



Research Article

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Phytochemical and Antibacterial Studies on *Jatropha curcas* L.

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ABSTRACT

Phytochemical and antibacterial property of crude petroleum ether, chloroform, acetone, methanolic and aqueous extracts of *Jatropha curcas* L leaves were studied as part of searching new bio-active compounds. The extracts of *J. curcas* revealed the presence of saponins, steroids, alkaloids, phenolic groups and flavonoids. Antibacterial activity of *J. curcas* showed varied degree of zone of inhibition against the tested bacterial pathogens. Chloroform extracts of *J. curcas* showed the broadest spectrum of antibacterial activity and the maximum zone of inhibition 10 mm were observed against *E. coli* and *S. aureus*. Petroleum ether extract exhibited antibacterial activity against *Proteus sp.* and *P. aeruginosa* with the zone of inhibition of 10 and 4 mm respectively. Methanolic extract of *J. curcas* proved the antibacterial activity against three pathogens except *S. aureus*. Acetone extract revealed the antibacterial activity against *S. aureus* only.

Key words: *Jatropha curcas*, Antibacterial, Phytochemical.

INTRODUCTION

Plants have been an important source of medicine for thousands of years. The World Health Organization estimates that up to 80 percent of people still rely mainly on traditional remedies such as herbs for their medicines [1]. There are thousands of species of medicinal plants used globally for the cure of different infections and they are recommended for treating various diseases [2,3]. The treatment and control of diseases by the use of available medicinal plants in a locality will continue to play significant roles in medical health care implementation in the developing countries [4]. The intractable problems of antimicrobial resistance has led to the resurgence of interest in herbal products as source of noble compound to suppress or possibly eradicate the ever increasing problems of emergence of newer diseases though to be brought under control [5].

Jatropha curcas (Euphorbiaceae) is native to the American tropics, most likely Mexico and Central America. It is a poisonous, semi-evergreen shrub or small tree, reaching a height of 6 m, 20 ft [6]. It is an ornamental plant which is also employed to cure various infections in traditional medicine [3]. *J. curcas* (physic nut) is a multipurpose tree of commercial significance because of its several industrial and medicinal uses. *Jatropha* species are used in traditional folklore medicine to cure ailments in Africa, Asia and Latin America [7]. They are used as antimicrobial agents and several works have been carried out by scientists to find out its scientific basis [8]. Previous studies have reported that the plant exhibits bioactive activities for fever, mouth infections, jaundice, guinea worm sores and joint heumatism [9, 10]. Fagbenro-Beyioku [11] investigated and reported the anti-parasitic activity of the sap and

crushed leaves of *J. curcas*. The water extract of the branches also strongly inhibited HIV induced cytopathic effects with low cytotoxicity [12].

J. curcas have played a major role in the treatment of various diseases including bacterial and fungal infections [13]. Previous works have shown that many *Jatropha* species possess antimicrobial activity [14-16]. The latex of *J. curcas* also showed antibacterial activity against *Staphylococcus aureus* [17]. *J. Curcas* contains saponins, tannins, glycosides, steroids, alkaloids and flavonoids [18]. The cultivation and germination of *J. curcas* seeds and their research suggests that the plant has the ability to show the pesticidal and fungicidal properties [19]. The latex of *J. curcas* contains alkaloids such as Jatrophine and Jatropham, which are widely used for their anti-cancerous properties [20]. The latex is applied for insect stings, skin diseases, rheumatism, burns, ringworms, hemorrhoids and ulcers, the leaf is used as an external application for piles [21]. With this knowledge, the present study was aimed to study the phytochemical and antibacterial property of crude extracts of *J. curcas* as part of searching new bio-active compounds.

EXPERIMENTAL SECTION

Collection of materials

Jatropha curcas L. are collected by handpicking from Kalakad, Tirunelveli, Tamil Nadu, India. The plant materials are cut into small pieces and shade dried for 15 days at room temperature. The shade dried plant samples are powdered using mechanical homogenizer. 5 g of shade dried powder were extracted (cold extraction) with 30 mL (1:6) of solvents viz., petroleum ether, chloroform, acetone, methanolic and aqueous for 72 hrs. After incubation, the slurry was filtered through filter paper (Whatmann No.1) and the filtrate was collected and stored in the refrigerator at 4°C.

Phytochemical screening

The crude extracts of *J. curcas* were subjected to phytochemical tests for plant secondary metabolites in accordance with Trease and Evans [22] & Harborne [23] with little modifications.

Antibacterial activity

The following bacterial strains *Escherichia coli*, *Proteus sp.*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were used in the present study. The test bacterial pathogens were inoculated into the nutrient broth and incubated at 37°C for 8-10 h. The antibacterial activity of *J. curcas* was evaluated by agar well diffusion method as described by Chung *et al* [24]. Nutrient agar medium was prepared and poured into the Petridishes. Then it was inoculated with a swab of bacterial culture (mid log phase) and spread throughout the medium uniformly with a sterile cotton swab. Using a sterile cork borer (10 mm diameter) wells were made in the agar medium. The test compound was introduced into the wells and all the plates were incubated at 37°C for 24 h. Sensitivity of the organisms were determined by measuring the diameter of the zone of inhibition. The control experiment was carried out with the antibiotic penicillin.

