Evaluation of antimicrobial activity of medicinal plant *Jatropha podagrica* (Hook)

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Abstract

Increasing prevalence of multidrug resistant strains of microorganisms has initiated the exploration of alternate antimicrobial agent. Taking into account the medicinal importance of Jatropha podagrica (hook) (Euphorbiaceae) in this respect, an attempt was made in the current study to investigate the antimicrobial potential of this plant. Fresh plants with authentication (Acc. No. 9126) were selected for antimicrobial assays. Extract of stem and stem bark was extracted in hexane by means of a Soxhlet device. It was then undertaken for determination of antimicrobial activity against ten clinical isolates of S. aureus (4), E. coli (4) and Candida albicans (2). MIC was found to be 15mg/ml at this concentration stem bark extract showed remarkable antibacterial activity as compared to stem extract and their zone of inhibition compared with standard antibiotics. The clinical isolates of S. aureus (GMC30) and E. coli (RGBC786) showed 17mm and 22mm zone of inhibition respectively that of ampicillin and streptomycin showed very less inhibition. Stem bark also sensitive to yeast fungus Candida albicans, reported a 16mm zone of inhibition, which was moderate as compared to fluconazole. Phytochemical screening of extract showed presence of steroid and triterpenes. Thus, the current investigation leads to fresh sources of new antimicrobials in future. This is the first report in vitro which revealed medicinal importance of ornamental plant Jatropha podagrica (hook).

Keywords: MIC, *Jatropha podagrica,* antimicrobial activity
Abbreviations: MIC- Minimum inhibitory concentration

Introduction

The multidrug resistant strain of many microorganisms has revealed exploration of alternative antimicrobial agent. Medicinal plants have become the focus of intense study in terms of validation of their traditional uses through the determination of their actual pharmacological effects. Synthetic drugs are not only expensive and inadequate for the treatment of diseases but also often with adulterations and side effects. Therefore, there is need to search new infection-fighting strategies to control microbial infections [1] *Jatropha podagrica* is an ornamental plant which is also employed to cure various infections in traditional medicine. The hexane extracts of this plant were analyzed phytochemically and screened against different microorganisms responsible for various infections especially nosocomial infection. *Jatropha podagrica* of family Euphorbiaceae is known for many biological activities such as antitumour, antimicrobial, molluscicidal and anti-insect [3, 5]. This plant is also used as an antipyretic, diuretic, choleretic and purgative [10] Antibiotic resistant strain *Staphylococcus aureus* is virulent organism that causes a broad array of health conditions including pneumonia, osteomyelitis, endocarditis and bacteraemia [2] likewise *Escherichia coli* cause UTI, diarrhea and septicemia. These microorganisms form resistant so called multi-drug resistant (MDR) strain. Hence there is urgent need to find alternative

antimicrobial agent to treat these virulent bacterial infection. Present investigation revealed that *in vitro* antimicrobial activity of stem and stem bark of *Jatropha podagrica.*

Materials and methods

Plant Material:

Plant were collected from the International Flori Farm Nursery, Nagpur (India) and authenticated at the Department of Botany, R.T.M. Nagpur University, Nagpur (M.S.) India (Herbarium voucher number Acc. No. 9126)

Preparation of plant Extract:

The plant material was separated into its selected parts (stem & stem bark) air dried ground to moderately fine powder & soxhlet extracted with hexane. Each extract was evaporated to dryness under reduce pressure using rotary evaporator. The stem bark (180g) gave a solid (11.2g) & stem (210g) gave a solid (9.2g).

Microorganism:

The microorganisms employed in the current study were procured from the Government Medical College, Nagpur (M.S.) India and the Rajiv Gandhi Biotechnology Centre, R. T. M. Nagpur University, Nagpur(M.S.) India which includes clinical isolates of *S. aureus*, *E. coli* and *Candida albicans*.

Media:

Nutrient broth, Nutrient agar, Malt extract broth and Sabouraud dextrose agar, all product of Hi-media Laboratories Mumbai (India) were used in this study.

Antimicrobial agents:

Amoxicillin (1ug/mL), Streptomycin (1.5ug/mL), Ampicillin (2ug/mL), Gentamycin (1.5mg/mL) and fluconazole, (1%w/v)

Agar well diffusion bioassay:

The antimicrobial activity of the extracts was determined by using the agar well diffusion technique[6] Nutrient agar plates were each seeded with 0.1 ml of an overnight culture of each bacterial (equivalent to 10^7–10^8CFU/mL), while the Sabouraud dextrose agar plates were each similarly seeded with each fungal strain

The 24 hrs. broth culture of each bacterium and 3 days inoculated fungus culture were used to seed sterile molten nutrient agar and sabouraud dextrose agar at 45°C respectively, allowed to set and well made by sterile standard cork borer and 200µl(0.2ml) of 15 mg/ml solution of extract added into each well. Then bacterial plates incubated at 37°C for 24hrs. and fungal plates were incubated at 25°C for 3 days after which diameter of zones of inhibition were measured. Each wells filled with extract, amoxicillin, streptomycin, gentamycin and ampicillin for bacteria along with control of each and Fluconazole in case of *Candida albicans*.

