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Research Article

Biochemistry for better diagnosis and therapy

A Comparative Study of Antibacterial Potential of Various Extracts of Different Parts of *Jatropha Curcas Linn* against Bacterial Strains

M. Siva Ganesh [1*], Dr. N. Agnel Arul John[1] and Dr. J. Radhika[2]

[1*]*Associate Professor of Biochemistry, Rathnavel Subramaniam College of Arts and Science (Autonomous) Affiliated to Bharathiar University, Sulur, Coimbatore- 641402*

[2]*Associate Professor of Biochemistry, Srimad Andavan Arts and Science College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli- 620005.*

[3]*Principal and Professor of Biochemistry, Srimad Andavan Arts and Science College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli- 620005*

Abstract: Herbal medicines derived from plant extracts are being increasingly utilized to treat a wide variety of clinical diseases, mainly in developing countries for primary health care because of better cultural acceptability, better compatibility with the human body and fewer side effects. Natural medicinal plants having various secondary metabolites such as flavonoids, alkaloids, phenol, terpenoids etc and these have rich medicinal value such as anti-oxidant and anti- microbial activities. Since time immemorial, medicinal plants are widely used for the treatment of different infectious diseases. Infectious diseases caused by bacteria strains have a large impact on public health. Now a days multiple drug resistance has developed due to the indiscriminate use of commercial anti-microbial drugs and impairs the treatment of infectious disease. The present study was focused on the different parts of *Jatropha curcas* Linn. It belongs to the family Euphorbiaceae , a large deciduous soft wooded shrub 3-4 m in height with sticky juice. The leaf part of the plant is used as galactagogue, lactagogue, rubefacient and have insecticidal properties and they are useful in foul ulcers, tumors and scabies. Seed of the plant is mainly used for dysentery, urinary discharge, abdominal complaints anaemia, fistula and diseases of the heart. The present investigation was carried out to study the antibacterial activity and evaluated for chloroform, methanol and diethyl ether extracts of various parts of *Jatropha curcas* Linn against *Escherichia coli, Staphylococcus aureus* and *Aeromonas* species by disc diffusion method. Based on the zone of inhibition, the antibacterial potential of different parts of the plant *viz*. leaves, stems and seeds were analysed. The evaluation of various solvent extractions revealed the effectiveness of the antibacterial activity of the plant. Among the various extracts, leaves, stems and seeds parts of the plant extracted with chloroform showed maximum zone of inhibition against all the tested bacterial species followed by methanol and diethyl ether. According to our results, the *Jatropha curcas* L can be considered as a rich source of active compounds with antibacterial activity. This may recommend a new pathway in elucidating a potent natural antibacterial agent.

Keywords: *Jatropha curcas* L, Chloroform extract, Methanol extract, Diethyl ether extract, Disc diffusion method, Different bacterial strains.

***Corresponding Author**

M.Siva Ganesh * , Associate Professor of Biochemistry, Rathnavel Subramaniam College of Arts and Science (Autonomous) Affiliated to Bharathiar University, Sulur, Coimbatore- 641402