Table 1: Preliminary phytochemical studies on different extracts of *J. curcas*

Secondary metabolites	Name of the extract				
	Petroleum Ether	Chloroform	Acetone	Methanol	Aqueous
Steroids	-	+	+	+	-
Alkaloids	-	+	-	-	+
Phenolics	-	-	+	+	+
Flavones	+	-	+	+	-
Saponins	-	-	-	-	+
Aminoacids	-	-	-	-	-
Anthroquinone	-	-	-	-	-

RESULTS AND DISCUSSION

The present phytochemical investigations on *J. curcas* leaves extracts revealed the presence of saponins, steroids, alkaloids, phenolic groups and flavonoids and they were tabulated in Table 1. Antibacterial activity of various extracts of *J. curcas* showed varied degree of zone of inhibition against the tested bacterial pathogens viz., *E. coli*, *S. aureus*, *Proteus sp.* and *P. aeruginosa*. The results were illustrated in Table 2. Chloroform extracts of *J. curcas* showed the broadest spectrum of antibacterial activity against all the four pathogenic bacteria and observed the

maximum zone of inhibition 10 mm against *E. coli* and *S. aureus*. Petroleum ether extract exhibited antibacterial activity against *Proteus* sp. and *P. aeruginosa* with the zone of inhibition of 10 and 4 mm respectively. Methanolic extract of *J. curcas* proved the antibacterial activity against three pathogens except *S. aureus* and the maximum zone of inhibition 7 mm was observed in *Proteus* sp. Acetone extract revealed the antibacterial activity against *S. aureus* only with the zone of inhibition of 8 mm in diameter. Aqueous extract of *J. curcas* does not show antibacterial activity against any of the selected four pathogenic bacteria.

Table 2: Antibacterial activity of different extracts of *J. curcas*

Organisms	Zone of Inhibition (mm)				
	Petroleum ether	Chloroform	Methanol	Acetone	Aqueous
<i>Escherichia coli</i>	-	10	5	-	-
<i>Proteus</i> sp.	10	6	7	-	-
<i>Staphylococcus aureus</i>	-	10	-	8	-
<i>Pseudomonas aeruginosa</i>	4	7	5	-	-

The therapeutic value of medicinal plants lies in the various chemical constituent's present in it. The bioactivity of plant extracts is attributed to phytochemical constituents. In order to extract the important phytochemical categories, we employed four different solvents with varied polarity. The presence of various compounds viz., saponins, steroids, alkaloids, phenolic groups and flavonoids in *J. curcas* is known to be biologically active and therefore aid the antimicrobial activities of *J. curcas* [25]. The plant extracts and their products are used in many parts of the world as the active principles in herbal remedies and locally in the treatment of infectious diseases [13]. The non-activity of the aqueous extract against most bacterial strains investigated in the present study is in agreement with the previous works which show that aqueous extracts of *J. curcas* generally showed little or no antibacterial activities [26, 27].

Steroids present in *J. curcas* leaves extract are of great importance and interest due to their relationship with various anabolic hormones including sex hormones [28]. Steroids extract from some medicinal plants exhibits antibacterial activities on some bacterial isolates [29]. The results of the present study confirm the steroids presence in the chloroform, acetone and methanolic extracts of *J. curcas*. One of the most common biological properties of alkaloids is their toxicity against the cells foreign organisms. These activities have been widely studied for their potential use in the elimination and reduction of human cancer cell lines [30]. Alkaloids which are one of the largest groups of phytochemicals in plants have amazing effects on humans and this has led to the development of powerful pain killer medications [20]. The results of the present study confirm the presence of alkaloids in chloroform and aqueous extracts of *J. curcas*. Flavonoids, another constituent of *J. curcas* leaves extract exhibited a wide range of biological activities like antimicrobial, anti-inflammatory, anti-angionic, analgesic, anti-allergic, cytostatic and antioxidant properties [31]. The results of the present study confirm the flavonoids presence in the petroleum ether, acetone and methanolic extracts of *J. curcas*.

Just *et al* [32] revealed the inhibitory effect of saponins on inflamed cells. Saponins present in *J. curcas* have supported the usefulness of this plant in managing inflammation [33]. Ayelaagbe *et al* [16] reported that the presence of secondary metabolites in the root extract of *J. curcas* inhibited some microorganisms isolated with sexually transmitted infections. Different parts of *J. curcas* contain the toxic alkaloids curcin and phorbol ester which prevent animals from feeding on it. Hence, the presence of these compounds in *J. curcas* supports the observed antimicrobial activities [33].

Bacterial infection causes high rate of mortality in human population and aquaculture organisms. *E. coli*, *S. aureus* and *P. aeruginosa* cause diseases like mastitis, abortion and upper respiratory complications. *P. aeruginosa* is an important and prevalent pathogen among burned patients capable of causing life-threatening illness [34]. The inhibitory effect of the extract of *J. curcas* against pathogenic bacterial strains can introduce the plant as a potential candidate for drug development. This research finding gives further scope to screen the chemical constituents of the extracts and shows that the leaves extracts of *J. curcas* contains the secondary metabolites like saponins, steroids, alkaloids, phenolic groups and flavonoids may be used to treat various bacterial infections caused by pathogenic bacteria.

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