Results and discussions

In the initial stages, the stem and stem bark extracts in three different solvent viz. chloroform, methanol and hexane were evaluated for antimicrobial activity against clinical isolates of *S. aureus*, *E. coli* and *Candida albicans.* Stem and stem bark extract prepared and screened (Plate No.1&2) for their capacities to inhibit the growth of these clinical isolates that

were quite resistant to antibiotics, as indicated in table no.1.stem bark extracts of *Jatropha podagrica* shows broad spectrum antimicrobial activity. The antifungal activity of the fluconazole and the stem bark were found to be nearly similar since the fluconazole is the drug of choice for *candida albicans*.

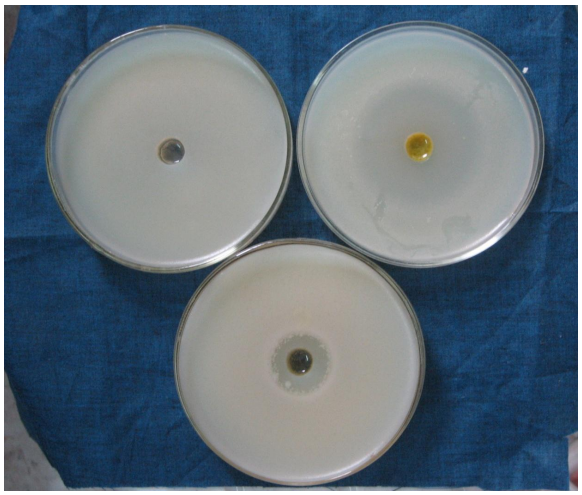

Plate No.1. Comparative zone of inhibition of streptomycin and stem bark. Extract at 15mg/ml on *E.coli* (GMC15) with control

Libermann-Burchard test confirmed that triterpens similarly found by Campelo and marsaioli [7] while steroids in extracts found by Salkowaski test and Libermans test. MIC value for hexane extract from stem bark of Jatropha *podagrica* were 15mg/ml for various clinical isolates viz. *S. aureus*, *E. coli* and *Candida albicans* (Fig 1,2,3).The stem and stem bark activity is due to steroids, terpenoids, flavonoids and alkaloids was also reported by Odebiyi [8] the stem bark extract were most susceptible to clinical isolates *S. aureus*, *E. coli* [9] thus result obtained by this extract revealed better control of this pathogens.

The current work has shown that *Jatropha podagrica* is a potential source of antimicrobial agents and its activity against various clinical isolates may be sufficient to perform further studies for isolation and identification for active principles.

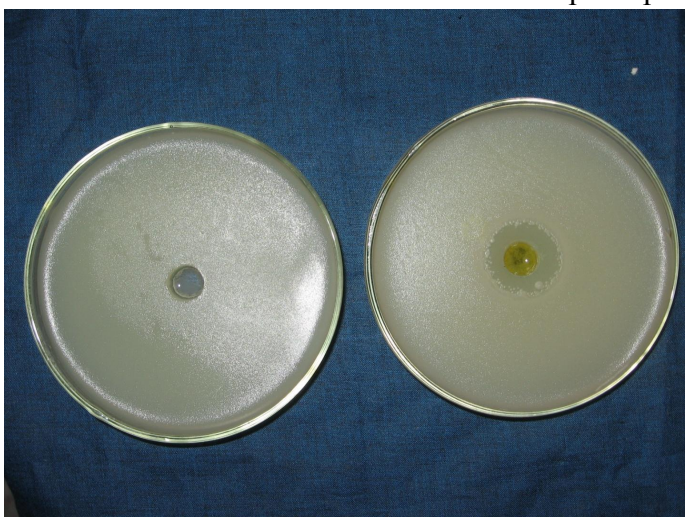

Plate No. 2. Antimicrobial activity of stem bark extract at 15mg/ml on *S.aureus* (GMC30) with control

Table 1. Antimicrobial activities of plant extracts

Sr. No.	Organisms	[a]Source of clinical isolates	Comparable antimicrobial agent	Relative Property of organisms	[b]Extract zone of inhibition	
					Hexane extract of stem	Hexane extract of stem bark
1.	*Staphylococus aureus*	GMC 30	Ampicillin (−)	Resistant to Te and S&T	++	+++
2.	*S.aureus*	GMC 32	Ampicillin (+)	Resistant to Te	−	++
3.	*S.aureus*	GMC 34	Ampicillin / Amoxicillin(+++)	Resistant to Am and P	++	+++
4	*S.aureus*	GMC35	Gentamycin(++)	-	+	++
5	*Escherichia coli*	GMC13	Amoxicilin(+++)	Resistant to Strept.	++	+++
6	*E.coli*	GMC 15	Streptomycin / Ampicillin (+++)	-	−	+++
7	*E.coli*	RGBC780	Gentamycin(+)	Resistant to S&T and Am	-	++
8	*E.coli*	RGBC 786	Streptomycin (++)	Resistant to Am and P	++	++++
9	*Candida albicans*	GMC 012	Fluconazole (++++)	Resistant to CIP	−	+++
10	*C.albicans*	GMC 07	Fluconazole (++++)	Resistant to CIP and Gn	−	+++

