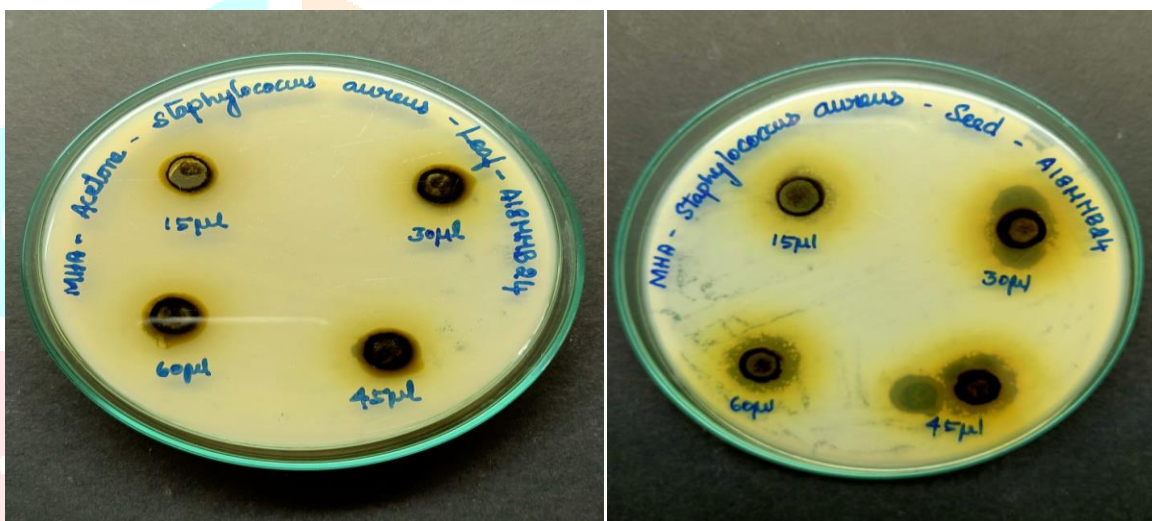
Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 µl	30 µl	45 µl	60 µl
<i>Cardiospermum helicacabum</i>	Leaves	Acetone	10	13	15	16
		Ethanol	12	13	14	15
		Methanol	10	11	13	14

TABLE – 6

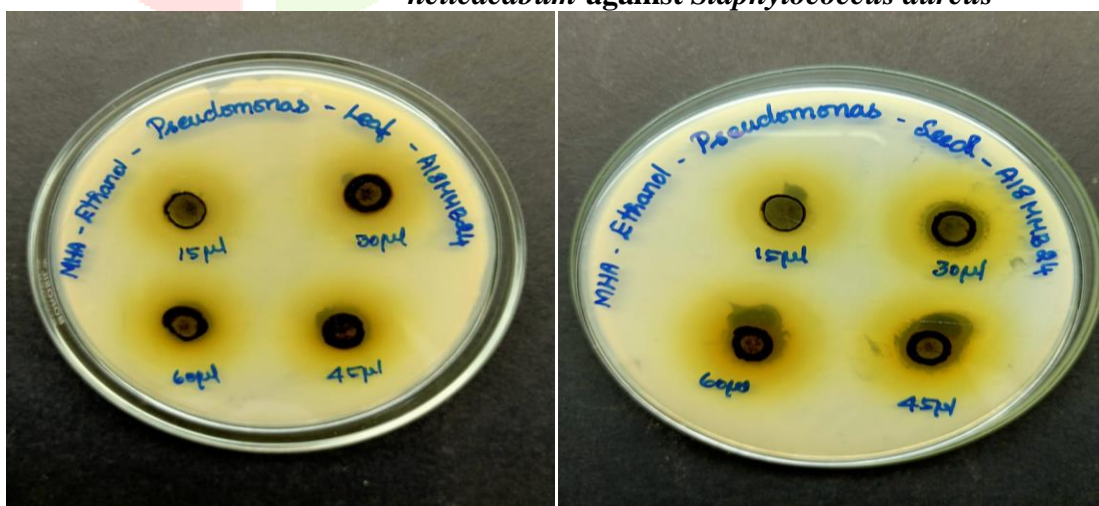
Antibacterial activity of plant extract of *Cardiospermum helicacabum* against *Escherichia coli*

Plant	Extract	Solvents used	Area of inhibition zone (mm)			
			15 μ l	30 μ l	45 μ l	60 μ l
<i>Cardiospermum helicacabum</i>	Seeds	Acetone	10	11	13	14
		Ethanol	11	12	15	15
		Methanol	10	11	11	12