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1. INTRODUCTION

Natural medicinal plants are the "backbone" of traditional medicine, which means more than 3.4 billion people in the less developed countries utilize medicinal plants on a regular basis. These herbal plants are considered as a high source of ingredients which can be used in drug development and synthesis.[1] Herbal plants have a good economic value in the Indian subcontinent. Almost all the parts of the plants namely leaves, roots, stem, flowers, fruits, have their own active principle which can be used for therapeutic purposes. About 80% of the population of south Asian and African countries prefers herbal medication has been estimated by World Health Organization (WHO) [2]. Herbal plants are traditional sources, incredible and invaluable sources as therapeutic compounds in the form of drug for different type of diseases.[3] Herbal drugs are vital role for prevention, cure of various diseases and ailments[4]. Active principle of plant sources have been implicated for therapeutic aspects of various diseases.[5]. Country with rich biodiversity and enormous treasure of natural herbal plants are consequently called as medicinal garden of the world was reported by India[6]. Natural herbal medicines have been used for efficacy, safety, lesser side effect and cultural acceptability from centuries. Continuous use of plant compounds as a medicine is detected to be an alternative way to treat the patients were practiced in ancient time[7] .In recent years, various drug resistances in human pathogenic bacteria has been developed due to the indiscriminate use of commercial antibacterial drugs commonly used in the treatment of infectious disease. In addition to this problem, antibiotics are sometimes associated with adverse effects on the host including hypersensitivity, and immune-suppression reaction. Effective therapeutic formations of drugs are very much essential for antibiotic resistance bacteria. Therefore, there is a need to develop alternative antimicrobial drugs for the treatment of infectious diseases from medicinal plant.[8] From the very beginning, man is gifted with plants which has treasured source of natural antibacterial agents for upholding normal health of human beings. Siddha, Ayurveda and Unani are the major natural therapeutic system for the treatment of various infectious diseases. In the last few decades, with more rigorous researches for therapies based on natural systems, plants are used extensively to cure different diseases. The search for unexplored plants or plant group with substantial antibacterial action has attained massive importance these days, due to a growing concern about the attainment of antibiotic- resistance by the pathogenic microorganism[9] *Jatropha curcas* L. is a species of flowering plant in the family of Euphorbiaceae. It has been reported to have a lot of health benefits because of its wide range of medicinal uses. Different parts of the plant including the leaves, fruits, latex and bark contains glycosides, tannins, phytosterol, flavonoids and steroidal sapogenins that exhibits wide range of medicinal properties. Some of the known medicinal properties of *Jatropha curcas* Linn include antitumor activities; anti-inflammatory, antiparasitic etc.[10] The present study intends to examine a *Jatropha curcas* Linn for its antibacterial potential against some selected strains of pathogenic bacteria with a vision to find out their probable medicinal use. It is hoped this research initiative will yield new compounds to help combat the rise of antibiotic resistant bacteria.

2. MATERIALS AND METHODS

2.1 Collection of plant material

The plant used for the present work was *Jatropha curcas* L which were collected from riverbed of Cauvery, Trichy district. The plant was identified and authenticated from Rapinat Herbarium, St. Joseph College, Trichy, Tamil Nadu, India. Collection of the different parts of the plant such as leaves, stem and seed for extraction process.

2.2 Processing of plant material

Leaves, stems and seeds were separated from respective plant, washed thoroughly and shade dried. The dried plant materials were coarsely powdered with electrical blender and used for preparation of extract.

2.3 Preparation of extracts

25gm of the air dried leaves, stems and seed powder of *Jatropha Curcas* L was solubilized in to 250 ml of respective solvents individually and transferred to extraction thimble , extracted with various solvents individually in the order of increasing polarity(Chloroform, Methanol, Diethyl ether) by using Soxhlet extraction apparatus(for 6 hrs). The extract was filtered into a tarred evaporating dish and the solvent was evaporated on a water bath. The residue was dried at 105° C to constant weight. Finally, stock solution of Conc. 50 mg /ml was prepared and used for antibacterial screening.

2.4 Procurement of bacteria

In the present study an attempt was done to evaluation of different solvent extracts of the *Jatropha curcas* Linn against various type of bacteria. Bacterial strains used for antibacterial studies were procured from Seahorse Hospital, Trichy, Tamilnadu. Pathogens used for the study were *Escherichia coli, Staphylococcus aureus* and *Aeromonas species.*

2.5 Revival of pathogen

The collected pathogen were revived in nutrient broth and stored in nutrient agar slants at 4°C.

2.6 Antibacterial activity

The chloroform, methanol and diethyl ether extracts of leaves, stem and seed of *Jatropha curcas* L were tested by disc diffusion method.[11] The test microorganisms were seeded into respective medium by spread plate method with the 24 hour cultures of bacteria growth in nutrient broth. After solidification the filter paper discs (5 mm in diameter) impregnated with the extracts were placed on test organism-seeded plates. *Escherichia coli, Staphylococcus aureus* and *Aeromonas species* were used for antibacterial test. The antibacterial assay plates were incubated at 37 °C for 24 h. The diameters of the inhibition zones were measured in cm

3. STATISTICAL ANALYSIS

All the results were expressed as Mean = SEM. Statistical analysis was done using student –t test. $p<0.05$, $p<0.01$ and $p<0.001$ were considered statistically significant.

