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Antimicrobial Activity of Stem Bark and Root Extract of *Jatropha curcas* L.

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Abstract: The hexane, butanol, ethanol and water extracts of the root and stem bark of *Jatropha curcas* L. were screened for their antibacterial activity using the well diffusion method. They were tested against 10 different bacterial strains (*Citrobacter sp, Enterobacter aeruginosa, Proteus vulgaris, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, Salmonella paratyphi, Bacillus subtilis, Staphylococcus aureus, Staphylococcus epidermidis*). The susceptibility of the microorganisms to the extracts of root and stem bark of *Jatropha curcas* L. was compared with each other and with selected antibiotics. The pattern of inhibition varied with the plant extract, the solvents used for extraction and the organism tested. The maximum zone of inhibition was seen in the ethanol and hexane extract (18mm) of root and in hexane and butanol extract (18mm) of stem bark.

Key words: Antimicrobial Activity · Medicinal plant · Crude extract · StemBark and Root

INTRODUCTION

The world population relies on traditional medicine for their primary healthcare needs. Use of herbal medicines in Asia represents a long history of human interactions with the environment. Plants used in traditional medicine contain a wide range of ingredients that can be used to treat for many infectious diseases. A vast knowledge of how to use the plants against different illness may be expected to have accumulated in areas where the use of plants is still of great importance [1].

Jatropha curcas L. belonging to family Euphorbiaceae is a medicinally potent plant of great economic value. It is a drought-resistant, photo-insensitive perennial plant. It is a potential source of non-edible biodiesel producing energy crop [2]. Seeds of *Jatropha curcas* contain 40-50% semidrying oil known as "curcas oil", which is an effective substitute fuel for diesel engine oil [3]. It is a multipurpose tree with a long history of cultivation in the tropical and subtropical regions of the world [4]. It occurs mainly at lower altitudes (0-500m) in areas with an annual temperature of well above 20°C. The plant can tolerate extreme in temperature, but not frost and water stagnation. It grows almost everywhere-ever on gravely, sandy, acidic and alkaline soils with pH ranging from 5.5 to 8.5.

The plant is reported to be abortifacient, anodyne, antiseptic, cicatrizant, depurative, diuretic, emetic, hemostat, lactagogue, narcotic, purgative, rubefacient, vermifuge. Physic nut is a folk remedy for alopecia, anasorca, ascites, burns, carbuncles, convulsions, cough, dermatitis, diarrhea, dropsy, dysentery, eczema, fever, gonorrhea, inflammation, jaundice, paralysis, pneumonia, rheumatism, scabies, sciatica, sores, syphilis, stomachache, tetanus, tumors, ulcers and yellow fever [5]. Bark, fruit, leaf, root and wood are all reported to contain HCN [6].

The root is reported to contain yellow oil with strong anthelmintic action. Root is used for eczema, ringworm and scabies. The root bark is used for external applications for sores. The roots are also reported to be used as an antidote for snakebite. The bark yields a dark blue dye, which is reported to be used in phillippines for colouring cloth, fishing nets and lines. It is also used for burning and spinning in the manufacture of hard soaps and candles, paints and lubricants [7]. The present study was designed to investigate the antimicrobial activity of Stem bark and root extract of *Jatropha curcas* L.

METHODOLOGY

Collection of Plant Material: The plants were collected from South-Western Ghats of Tirunelveli district, Tamilnadu, India during December 2008. The plant materials such as stem bark and root explants of *Jatropha curcas* L. were collected and air-dried.

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Preparation of Crude Extracts: The dried explants were coarsely powdered and stored in an airtight container. About 10 gram of plant materials (stem bark and root) was taken in a clean sterile Soxhlet apparatus and extracted with 150ml of different solvents such as hexane, butanol, ethanol and water. The obtained extracts were collected and filtered using Whattman No. 1 filter paper. Then the extracts were dried in vacuum evaporator to obtain concentrated crude extracts. Then the crude extract was made in to suitable concentrations using Dimethyl sulfoxide (DMSO). This suspension is used for further antimicrobial analysis.

Well Plate Method [8]: Antimicrobial activity of plant extracts were tested by well plate method. The bacterial culture is swapped on the Muller Hinton Agar Petriplates with a sterile bud. Wells were cut by using sterile cork borer. The wells were filled with 100µl of plant extracts at the concentration of 100 mg/ml for root and 20 mg/ml for stem bark. The plates were allowed to stand for 2 hours. Then the plates were incubated at 37°C. After 24 hours incubation the diameter of zone of inhibition was measured.

RESULTS

The antibacterial activity was carried out by using hexane, butanol, ethanol, water extracts from stem bark and root explants of *Jatropha curcas* L. at the concentration of 20 mg/l and 100 mg/l respectively.