Te, tetracycline; S&T, septrin (cotrimoxazole); Am, ampicilin P, penicillin; Gn, gentamycin; CIP, ciprofloxacin

[a]**Source of Clinical Isolates:** Government Medical College (GMC), Nagpur (M.S.) India Rajiv Gandhi Biotechnology Centre, R.T.M. Nagpur University, Nagpur (M.S.) India.

[b]**Zone of Inhibition:** −, no zone; ++, (9 − 11mm); +++, (15−18 mm) and ++++, 19mm and above.

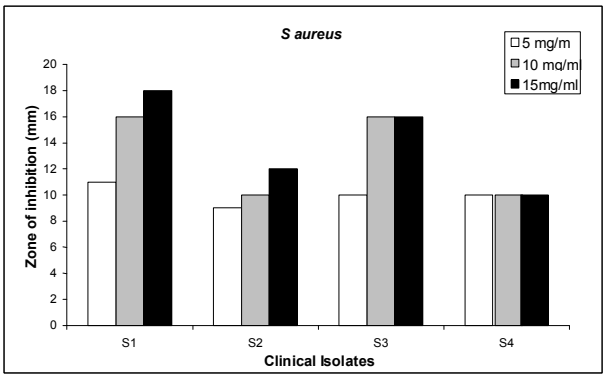

Figure 1

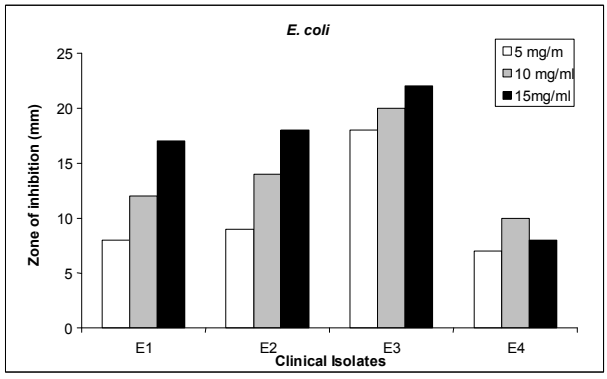

Figure 2

Figure1&2. Antibacterial activity of hexane extract of *Jatropha podagrica* at three concentrations viz. 05mg/ml, 10mg/ml and 15mg/ml against *S. aureus* and *E. coli* S1: *S .aureus* (GMC 30), S2: *S. aureus* (GMC 32), S3: *S. aureus* (GMC 34), S4*: S. aureus* (GMC 35). E1: *E.coli* (GMC 12), E2: *E.coli* (GMC 13), E3: *E.coli* (RGBC786), E4: *E.coli* (RGBC780),

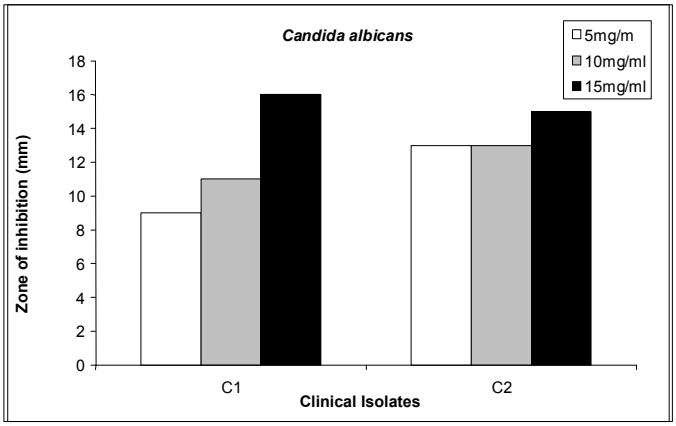

Figure 3. Antifungal activity of hexane extracts of *Jatropha podagrica* at three concentrations viz. 05mg/ml 10mg/ml and 15mg/ml against *Candida albicans* C1: *C. albicans* (GMCO12), C2: *C. albicans* (GMC 07)

Conclusion

In the current investigation, the hexane extract of stem bark was found to be active on most of clinical isolates of *S. aureus, E.coli* and *Candida albicans*. Phytochemical test confirms the presence of steroids and triterpenes. In most cases 15mg/ml concentration shows the maximum activity, which revealed *Jatropha podagrica* as novel antimicrobial agent.

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