4. RESULTS

A variety of extracts of *Jatropha curcas* Linn demonstrated diverse antibacterial activity against three selected strains of bacteria (Table 1-3). The antibacterial activity was quantitatively determined by the presence or absence of inhibition zone around the discs containing extracts. The inhibition zones were recorded to be considerably different from each other. When tested by disc diffusion method, Table -1 and Figure -1 showed that the chloroform leaf extracts of *Jatropha curcas* Linn exhibited highest inhibitory activity against all the three tested bacterial species. The methanolic extracts possessed significant activity while the diethylether extract showed least inhibitory activity against various strains of bacteria.

Table 1. Antibacterial activity of various extracts of leaves of *Jatropha curcas* L against test bacteria.

S.no	Test bacteria	Inhibition zone (cm)		
		Chloroform extract	Methanol extract	Diethyl ether extract
1	*Escherichia coli*	1.03±0.06	0.86 ±0.02	0.63±0.04
2	*Staphylococcus aureus*	1.08±0.08	0.82 ±0.04	0.60±0.05
3	*Aeromonas species*	0.93 ±0.03	0.73 ±0.03	0.50±0.04

Different solvent leaf extracts of Jatropha curcas L against various bacterial strains. Values are presented as mean ± SEM; N=5

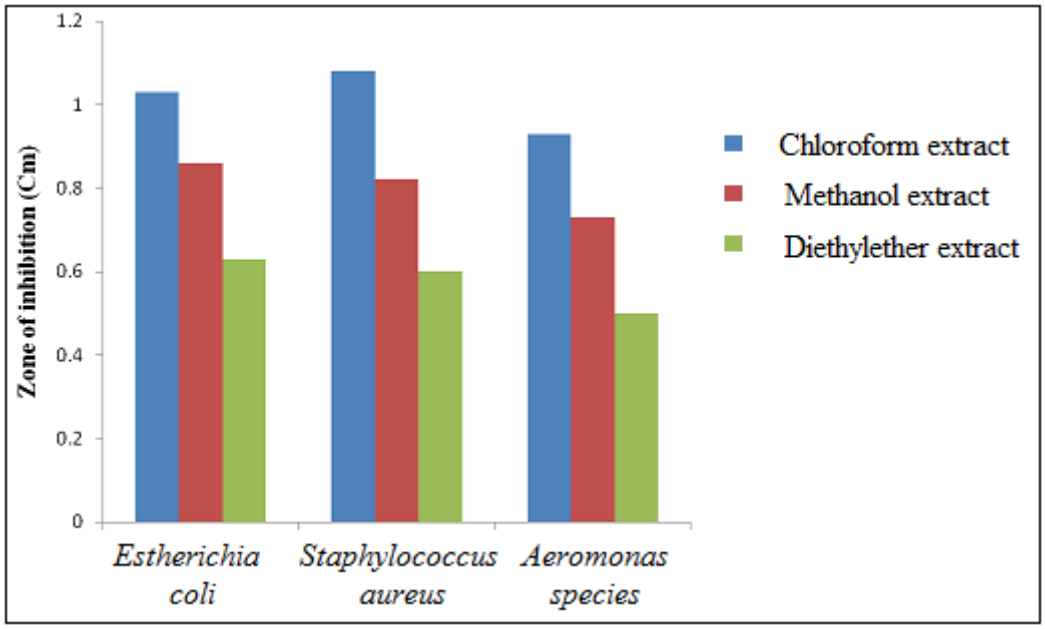

Fig 1. Antibacterial activity of various extracts of leaves of *Jatropha curcas* L against test bacteria

Table -1 and Figure -1 showed that the chloroform leaf extracts of *Jatropha curcas* Linn exhibited highest inhibitory activity against all the three tested bacterial species. The methanolic extracts possessed significant activity while the diethylether extract showed least inhibitory activity against various strains of bacteria by disc diffusion method.

Table 2. Antibacterial effect of various extracts of stems of *Jatropha curcas* L against test bacteria.