The hexane extract of root showed high activity against *Pseudomonas aeruginosai* (18mm), *Citrobacter sp* (17mm) followed by *Staphylococcus aureus* (14mm). The butanol extract showed maximum activity against *Pseudomonas aeruginosai* (17mm) and *Citrobacter sp* (16mm). The ethanol extract was found to be effective against *Citrobacter sp* (18mm) and *Pseudomonas aeruginosai* (12mm). The water extract was inactive against all bacterial strains used except *Citrobacter sp* (6mm). The hexane, butanol and ethanol extract *showed* maximum activity against *Citrobacter sp* and *Pseudomonas aeruginosa*. (Table 01)

All the solvent extract showed high activity against all bacterial strains used. The hexane extract of stem bark was found to be effective against most bacterial strains such as *Proteus vulgaris* (18mm), *Bacillus subtilis* (18mm), *Enterobacter aeruginosa*

Table 1: Antimicrobial Activity of *Jatropha curcas* L. (ROOT) Well Plate Method [8]

			Solvents Used (100mg/ml)				
S. No	Culture Used	Tet (5µg/ml)	Dmso	Hexane	Butanol	Ethanol	Water
1	*Citrobacter sp*	32	-	17	16	18	6
2	*Enterobacter aeruginosa*	14	-	-	-	-	-
3	*Proteus vulgaris*	12	-	-	-	6	-
4	*Klebsiella pneumonia*	25	-	-	-	7	-
5	*Pseudomonas aeruginosa*	30	-	18	17	12	-
6	*Escherichia coli*	13	-	6	7	7	-
7	*Salmonella paratyphi*	18	-	12	13	6	-
8	*Bacillus subtilis*	19	-	7	6	-	-
9	*Staphylococcus aureus*	20	-	14	8	8	-
10	*Staphylococcus epidermidis*	15	-	6	7	8	-

Zone of inhibition ¬ in mm diameter; Tetracycline (Tet) ¬ Antibiotic Control (5µg/ml);
Extracts¬ 50µl Extracts/Well; Di methyl sulfoxide (DMSO) ¬ Control
(- ¬ Absence of zone)

Table 2: Antimicrobial Activity of *Jatropha curcas* L. (Stem Bark) Well Plate Method [8]

			Solvents Used (20mg/ml)				
S. No	Culture Used	Tet (5µg/ml)	Dmso	Hexane	Butanol	Ethanol	Water
1	*Citrobacter sp*	25	-	11	13	7	6
2	*Enterobacter aeruginosa*	35	-	17	18	17	14
3	*Proteus vulgaris*	28	-	18	17	13	13
4	*Klebsiella pneumonia*	27	-	12	7	8	6
5	*Pseudomonas aeruginosa*	32	-	16	18	19	14
6	*Escherichia coli*	25	-	13	6	7	7
7	*Salmonella paratyphi*	27	-	16	17	14	13
8	*Bacillus subtilis*	27	-	18	17	13	8
9	*Staphylococcus aureus*	34	-	12	6	7	6
10	*Staphylococcus epidermidis*	27	-	17	16	13	6

Zone of inhibition ¬ in mm diameter; Tetracycline (Tet) ¬ Antibiotic Control (5µg/ml);
Extracts ¬ 100µl Extracts/Well; Di methyl sulfoxide (DMSO) ¬ Control
(- ¬ Absence of zone)

(17mm) and *Staphylococcus epidermidis* (17mm). The butanol extract showed high activity against *Enterobacter aeruginosa* (18mm), *Pseudomonas aeruginosa* (18mm), *Proteus vulgaris* (17mm), *Salmonella paratyphi* (17mm) and *Bacillus subtilis* (17mm). The ethanol extract showed high activity against *Pseudomonas aeruginosa* (19mm) and *Enterobacter aeruginosa* (17mm). The water extract showed minimum activity against *Pseudomonas aeruginosa* (14mm) and *Enterobacter aeruginosa* (14mm) (Table 02).

DISCUSSION

The hexane, butanol, ethanol and water extracts of the roots and stem bark of *Jatropha curcas* L. were subjected to a preliminary screening for antibacterial activity against 10 bacterial strains (*Citrobacter sp, Enterobacter aeruginosa, Proteus vulgaris, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, Salmonella paratyphi, Bacillus subtilis, Staphylococcus aureus, Staphylococcus epidermidis*).

By well plate method, the maximum zone of inhibition were seen in the ethanol and hexane extract of root and the maximum zone of inhibition were seen in the stem bark extract of Hexane and Butanol on different bacterial strains.

It is not surprisingly that there are difference in the antibacterial activities of the plant on different extracts of *Jatropha curcas* L.This could be due to the phytochemical difference between them.

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