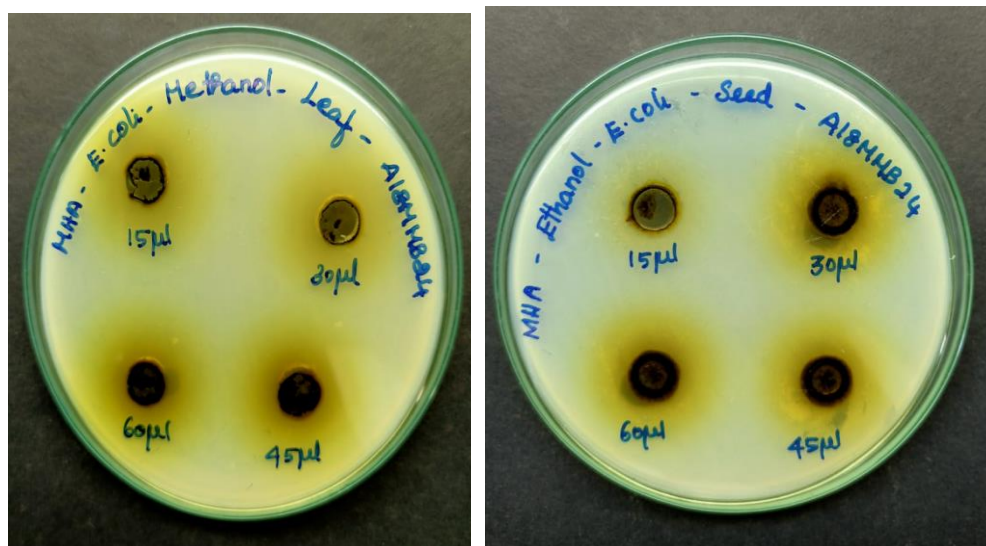
PLATES



PLATES: 1 Antibacterial activity of Leaves and Seeds extract of *Cardiospermum helicacabum* against *Staphylococcus aureus*



PLATES: 2 Antibacterial activity of Leaves and Seeds extract of *Cardiospermum helicacabum* against *Pseudomonas aeruginosa*



PLATES : 3 Antibacterial activity of Leaves and Seeds extract of *Cardiospermum heliacabum* against *Escherichia coli*

C. heliacabum known as mudakattan in Tamil, Ballon vine or Heart's pea in English. This plant is distributed throughout India in the plains. The plant is pubescent or nearly glabrous, annual or perennial with slender branches, climbing by means of tendrillar hooks, leaves ternately bicomponent, leaflets acuminate at the apex, flowers white, small fruits membranous, depressed, pyriform capsule winged at the angles, seeds black with a large white heart shaped aril. The roots, leaves and seeds of the plant were used as herbal medicine (Warrier, 1996). The roots are diuretic, diaphoretic, emetic, mucilaginous, laxative and emmenago-gue. They are useful to cure strangury, fever, arthritis, amenorrhoea, lumbago and neuropathy. According to earlier research the roots are ineffective for chronic rheumatism. The leaves are rubifacient and are good for arthritis and fever. The plant has sedative action on the central nervous system (Nadkarni *et al.*, 1996).

The antipyretic activity of was reported by Asha *et al.* (1999) Treatment of chronic dermatoses with plant pharmaceuticals was reported by Shakhtmeister *et al.* (1997). Having known these facts an attempt was made to evaluate the antimicrobial activity of *C. heliacabum* extracts on various gram-positive, gram-negative bacteria and fungi.

The *Cardiospermum heliacabum* leaves extract against *S. aureus*, *B. subtilis* and *E. coli*. The extracts exhibited marked anti-microbial activity against both Gram positive and Gram negative bacteria. When the concentration of the extracts was increased the zone of inhibition also increased (Deeopan *et al.*, 2012).

In the present study, the *in vitro* antibacterial activity of *Cardiospermum heliacabum* showed the inhibitory action against the tested microorganisms. All the plant extracts inhibited the microorganisms to a significant level (Table 1-6). When comparing among extracts, the leaves extracts showed maximum antibacterial activity than seed extracts.

When comparing among different solvent extracts, ethanol extracts of *Cardiospermum halicacabum* viz., leaves and seeds showed maximum antibacterial activity than Acetone and Methanol extracts. *Cardiospermum halicacabum*, reservoir of highly active chemical constituents. The antimicrobial activity of extracts of *C. halicacabum* was studied. The leave, stem, flower, seed, seed coat and root of the *C. halicacabum* were subjected to butanol, acetone, methanol and petroleum ether extractions were used. The butanol and methanol extract had composed of plenty of phytochemical compounds compared to acetone and petroleum ether extracts. Alkaloid was present only in stem and root of butanol extract, leaf and root of acetone extract and seed of methanol extracts. Phenol, tannin and glycosides were observed in Butanol and methanol extract of all the portion of the *C. halicacabum*. The antibacterial activity of extracts of *C. halicacabum* against clinical pathogens. The zone of inhibition (ZoI) of extracts namely butanol, acetone, methanol and petroleum ether were ranged between 12 to 23mm, 11 to 33mm, 13 to 28mm and 12 to 30mm respectively (Selvarani *et al.*, 2018).

The present study shows that the Actone, Ethanol, Methanol extracts have inhibitory activity against most of the pathogenic microorganisms (**Plates 1, 2 and 3**). The inhibition of the growth of these organisms *in vitro* by extracts may be due to the presence of some active constituents in the extracts. These active principles may have acted alone or in combination to inhibit the growth of the bacterial organisms. The medicinal uses of these plants to heal diseases including infectious one has been extensively applied by people. The problem of microbial resistance is growing and the outlook for use of antimicrobial drugs in the future is still uncertain. Therefore, actions must be taken to develop research to better understand the genetic mechanisms of resistance, and to continue studies to develop new drugs, either synthetic or natural. The ultimate goal is to offer appropriate and efficient antimicrobial drugs to the patient.

In the present study, it was generally observed that *Cardiospermum halicacabum* have brought about the possibility of utilization of plant extracts, which has provided scientific evidence for the development of antibacterial products and the treatment of bacterial infections in the future.

CONCLUSION

In conclusion, the leaves and Seeds of *Cardiospermum halicacabum* extract could be potential source of inhibitory substance for certain pathogens. It's a rich source of biological active compounds. The result may justify the use of the plant in the treatment of some diseases as broad spectrum antibacterial agent.

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