ISSN: 0976-7126
Jayarajan *et al.,* 16 (1):29-40, 2025

International Journal of Pharmacy & Life Sciences
Open Access to Researcher


# A Pilot Study on Phytoconstituents in Leaves Extracts of *Cardiospermum halicacabum* and its Antimicrobial activity against Selective Pathogens

**Malinidevi M.[1], Vijayasimha M.[2] , Sajad Ahamad Bhat [3]and Jayarajan D[*]**

*1, Dept. of Medical lab Technology, Divine Mother College, Korkadu, Puducherry-India

2, Dept. of Medical lab Technology, School of Allied Health Sciences, Jaipur National University, Jaipur, (R.J.) - India

3, Dept of Medical Lab Technology, NIMS College of Paramedical, NIMS University, Jaipur, (R.J.) - India

**Article info**

**Received: 1/11/2024**

**Revised: 26/11/2024**

**Accepted: 1/12/2024**



***www.ijplsjournal.com***

**Abstract**

Increasing interest is devoted to phytochemical for their role in plant immunity. Medicinal plant are rich source of these bionutrients. *Cardiospermum halicacabum* is a climbed plant variety with seeds and fruits. It has a unique biodiversity in occurrence and distributed globally. A special attention is given to screening of phyto compounds, antibacterial activity was determined by agar well diffusion method against selected bacterial strains. Phytochemical screening revealed the presence of Terpenoids, glycosides, Saponins, Proteins, Carbohydrates, Volatile esters, Fatty acids and Quinones. It act as a diuretic, laxative, rubefacient, antipyretic, antiulcer,antianxiolytic, adulticidal activity in mosquito, antifilaril and effective in treating itchy scalp and infertility.

**Key Words:** *Cardiospermum halicacabum Linn.* Phytochemical Studies. Antibacterial activity etc

## Introduction

*Cardiopermum halicacabum* is a medicinal plant fits into the *Sapindaceae* family. It is otwell-known as Ballon vine, Love in a Puff, Heart seed, Modakathon(in Tamil ) etc. It has the natural healer properties for hay fever, allergic reactions, sneezing and watery eyes. Balloon vine is considered to be a traditional medicinal herb and the leaves are used to treat diarrhea, dysentery, Oedema, Nephritis and Oliguria haemorrhoids, asthma, pyodermas and carbuncles, earaches, ophthalmias and muscular pains, rheumatism and arthritis. (Shekhawat *et al.,* 2013). It is a dioecious, woody perennial climber originated from the region of native tropical America, distributed in the tropical and subtropical America. The plant grows up to the length of 2 to 4 m which are deltoid with two highly lobed leaflets. Each leaflet comprises of 2-ternate, lanceolate segment with inciso-serrate margins. Stem looks long and wiry. Flowers are white, small and hermaphrodite which are arranged in axillary, umbellate cymes. Two circinate tendrils also located at the top on a slender peduncles.

***Corresponding Author**
**E.mail:** asairaj123@gmail.com

## Material and Method

### Collection of plant material

Fresh *Cardiospermum halicacabum* leaves were collected from the local study area Korkadu, Puducherry, South India in month of Janauary2024 for our study.Taxonomic characteristics and expertconsultation were done to authenticate the plant leaves.

### Processing of plant material

Fresh *Cardiospermum halicacabum* leaves were collected, washed, dried, and powdered, then stored in sealed glass bottles for analysis until needed (Subramanian *et al.,* 2020)

### Preparation of plant extract

The study used distilled water and cold maceration to extract plant leaves. The leaf powder was dissolved in the solvent, shaken, and left to stand for 24 hours. The resulting solution was distilled, collected in pre-weighed bottles, and stored at 4°C For analysis.The extraction of the plant leaves were carried out using chloroform and aqueous as extracting solvents. The cold maceration extraction method was used. 50g of leaf powder was weighed and dissolved in 1000mL of the extracting solvent inside a 2L conical flask and covered with parafilm. The flasks were shaken vigorously at 30 minutes interval and left to stand for 24 hours at room temperature. The resultant mixture was then filtered with Whatman's No.4 filter paper and cotton wool to remove particles of plant sample. The clear solution obtained was distilled at 65°C under low pressure on a steam bath. The semi solid concentrations of the extracts were then collected in sterile pre-weighed screw capped bottles and labeled accordingly The extracts were Stored at 4°C until when needed. (Ogunjobi *et al*., 2007)

### Phytochemical analysis

The phytochemical tests were performed to identify active chemical constituents such as carbohydrates, phenolic compounds, steroids, alkaloids, proteins, terpenoids, flavonoids, cardiac glycosides, saponins, tannins, gums, and mucilages. (Waiganjo *et al* .,2020*)*

### Qualitative Analysis

### Test For Carbohydrate

#### Molisch's Test

To 2mL of the extract, 2 drops of Molisch reagent was added and mixed. 2mL of concentrated Sulphuric acid was added to this solution. Occurrence of violet ring at the junction of the solution and its vanishing on addition of excess alkaline solution indicates the presence of carbohydrate. (Mohammed *et al*., 2018).

