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Bioefficacy of Crude Extracts from *Jatropha Gossypifolia* against Human Pathogens

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Abstract

In vitro antibacterial activity of Jatropha gossypifolia used as ornamental plant was analyzed in this study. Traditionally various parts of the plant are used treat intermittent fevers, carbuncles, eczema, itches and over-the-counter medications used to treat specific conditions or diseases. The present study examined the antibacterial activity of aqueous and ethanol extract of J. gossypifolia using the disc diffusion method. Extracts were tested against both Gram positive (Bacillus subtilis MTCC 441 and Staphylococcus aureus MTCC 3381) and Gram negative (Escherichia coli MTCC 1562 and Pseudomonas fragi MTCC 2458) bacteria. The aqueous and ethanol extracts were found active against both Gram-positive and Gram-negative bacteria. Leaves extracts were found more effective against S. aureus. On the other hand also ethanol extract of stem and root inhibited the growth of B. subtilis, S. aureus and P. fragi respectively to high level. These data support the use of plant based medicines in treatment of infectious diseases where access to commercial antibiotics is restricted. The plant extracts are active against human microbial pathogens thus emerging as potential sources of new antimicrobial compounds. The present investigation expresses that J. gossypifolia has great potential as a source of antimicrobial compounds against microorganisms. These findings provide scientific evidence to support the traditional medicinal uses of the experimental plant and indicate a promising potential of the plant for medicinal purposes. Thus J. gossypifolia can be used in the treatment of infectious diseases caused by pathogenic bacteria. Further in vivo studies are necessary to corroborate the findings. More importantly there is need for detailed scientific study of traditional

medical practices to ensure that valuable therapeutic knowledge of plant is preserved and also to provide scientific evidence for their efficacy. This study serves as basis for further research on J. gossypifolia.

Keywords: Jatropha gossypifolia, antimicrobial, antibacterial, antibiotics, pathogens.

1. Introduction

Nowadays multiple drug resistance has developed due to the indiscriminate use of commercial antimicrobial drugs commonly used in the treatment of infectious disease (Davis, 1994; Service, 1995). In addition to this problem, antibiotics are sometimes associated with adverse effects on the host (Ahmad *et al*., 1998). This situation generates the need to search for new alternatives for antimicrobial drugs for the treatment of infectious diseases from natural resources (Clark, 1996; Cordell, 2000) and recently much attention has been paid to extracts and biologically active compounds isolated from plant species. The beneficial medicinal effects of plant materials typically result from the combinations of secondary metabolites present in the plant which are synthesized and deposited in specific parts or in all parts of the plant. The plants' secondary products may exert their action by resembling endogenous metabolites, ligands, hormones, signal transduction molecules or neurotransmitters and thus have beneficial medicinal effects on humans due to similarities in their potential target sites. Therefore, random screening of plants is important. *Jatropha gossypifolia*, member of the Euphorbiaceae family, is a perennial, short-lived, erect, bushy, gregarious shrub or small tree with leaves having a long petiole, covered with glandular hairs cultivated as ornamental plant with alternate or opposite leaves and glands which are located at the barks of the plants or at the base of the leaf-blade. It contains milky juice and used in traditional medicine. Plant possesses various biological properties such as anti-alergic, molluscicidal, and insect repellent activity (Singh *et al*., 2013; Parvathi *et al*., 2012; Apu *et al*., 2013). In the present work *J. gossypifolia* was evaluated for antibacterial properties.

2. Materials and Methods

2.1 Collection of plant sample

Jatropha gossypifolia was collected from World Arboratum, Jaipur, Rajasthan. The plant material was botanically identified from Department of Botany, University of Rajasthan. A voucher specimen (accession # RUBL 20828) was deposited at the Herbarium, Department of Botany, University of Rajasthan. The collected plant parts (stem, leaf and roots) were shade dried and finely powdered.

2.2 Preparation of plant extracts:
The powdered plant parts were successively extracted with ethanol and water in Soxhlet's apparatus for 8-12 hours. The extracts were filtered using Whatman No. 1 filter paper and then concentrated *in vacuo* at 40°C using a Rotary evaporator and stored at 4°C.