S.no	Test bacteria	Inhibition zone (cm)		
		Chloroform extract	Methanol extract	Diethyl ether extract
1	*Escherichia coli*	0.91 ±0.05	0.73±0.03	0.53±0.01
2	*Staphylococcus aureus*	1.16 ±0.09	0.68±0.10	0.49±0.09
3	*Aeromonas species*	0.70 ±0.06	0.56±0.04	0.43±0.03

Different solvent stem extracts of Jatropha curcas L against various bacterial strains. Values are presented as mean ± SEM; N=5

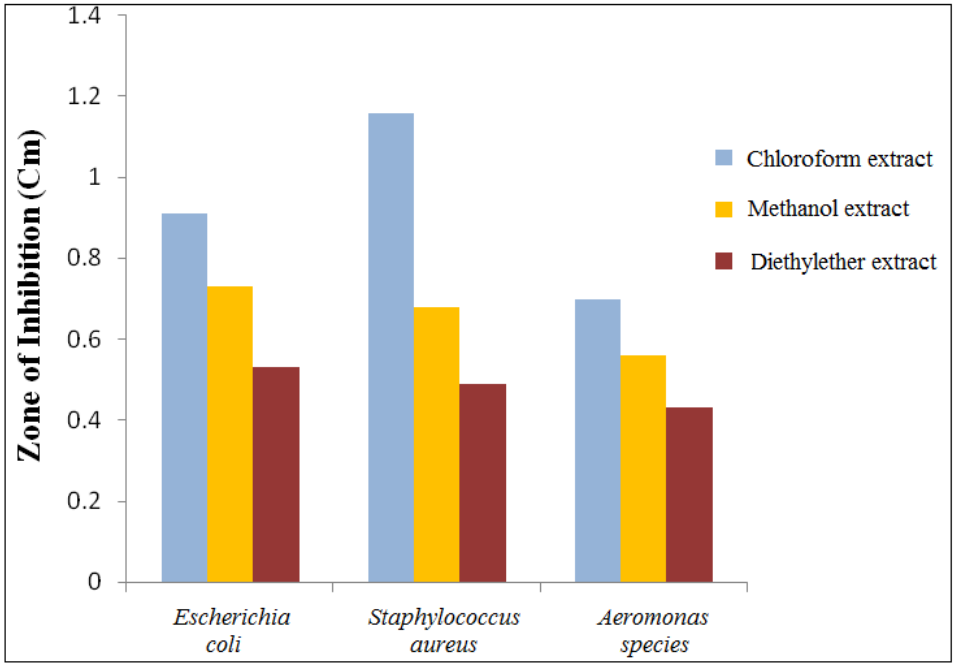

Fig 2. Antibacterial effect of various extracts of stems of *Jatropha curcas* L against test bacteria

Table 2 and Figure -2 showed inhibitory effect of various extracts obtained from stem parts of *Jatropha curcas* Linn. In chloroform stem extract, significant inhibition was noted against *E.Coli*, *S.aureus* followed by *Aeromonas species*. However, the methanol showed moderate inhibition against *E.coli, S.aureus* and *Aeromonas species*. The diethyl ether extract of stem exhibited satisfactory result against E.coli, S.aureus and the same extract showed least antibacterial activity against *Aeromonas species*.by disc diffusion method.

Table 3. Effect of various extracts of *Jatropha curcas* L seed against test bacteria

S.NO	Test bacteria	Inhibition zone (cm)		
		Chloroform extract	Methanol extract	Diethyl ether extract
1	*Escherichia coli*	0.83±0.08	0.60±0.03	0.50±0.05
2	*Staphylococcus aureus*	0.96±0.07	0.75±0.05	0.38±0.02
3	*Aeromonas species*	1.10±0.08	0.96±0.07	0.50±0.05

Different solvent seed extracts of Jatropha curcas L against various bacterial strains. Values are presented as mean ± SEM; N=5