#### Benedict's Test

To the test solution few drops of Benedict's reagent was added and heated on water bath.The presence of sugars was indicated by reddish precipitate formation. Depending on the concentration of the reducing sugars, the amount and colour of the precipitate produced varied. A positive Benedict's test appears green, yellow, orange, or red (Nagaraju *et al*., 2014)

#### Fehling's Test

To 1mL of the extracts, 1mL of Fehling's A and 1mL of Fehling's B solution were added in a test tube and heated in a water bath for 10 minutes formation of red precipitate indicates the presence of a reducing sugar. The filtrate was reacted with a 1mL of Fehling's A and B and heated in water bath for 5-10 minutes. Appearance of reddish orange precipitate shows the presence of carbohydrates (Mahendra *et al*., 2018).

### Test for Protein

#### Biuret Test

To 3 mL of extracts add equal volume of 4% sodium hydroxide and add a few drops of 1%solution CuSo4 to form violet or pink color (Rangarajan *et al*., 2015).

#### Millon's Test

Add 5mL of million's reagent to 3mL extract warm the solution till it boils white precipitates

formed where precipitate turns brick red color solution.(Sagar & Ashok, 2012)

#### Xanthoproteic's Test

Add few drops of Concentrated Nitric acid to

the walls of test tube containing 2mL of extract. Appearance of yellow color indicated the presence of proteins (Saima *et al* .,2020)

**Saponins**

**Foam Test**

Add 1ml of extract and 2mL of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins. (Them *et .al.,*2019)

**Cardiac Glycosides**

**Test for Cardiac Glycosides**

Add 2 mL of extract and glacial acetic acid and add a 2-3 drops of 5% Ferric chloride along with concentrated Sulphuric acid in a test tube and observed for a reddish brown coloration at the junction of two layers and the bluish green color in the upper layer denoted the presence of cardiac glycosides (Rahman *et al*., 2017).

**Quinones**

**Test for Quinones**

Take 1mL of extract in a clean test tube and add 5 mL of distilled water and observe for the turbidity(Farooque & Jadada,2021).

**Test For Steroid**

**Liebermann Burchard Test**

Crude extracts were dissolved in 2mL of chloroform to which 10 drops of acetic acid and 5 drops of concentrated sulphuric acid were added in a test tube and mixed. Formation of red colour from blue to green indicated the presence of steroids (Kalpana*et al*., 2018)

**Test For Alkaloids**

**Wagner's Test**

2mL of crude extract filtrate was taken in a test tube and it was added with same quantity of Wagner's reagent. The formation of reddish-brown precipitate reveals the presence of alkaloids (Balamrugan *et al.,*2019)

**Test For Terpenoids**

**Salkowski Test**

5mL of the extract was added to chloroform along with a few drops of concentrated sulphuricacid. The mixture was shaken well and kept aside for some time. Appearance of red color in thelower layer indicates the presence of steroids and the formation of yellow color in the lower layerindicates the presence of terpenoids.(Krvavych*et al*., 2014).

**Test For Phenolic compound**

**Ferric Chloride Test**

A little extracts was dissolved in distilled water. To this, 2 mL of 5% Ferric chloride solution was added. Formation of blue, green, or violet color indicates the presence of phenolic compounds. (Vimalkumar *et al*., 2014).

**Ellagic Acid Test**

Add 5-6 drops of extract solution and add 5% Glacial acetic acid and 5% Sodium nitrate and mix well. Transformation of dark brown precipitate known as Niger brown indicates the presence of Phenolic compounds (Wang*et al*., 2019).

**Potassium dichromate Test**

To 1 mL of extract add 2-3 drops of Potassium dichromate solution. The solution colourwill change into dark indicates the presence of phenolic compounds(Shaikh *et al* 2020)

**Test For Phlobatannins**

**Haemolysis Test**

One drop of fresh human blood is taken on a glass slide and few drops of extract were added and mixed well. Formation of Zone of haemolysis indicates the presence of phlobatannins (Yusuf *et al.,2014)*

**Test For Anthocyanins**

**Hydrochloric acid Test**

To 2 mL of extract, add 2 mL of 2N Hydrochloric acid solution and 5-7 drops of Ammonia solution was added. Pink-red solution which turns blue-violet after addition of ammonia solution indicates the presence of anthocyanins (Obouayeba *et al*.,2015)

**Test For Coumarins**

In a clean glass test tube mL of extract was taken and added with 1.5ml of 10% Sodium

Hydroxide and was observed for the formation of yellow color which indicated the presence of coumarins(Saberi *et al*.,2013*)*

**Test For Chloesterol**

To 2mL of extract add 2mL of chloroform and add 2-3 drops of acetic anhydride along with 2-3 drops of concentrated Sulphuric acid. Transformation of vibrant red-rose color indicates the presence of chloesterol (Oyewole *et al*.,2011)

**Test For Flavanoid**

5 mL of dilute ammonia solution was added to a portion of the extracts followed by addition of concentrated sulphuric acid. Development of a yellow color in the extract designates the presence of flavonoids. After some time the yellow color will disappears (Mishra *et al.,* 2024)

**Test For Tannins**

**Braymer's Test**

Take 1mL of extract and treat it with 1ml of 10% alcoholic ferric chloride solution and observe for the formation of blue or greenish color. (Morsy *et al.,* 2014)

**Test For Gums and Mucilages**

**Gums and Mucilages Test**

To mL of distilled water the extract is mixed and dissolved and to this 2mL of absolute alcohol is added and further stirred constantly. The formation of white or cloudy precipitate indicates the presence of Gums and Mucilages(Kumar *et al.,* 2014)

**Determination of Antimicrobial Activity**

***Selection of Test organisms***

Invitro antibacterial activity was evaluated against five bacterial pathogens of clinical origin. Gram positive strain *Staphylococcus aureus*, Gram negative strains *Escherichia coli*, *Shigella* sp, *Alcaligens feacalis* and *Pseudomonas aeruginosa* were used in the study. All the clinical strains were procured from Microbiology laboratory of Divine Mother College, Puducherry, India.