2.3 Bacterial culture collection:
Pure Bacterial cultures of *Escherichia coli* (MTCC1562), *Bacillus subtilis* (MTCC 441), *Staphylococcus aureus* (MTCC 3381), and *Pseudomonas fragi* (MTCC 2458) obtained from Institute of Microbial Technology (IMTECH), Chandigargh, India were used in the present study. These cultures were grown on nutrient agar medium and incubated at 37°C for 24 hours.

2.4 Screening for Antimicrobial activity:
Kirby-Bauer (Bauer *et al.*, 1966) disc diffusion method was used to study antimicrobial activity of each of the plant extracts. The results were obtained by measuring the diameters of the inhibition zones in millimeters. All measurements were found to the closest whole millimeter. Each antimicrobial assay was performed in three replicas and mean values were recorded. Tetracycline (10µg/ml) was used as positive control.

3. Results

The ethanol extracts of plant parts were found to be more active against almost all tested pathogenic bacteria as S. aureus (leaf) > P. aeruginosa (leaf) > B. subtilis (root) > E. coli (root) compared to aqueous extracts. On contrary, the aqueous extract of leaves showed maximum inhibitory effect against *S. aureus* (IZ=15.43 ± 0.25mm and AI= 0.70). While minimum zone of inhibition was observed in aqueous extract of leaves against E. coli (IZ=6.83 ± 0.21mm and AI= 0.34) Table 1.

Table 1: Antibacterial activity of various crude extracts of J. gossypifolia (L.)

Plant part used	Extracts	Bacterial Strains							
		E.coli		B. subtilis		S. aureus		P.aeruginosa	
		IZ	AI	IZ	AI	IZ	AI	IZ	AI
Leaf	Aqueous	6.00 ± 0.00	0.27	8.27 ± 0.23	0.33	15.43 ± 0.25	0.70	6.83 ± 0.21	0.34
	Ethanol	8.07 ± 0.12	0.37	10.00 ± 0.00	0.40	17.23 ± 0.21	0.78	13.50 ± 0.30	0.68
Stem	Aqueous	7.10 ± 0.10	0.32	9.00 ± 0.00	0.36	7.30 ± 0.36	0.33	7.00 ± 0.00	0.35

	Ethanol	9.23 ± 0.21	0.42	9.33 ± 0.35	0.37	12.17 ± 0.21	0.55	10.43 ± 0.40	0.52
Root	Aqueous	7.27 ± 0.25	0.32	7.23 ± 0.40	0.29	8.37 ± 0.35	0.38	9.03 ± 0.15	0.45
	Ethanol	9.47 ± 0.42	0.43	11.23 ± 0.25	0.45	11.57 ± 0.35	0.53	12.33 ± 0.35	0.62

Abbreviation: IZ = Inhibition zone (mm); AI=Activity index.

4. Discussion

The results suggest that ethanol extracts of leaves and roots of the plant are more potent antimicrobial agents against used gram positive bacteria (Igbinosa *et al*., 2009). Similarly the positive response (Seth *et al*., 2010) also observed for ethanol and aqueous extracts of *J. gossypifolia* (L.). The results conclude that the extracts of the plant parts used in the present investigation showed significant antibacterial activities against the pathogenic bacteria. Thus *J. gossypifolia* can be used in the treatment of infectious diseases caused by pathogenic bacteria. Further *in vivo* studies are necessary to corroborate the findings.

5. Conclusion

The results of present investigation clearly indicate that the antibacterial activity vary with the plant parts used. The present investigation data on antibacterial potency of *J gossypifolia* provide basis for synthesis of novel antibiotics. From our investigation of screening different plant parts, the results obtained confirm the therapeutic potency of plant used in traditional folkloric medicine and suggest that the plant extracts possess compounds with antibacterial properties that can be used as antimicrobial agents in new drugs for the therapy of infectious diseases caused by pathogens. In addition, these results form a good basis for selection of candidate plant parts for further phytochemical and pharmacological investigation. The most active extracts can be subjected to isolation of the therapeutic antimicrobials and undergo further pharmacological evaluation.

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