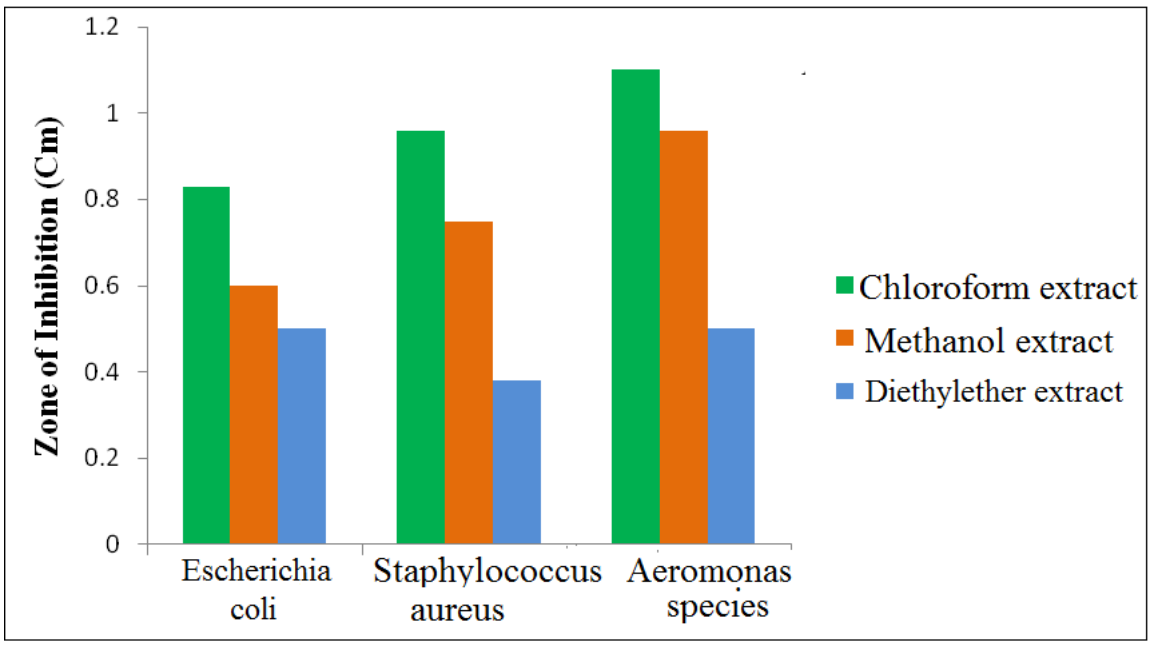

Fig 3. Effect of various extracts of *Jatropha curcas* L seed against test bacteria

Table -3 and Figure -3 showed that the seed extracted with chloroform showed greater inhibition against *Aeromonas species* whereas in the same extract moderate antibacterial activity was associated with *E.coli* and *S.aureus*. The methanol extract showed moderate activity on all tested species. Likewise, the diethylether extract showed satisfactory inhibitory effect by disc diffusion method.

5. DISCUSSION

Our results indicated that chloroform extract showed the highest inhibition followed by methanol and diethylether extract. The antibacterial activity of the plant was associated with the plant part and extraction solvent[12]. Plant extracts are rich in many phytocompounds that are the causes of their bioactivities. In addition, the phenomenon of membrane bleeding has been observed with several antimicrobial agents.[13] .For example, phenolic compounds make their actions through different mechanism, which includes membrane disruption, proteins binding, inhibition of proteins synthesis, enzyme inhibition, production of cell wall complexes, formation of disulfide bridges and intercalation with cell wall and/or DNA, among other[14].In the same manner, the antimicrobial action of alkaloids could be through intercalation with cell wall and/or DNA constituents; while, terpenoids display their action through membrane disruption mechanisms.[15]. Hence, the antimicrobial activity evaluated in this work could be attributed to the presence of different phytocompounds in variable amounts in plant extracts. The assayed antimicrobial activity from the plant species depends on the parts of the plant studied as well as the solvent used for the extraction procedures. The present study would signal new therapeutic options to be tried on the pathogen by future researches.

6. CONCLUSION

It was concluded from the above experimental observations that the plant *Jatropha curcas* Linn showed potent antibacterial activity against different bacterial strains from its various extracts. Chloroform extract was found to be more effective against pathogenic bacterial *spp*. as compared to methanol followed by diethyl ether extract. Possible reasons for this antibacterial activity of *Jatropha curcas* L may be due to the presence of alkaloids, tannins, saponins, terpenes and flavonoids etc. Findings of present study are preliminary and further investigations are required to determine the exact nature of the bioactive compounds which may be present in the different parts of the plant.

7. AUTHORS CONTRIBUTION STATEMENT

Dr. N.Agnel Arul John conceived the presented idea motivating to investigate the research and supervised the finding of this work. All authors discussed the results and contributed to the final manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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