***Inoculum preparation***

Bacterial inoculum was prepared by inoculating a loopful of test organisms in 5 ml of Muller Hinton Broth and incubated at 37°C for 3-5 hours till a moderate turbidity was developed. The turbidity was matched with 0.5 Mc Farland standards.

**Assessment of antibacterial activity**

Immediately after standardization, a sterile cotton swab was immersed in the bacterial suspension and swabbed aspetically on the surface of sterile Mueller-Hinton agar (Hi-media, Mumbai) plates. Wells of 8mm diameter were punched in to the agar medium and filled with 10µL, 50µL and 100µL of root extracts (100mg/mL of water). Well loaded with 100µL of Levofloxacin (5µg) served as positive control. The plates were incubated at $37^0$ C for overnight in a bacteriological incubator. Anti-microbial activity was measured by measuring the zone of inhibition in mm around each well, negotiating the diameter of well. (Balouiri*etal.,* 2016)

**Results and Discussion**

**Preliminary Phytochemical Analysis**

The phytochemical screening of Aqueous and chloform Leaves extract of *Cardiospermum halicacabum* was analysed and it exhibited the presence of various phytoconstituents during the investigation.**(Table.1)**Phytoconstituents such as Carbohydrates, Proteins, Terpenoids, Amino acid, Saponins, Quinones, Coumarins and Alkaloids were detected. Tannins and Anthocyanins were absent in both the extract...Carbohydrates were present in both the aqueous and chloform extracts**.(Fig.1)**Carbohydrates, essential for genetic material and energy, are crucial in living cells. Glucose, found in fruit juices and honey, is the most common carbohydrate found in polysaccharides like cellulose and starch.(Beta & Camire, 2018).

Both the extracts revealed the presence of Proteins during millon's and xanthoproteic test.But in biuret test only chloform extract exhibited its presence and were absent in aqueous extract.**(Fig.2)** Plant proteins and amino acids were crucial for food and feed, absorbed by the intestine and converted into modified proteins. These bioactive proteins and peptides exert specific body actions. (Ghaly & Alkoaik 2010). Saponins were present in aqueous extract and

absent in chloroform extract. Saponins were naturally occurring amphiphilic glycosides widely distributed in the plant kingdom glycosides were used in treatment of atrial fibrillation, flatter, and they acts as emetics and as diuretics (Agidew, 2022). **Fig.3).**

Steroids were existed in chloform extract and in absent in aqueous extract**.(Fig.4).**Steroid glycosides should be used cautiously, as excessive dosage can cause severe heart damage, while small amounts can provide necessary stimulation. (Rana *et al.*, 2022)

**Table 1: Phytochemical Constituents of *Cardiospermum halicabubum***

| SL.NO | PHYTOCHEMICAL ANALYSIS | AQUEOUS EXTRACTS | CHLOROFORM EXTRACTS |
|---|---|---|---|
| **1.** | **CARBOHYDRATE** | | |
| | Molisch's Test | + | + |
| | Benedict's Test | + | + |
| | Fehling Test | + | + |
| **2.** | **PROTEIN** | | |
| | Biuret Test | - | + |
| | Millon's test | + | + |
| | Xanthoproteic test | + | + |
| **3.** | **PHENOLIC COMPOUNDS** | | |
| | Ferric Chloride Test | + | + |
| | Ellagic Acid Test | - | + |
| | Potassium Dichromate Test | + | + |
| **4.** | **STEROID** | | |
| | Liebermann Burchard Test | - | + |
| **5.** | **ALKALOIDS** | | |
| | Wagner's Test | + | + |
| **6.** | **FLAVONOIDS** | | |
| | Ferric chloride Test | + | + |
| **7.** | **TERPENOIDS** | | |
| | Salkowski Test | + | - |
| **8.** | **SAPONINS** | | |
| | Foam's Test | + | - |
| **9.** | **TANNINS** | | |
| | Braymer's Test | - | - |
| **10.** | **GLYCOSIDES** | + | - |
| **11.** | **QUINONES** | - | + |
| **12.** | **COUMARINS** | + | + |
| **13.** | **GUMS AND MUCILAGES** | + | + |
| **14.** | **ANTHOCYANINS** | - | - |

| | | | |
|---|---|---|---|
| **15.** | **CHOLESTEROL** | - | + |
| **16.** | **PHLOBATANNINS** | + | + |

Alkaloids were present in both the extracts**(Fig.4).** Alkaloids are secondary compounds derived from amino acids or transamination, found in nature. They are diverse and categorized based on amino acid structure , with different biosynthetic pathways and biological activity. (Gul *et al.*, 2017)

Aqueous extracts demonstrated the prevalence of Terpenoids where as it was absent in Chloroform extracts( **Fig.4).(**Terpenoids, also known as isoprenoids, are diverse in natural products found in plants with over 25,000 compounds. They have strong odors and flavors, and were used in herbal remedies due to their varied actions.(Indumathi, *et al.*, 2014)

Both the extracts confirmed the existence of Phenolic compounds except in Ellagic acid test for Aqueous extract**.(Fig.5).** Phenolic compounds, abundant secondary metabolites of plants, consist of aromatic rings and hydroxyl groups. With over 8,000 structures, they produce natural color pigments, responsible for fruit color in plants.(Maria,*et al.*, 2018)

Flavanoids werefound existent in both the extracts.**(Fig.6).** Flavonoids were the active biological phytochemicals found in plants, used in herbal medicines, and essential in daily diets. Found in fruits, vegetables, grains, bark, stems, tea, and wine, they are synthesized by plants in response to microbial infections.The presence of flavonoids in human diet may control inflammation and play a significant role in cancer prevention which were already reported in our earlier studies in Piper betle (Jayarajan *et al.*, 2023).Tannins were not detected in both the extract).**(Fig.6).**(Pinheiro *et al.*, 2012.Tannins, plant polyphenols, exhibit binding properties to proteins, pigments, and large-molecular compounds, as well as anti-oxidant activities, distinguishing them from other plant polyphenol(Waiganjo, *et al.*, 2016)

Gums and mucilages were detected in both the extracts during the study **(Fig.6).** Plant-derived gums have been used by humans since ancient times for numerous application(Vasile, *et al.*, 2019). Natural coumarins play a significant role in cancer prevention and treatment. (Jain & Joshi,2012). Both extracts comprised Phlobatannins were confirmed during the study**(Fig.7).** Phlobatannins has the property of ,anti inflammatory and analgesic..Phlobatannins, found in plants, protect the body by slowing artery hardening, maintaining blood pressure, and lowering cholesterol levels (Doss,2009). Anthocyanins were also not found in both the extract**(Fig-8).** Anthocyanins were extracted from plant materials using methanol with hydrochloric or formic acid, which lowers pH and prevents pigment degradation. However, concentrated acid during evaporation can cause degradation.(Obouayeba *et al.*, 2015). Cholesterol were identified only in chloroform extract and could not be identified in aqueous extracts**. (Fig.8).**Cholesterol was a vital molecule in human life, contributing to cell membrane structure and fluidity. It also play a significant role in synthesis of vitamin D, steroid hormones, and sex hormones. Cholesterol was also a constituent of bile salt, aiding digestion and fat-soluble vitamin absorption. (Negm El-Dein *et al*., 2023)

**TEST FOR CARBOHYDRATE**

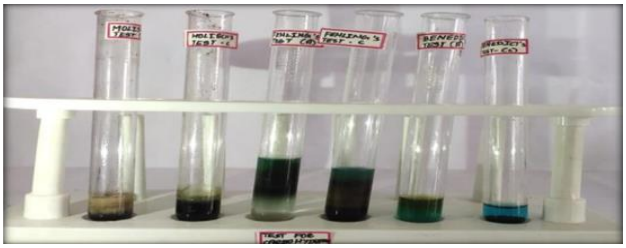


**Figure.1 Shows the test results for Carbohydrate**

**TEST FOR PROTEIN**

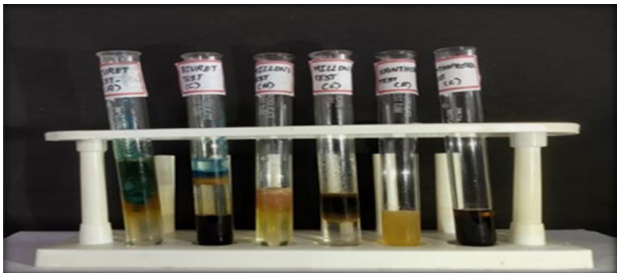


**Figure .2. Shows the test results for Proteins**

ISSN: 0976-7126
Jayarajan *et al.*, 16 (1):29-40, 2025

**TEST FOR SAPONINS,CARDIAC GLYCOSIDES AND QUINONES**

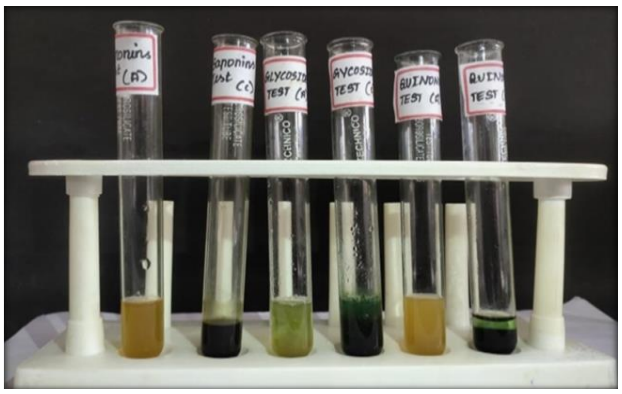


**Fig.3. Shows the test result for Saponins, Cardiac Glycosides and Quinones**

**TEST FOR STEROIDS,ALKALOIDS AND TERPENOID**

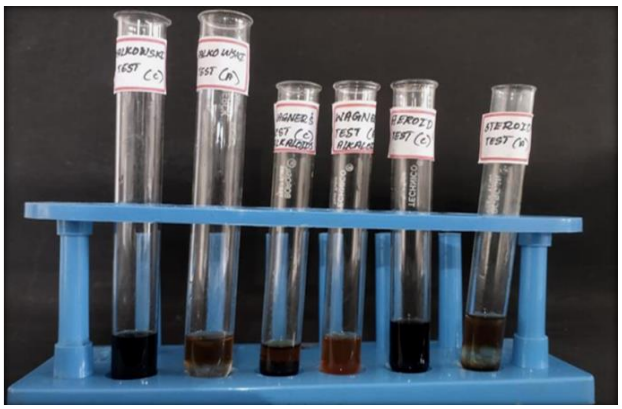


**Fig.4. Shows the test results for Steroids, Alkaloids and Terpenoids**

**TEST FOR PHENOLIC COMPOUNDS**

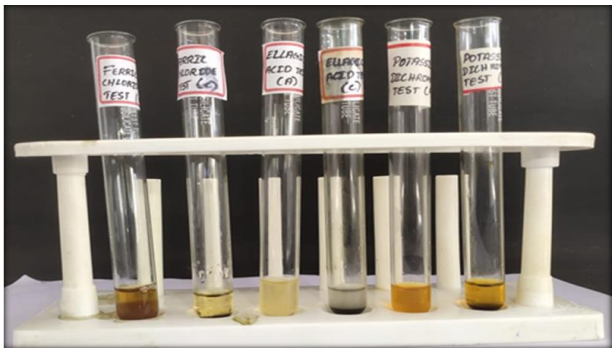


**Fig.5. Shows the test results for Phenolic compounds**

**TEST FOR FLAVONOIDS,TANNINS AND GUMS AND MUCILAGES**

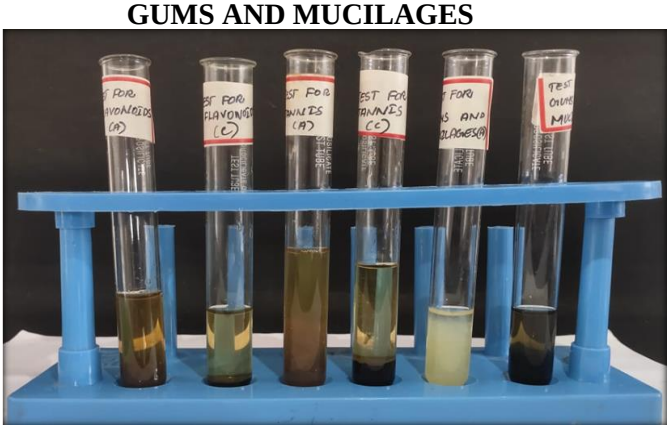


**Fig.6. Shows the test results for Flavonoids, Tannins, Gums and Mucilages**

**TEST FOR PHLOBATANNINS (FIGURE -7)**

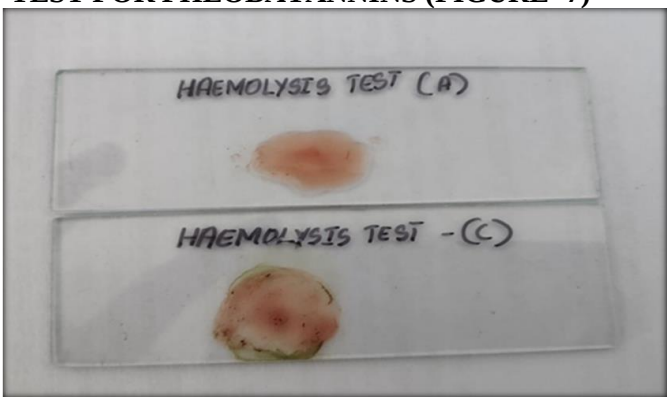



**Fig.7 Shows the test results for Phlobatannins**

**TEST FOR ANTHOCYANINS, COUMARINS AND CHOLESTEROL**

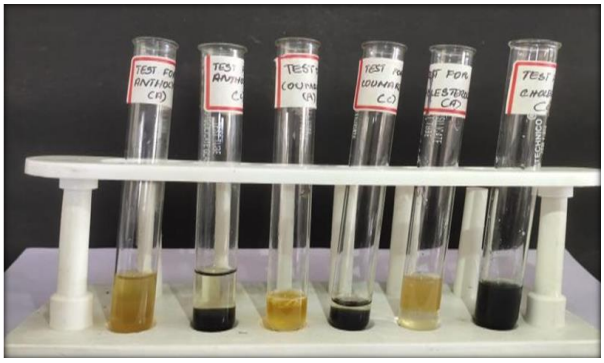


**Fig.8. Shows the Test results for Anthocyanins, Coumarins and Cholesterol**

**Antibacterial Activity**

Antimicrobial agents are the substances that possess the ability to either destroy or inhibit the growth of microorganisms. Evidences are increasing day by day from various regions around the world that medicinal plants have potential antimicrobial characteristics. It is expected that plant extracts will be more effective in targeting specific sites than standard antibiotics in combating drug-resistant pathogenic microorganisms. The phytochemicals which are biologically active compounds within the plants were responsible for their effective action against microbial pathogens.(Jayarajan *et al.*, 2023).

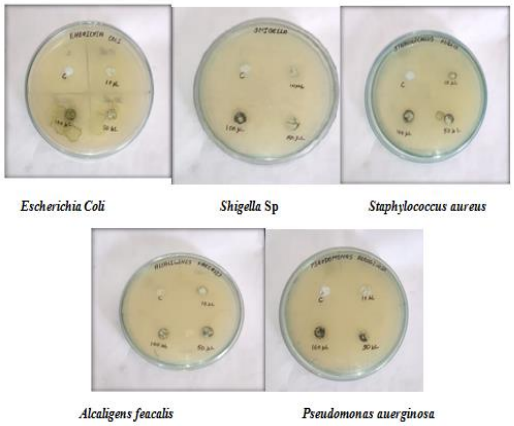
The antibacterial properties of Chloroform leaves extract of *Cardiospermum halicacabum* was assessed against bacterial pathogens using agar well diffusion method by measuring the diameter of growth inhibition zones with 10µL, 50µL, 100µL of suitable extracting solvents with Levofloxacin (commercial antibiotic) as control. The results illustrated that the chloroform extract possess antibacterial activity against the tested gram positive (*Staphylococcus aureus)* and gram negative (*Escherichia coli, Shigella* Sp, *Alcaligenes faecalis* and *Pseudomonas aeuriginosa* bacterial strains.(**Fig.9 &Table.2)**

**Table. 2 Antibacterial Activity of *Cardiospermum halicacabum***

| **Test organisms** | **Zone of inhibition(mm)** | | | |
|---|---|---|---|---|
| | **Control (Levofloxacin) (10 µg)** | **Chloroform extract** | | |
| | | **10(µL)** | **50(µL)** | **100(µL)** |
| *Staphylococcus* aureus | | 4 | 8 | 12 |
| *Escherichia coli* | | 2 | 6 | 10 |
| *Alcaligens faecalis* | | -- | -- | -- |
| *Shigella* sp sp | | 4 | 9 | 15 |
| *Pseudomonas aeruginosa* | | -- | -- | -- |

In the present antibacterial assay the maximum activity was recorded against *Shigella* sp . Similarly least activity was recorded against *Escherichia coli*.. Plant-based antibacterials have significant therapeutic potential due to their minimal side effects compared to synthetic ones. Due to the increasing failure of chemotherapeutics and antibiotic resistance, medicinal plants are being screened for their potential antimicrobial activity. Further research and exploration of plant-derived antimicrobials is needed to develop new chemotherapeutic drugs and phytomedicines against microbes. Medicinal plants are crucial sources for developing potential chemotherapeutic drugs.(Silva *et al* 2010)

Fig.9 Antibacterial Activity of *Cardiospermum halicacabum*



*Escherichia Coli* *Shigella Sp* *Staphylococcus aureus*

*Alcaligens feacalis* *Pseudomonas auerginosa*

## Conclusion

The invitro analysis for the presence of phytoconstituents, antibacterial activity of *Cardiospermum halicacabum* exposedthat plant was medically potent has been demonstrated. The pharmacological effects exhibited by the phytoconstituents from *Cardiospermum halicacabum* would be an alternative for various health disorders. While some traditional applications have been supported by modern scientific studies, more pharmacological evaluations are needed to validate other traditional uses Bioassay-guided isolation, pharmacokinetic evaluations, and mode of action identification are recommended for future research on *Cardiospermum halicacabum* therapeutic drug leads.

## Acknowledgements

The authors are greatly indebted to the Management, Divine Mother College, Korkadu, Puducherry, South India for granting permission to carry out the work..

## Grant information:

The author(s) declare(s) that no grants were involved in supporting this work

## References

1. Agidew, M. G. (2022). Phytochemical analysis of some selected traditional medicinal plants in Ethiopia. *Bulletin of the National Research Centre*, *46* (87) 1-22
2. Balamurugan, V., Fatima, S., & Velurajan, S. (2019). A guide to phytochemical analysis. *International Journal of Advance Research and Innovative Ideas in Education*, *5*(1), 236-245.
3. Balouiri, M., Sadiki, M., & Ibnsouda, S. K. (2016). Methods for in vitro evaluating antimicrobial activity: A review. *Journal of pharmaceutical analysis*, *6*(2), 71-79.
4. Beta, T., & Camire, M. E. (Eds.). (2018). *Cereal Grain-Based Functional Foods: Carbohydrate and Phytochemical Components*. Royal Society of Chemistry. 1-11
5. Chandrasekar, A., Sagadevan, S., & Dakshnamoorthy, A. (2013). Synthesis and characterization of nano-hydroxyapatite (n-HAP) using the wet chemical technique. *Int. J. Phys. Sci*, *8*(32), 1639-1645.
6. Chandrasekar, M., Suresh, S., & Senthilkumar, T. (2012). Mechanisms proposed through experimental investigations on thermophysical properties and forced convective heat transfer characteristics of various nanofluids–A review. *Renewable and Sustainable Energy Reviews*, *16*(6), 3917-3938.
7. Doss, A. (2009). Preliminary phytochemical screening of some Indian medicinal plants. *Ancient science of life*, *29*(2), 12-16.
8. Farouk, S., & Al-Huqail, A. A. (2022). Sustainable biochar and/or melatonin improve salinity tolerance in borage plants by modulating osmotic adjustment, antioxidants, and ion homeostasis. *Plants*, *11*(6), 765. 1-22
9. Ghaly, A. E., & Alkoaik, F. N. (2010). Extraction of protein from common plant leaves for use as human food. *American Journal of Applied Sciences*, *7*(3), 331-342
10. Gul, R., Jan, S. U., Faridullah, S., Sherani, S., & Jahan, N. (2017). Preliminary phytochemical screening, quantitative analysis of alkaloids, and antioxidant activity of crude plant extracts from Ephedra intermedia indigenous to

Balochistan. *The Scientific World Journal*, *2017*(1) 1-7.

11. Indumathi, C., Durgadevi, G., Nithyavani, S., & Gayathri, P. K. (2014). Estimation of terpenoid content and its antimicrobial property in Enicostemma litorrale. *Int J ChemTech Res*, *6*(9), 4264-4267.
12. Jain, P. K., & Joshi, H. (2012). Coumarin: chemical and pharmacological profile. *Journal of applied pharmaceutical science*, (Issue), 236-240.
13. Jayarajan ,D., Malinidevi M , Sathiya , Vijayasimha M and Dreviyaraj.VMA.(2023)Qualitative Phytochemical Analysis And In-Vitro Antimicrobial Screening of *Amaranthus Blitum* (L) Extracts,*International Journal of Recent Scientific Research* 13 ( 09)2313-2319
14. Jayarajan, D.,Mary Britto, Thenmozhi,S., Malinidevi,M and Vijayasimha,M.(2023).Assesment of phytoconstituents and in-vitro Antimicrobial screening of *piper betle (l)* Extracts. *Journal of Population therapeutics and Clinical Pharmacology*. 30 (18) 248-262
15. Kalpana, V. N., & Devi Rajeswari, V. (2018). A review on green synthesis, biomedical applications, and toxicity studies of ZnO NPs. *Bioinorganic chemistry and applications*, *2018*(1), 1-12
16. Krvavych, A. S., Konechna, R. T., Petrina, R. O., Kyrka, M. S., Zayarnuk, N. L., Gulko, R. M.& Novikov, V. P. (2014). Phytochemical research of plant extracts and use in vitro culture in order to preserve rare wild species Gladiolus imbricatus.5(1) 240-246
17. Kumar, S. (2014). Physicochemical, Phytochemical and toxicity studies on gum and mucilage from plant Abelmoschus esculentus. *Extraction*, *3(3)200-203*
18. Mahendra M, Jayaraj BS, Lokesh KS, Chaya SK, Veerapaneni VV, Limaye S Mahesh, P. A. (2018).. Antibiotic prescription, organisms and its resistance pattern in patients admitted to Respiratory ICU with respiratory infection in Mysuru. *Indian J Crit Care Med* 22:223-30.
19. Mahipal, P., & Pawar, R. S. (2017). Nephroprotective effect of Murraya koenigii on cyclophosphamide induced nephrotoxicity in rats. *Asian Pacific journal of tropical medicine*, *10*(8), 808-812.
20. María, R., Shirley, M., Xavier, C., Jaime, S., David, V., Rosa, S., & Jodie, D. (2018). Preliminary phytochemical screening, total phenolic content and antibacterial activity of thirteen native species from Guayas province Ecuador. *Journal of King Saud University-Science*, *30*(4), 500-505.
21. Mishra, R. R. (2024). Phytochemical analysis and comparison of some selected plants. *Vegetos*, 1-12.
22. Mohammed, M., Rozyanty, R., Mohammed, A. M., Osman, A. F., Adam, T., Dahham, O. S., ... & Betar, B. O. (2018). Fabrication and characterization of zinc oxide nanoparticle-treated kenaf polymer composites for weather resistance based on a solar UV radiation. *BioResources*, *13*(3), 6480-6496.
23. Mohammed, M., Rozyanty, R., Mohammed, A. M., Osman, A. F., Adam, T., Dahham, O. S.& Betar, B. O. (2018). Fabrication and characterization of zinc oxide nanoparticle-treated kenaf polymer composites for weather resistance based on a solar UV radiation. *BioResources*, *13*(3), 6480-6496.
24. Morsy, N. (2014). Phytochemical analysis of biologically active constituents of medicinal plants. *Main Group Chemistry*, *13*(1), 7-21.
25. Nagaraju, R., Reddy, B. S., Gloridoss, R., Suresh, B. N., & Ramesh, C. (2014). Effect of dietary supplementation of humic acids on performance of broilers. *Indian Journal of Animal Sciences*, *84*(4), 447-452.
26. Negm El-Dein, S., Hussein, A., Abu-Bakr, M. S., Negm El-Dein, A., Awad, H. M., & Ragab, E. A. (2023).

Phytochemical analysis and determination of antioxidant, anti-cholesterol, anti inflammatory and anti-proliferative activities of Gerbera jamesonii flowers. *Advances in Traditional Medicine*, *23*(3), 863-875.

27. Obouayeba, A. P., Diarrassouba, M., Soumahin, E. F., & Kouakou, T. H. (2015). Phytochemical analysis, purification and identification of Hibiscus anthocyanins. *J Pharm Chem Biol Sci*, *3*(2), 156-68.
28. Obouayeba, A. P., Diarrassouba, M., Soumahin, E. F., & Kouakou, T. H. (2015). Phytochemical analysis, purification and identification of Hibiscus anthocyanins. *J Pharm Chem Biol Sci*, *3*(2), 156-68.
29. Ogunjobi A. A., Fagade O. E and David O. O, 2007. Antimutagenic and potential Anticarcinogenic activities of Aloe-vera gel and aqueous Garlic extract in the Bacterialreverse mutation test (Ames assay) *African Journal of Biomedical Research* 10: 275-278.
30. Oyewole, O. I., & Akingbala, P. F. (2011). Phytochemical analysis and hypolipidemic properties of Jatropha tanjorensis leaf extract. *European Journal of Medicinal Plants*, *1*(4), 180-185.
31. Pinheiro, P. F., & Justino, G. C. (2012). Structural analysis of flavonoids and related compounds-a review of spectroscopic applications. *Phytochemicals—A Global Perspective of Their Role in Nutrition and Health*, 33-56.
32. Rahman, M. T. (2017). Role of agriculture in Bangladesh economy: uncovering the problems and challenges. *International Journal of Business and Management Invention*, *6*(7) 36-46
33. Rana, A., Negi, P. B., & Sahoo, N. G. (2022). Phytochemical screening and characterization of bioactive compounds from Juniperus squamata root extract. *Materials Today: Proceedings*, *48*, 672-675.
34. Rangarajan, P., Karthikeyan, A., Lu, J., Ling, E. A., & Dheen, S. T. (2015). Sirtuin 3 regulates Foxo3a-mediated antioxidant pathway in microglia. *Neuroscience*, *311*, 398-414.
35. Raza, A., Yousaf, W., Giannella, R., & Shata, M. T. (2012). Th17 cells: interactions with predisposing factors in the immunopathogenesis of inflammatory bowel disease. *Expert review of clinical immunology*, *8*(2), 161-168.
36. Saberi, A. H., Fang, Y., & McClements, D. J. (2013). Fabrication of vitamin E-enriched nanoemulsions by spontaneous emulsification: Effect of propylene glycol and ethanol on formation, stability, and properties. *Food research international*, *54*(1), 812-820.
37. Sagar, G., & Ashok, B. (2012). Green synthesis of silver nanoparticles using Aspergillus niger and its efficacy against human pathogens. *European Journal of Experimental Biology*, *2*(5), 1654-1658.
38. Saima, S., Fiaz, M., Manzoor, M., Zafar, R., Ahmed, I., Nawaz, U., & Arshad, M. (2020). Molecular investigation of antibiotic resistant bacterial strains isolated from wastewater streams in Pakistan. *3 Biotech*, *10*, 1-11.
39. Shaikh, J. R., & Patil, M. (2020). Qualitative tests for preliminary phytochemical screening: An overview. *International Journal of Chemical Studies*, *8*(2), 603-608.
40. Shekhawat, M. S., Manokari, M., Kannan, N., Revathi, J., & Latha, R. (2013). Synthesis of silver nanoparticles using Cardiospermum halicacabum L. leaf extract and their characterization. *J Phytopharmacol*, *2*(5), 15-20.
41. Silva, N. C. C., & Fernandes Júnior, A. J. J. O. V. A. (2010). Biological properties of medicinal plants: a review of their antimicrobial activity. *Journal of venomous animals and toxins including tropical diseases*, *16*, 402-413.
42. Subramanian, M. P. S., Ganthi, A. S., & Subramonian, K. (2020). Biosciences and Plant Biology. *Int. J. Curr. Res. Biosci. Plant Biol*, *7*(6), 45-54.

*43.* Suresh sagadeven, selvaraj vennila, Lakshmipathy Muthkrishnan, K Gurunathan, won chnuoh,suriati paiman,Faruq Mohammad, Hama A AI-Lohedan,Ainil hawa Jansi, I Fatimah, Kuppan Sivarajan, Prananna Kumar Obulapuram (2020) Exploring the therapeutic potentials of phyto-mediated silver nonopraticles formed via calotropis procer(ait) R.Br.root extract.. *Journal of Expermental Nanoscience 15 (1),217-231*

44. Them, L. T., Tuong Nguyen Dung, P., Thi Nhat Trinh, P., Tong Hung, Q., Tuong Vi, L. N., Trong Tuan, N.& Dung, L. T. (2019, June). Saponin, Polyphenol, flavonoid content and α-glucosidase Inhibitory activity, antioxidant potential of launaea sarmentosa leaves grown in ben tre province, Vietnam. In *IOP Conference Series: Materials Science and Engineering* (Vol. 542, (1) 120-36).
45. Vasile, F. E., Romero, A. M., Judis, M. A., Mattalloni, M., Virgolini, M. B., & Mazzobre, M. F. (2019). Phenolics composition, antioxidant properties and toxicological assessment of Prosopis alba exudate gum. *Food chemistry*, *285*, 369-379.
46. Vimalkumar, C. S., Hosagaudar, V. B., Suja, S. R., Vilash, V., Krishnakumar, N. M., & Latha, P. G. (2014). Comparative preliminary phytochemical analysis of ethanolic extracts of leaves of Olea dioica Roxb., infected with the rust fungus Zaghouania oleae (EJ Butler) Cummins and non-infected plants. *Journal of Pharmacognosy and phytochemistry*, *3*(4), 69-72.
47. Waiganjo, B., Moriasi, G., Onyancha, J., Elias, N., & Muregi, F. (2020). Anti plasmodial and cytotoxic activities of extracts of selected medicinal plants used to treat malaria in Embu County, Kenya. *Journal of Parasitology Research*, *2020*(1) 1-12
48. Waiganjo, N., Ochanda, H., & Yole, D. (2016). Phytochemical analysis of the selected five plant extracts. 3(9) 12-17
49. Wang, H., Wan, K., & Shi, X. (2019). Recent advances in nanozyme research. *Advanced materials*, *31*(45) 1-26
50. Yusuf, A. Z., Zakir, A., Shemau, Z., Abdullahi, M., & Halima, S. A. (2014). Phytochemical analysis of the methanol leaves extract of Paullinia pinnata linn. *Journal of pharmacognosy and phytotherapy*, *6*(2), 10-16.

**Cite this article as:**
Malinidevi M., Vijayasimha M., Sajad A.B. and Jayarajan D. (2025). A Pilot Study on Phytoconstituents in Leaves Extracts of *Cardiospermum halicacabum* and its Antimicrobial activity against Selective Pathogens. *Int. J. of Pharm. & Life Sci.*, 16(1): 29-40.

Source of Support: Nil
Conflict of Interest: Not declared
For reprints contact: ijplsjournal@gmail.com