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***J. Nat. Prod. Plant Resour.*, 2013, 3 (2):72-75**
(http://scholarsresearchlibrary.com/archive.html)

ISSN : 2231 – 3184
CODEN (USA): JNPPB7

Antimicrobial potential of various extracts of *Ricinus communis* L.

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ABSTRACT

The plants represent an enormous reservoir of potential antimicrobial compounds that could be useful as an alternative to synthetic microbicides and are being used to develop drugs. In the present study, antimicrobial activity of various leaf extracts of Ricinus communis was performed by Disc diffusion method. The results of antimicrobial activity revealed that all the extracts showed good inhibitory activity against all the tested microbes. Ethyl acetate and methanol extracts of leaves showed comparatively better activity than petroleum ether extract. These findings established the potential of Ricinus communis L. as an effective antimicrobial agent. Thus they can be used in the treatment of infectious diseases caused by microbes. Further studies are necessary to substantiate our findings and medicinal benefits in chemotherapy among humans.

Key words: *Ricinus communis,* Chemotherapy, infectious diseases, microbicides.

INTRODUCTION

Nature has been a source of medicinal agents since times immemorial. The importance of herbs in the management of human ailments cannot be over emphasized. It is clear that the plant kingdom harbours an inexhaustible source of active ingredients invaluable in the management of many intractable diseases. The Euphorbiaceae is the fourth largest family of the angiosperms comprising over 300 genera and about 7500 species distributed widely in tropical Africa [1].The Euphorbiaceae plants are shrubs, trees, herbs or rarely lianas [2] . According to WHO (1993), 80% of the world's population is dependent on the traditional medicine and a major part of the traditional therapies involves the use of plant extracts or their active constituents. With the continuous use of antibiotics, microorganisms have become resistant. This has created immense clinical problem in the treatment of infections diseases [3]. Therefore, there is a need to develop alternative antimicrobial drugs for the treatment of infectious diseases. One approach is to screen local medicinal plants for possible antimicrobial. Wide variety of antibiotics are commonly used for the treatment of infections occurred by microbes [4]. However, multiple drug resistance has developed due to excessive use of existing antimicrobial drugs in the treatment of infectious diseases. Antimicrobial resistance is harmful to mankind, because most of the infectious microbes become multiple drug resistant [5].In concern to drawbacks of convectional medicine, the use of natural products as an alternate to the convectional treatment in healing and treatment of various diseases has been rise in the last few decade [6]. *Ricinus communis* L. Known as Castor oil plant of family Euphorbiaceae is a soft wooden small tree, wide spread throughout tropics and warm temperature regions of the world [7]. Different parts of the plant are widely used by various communities and forest dwellers in many regions of the world for treating a variety of ailments. The medicinal plants are rich in rich in secondary metabolites [which are potential source of drugs] and essential oils of therapeutic importance. These products are known by their active substances, for example, the phenolic compounds which are part of essential oils [8], as well as in tannin [9]. About 80% of world population is still dependent on traditional herbal medicines. In the Indian

system of medicine, the leaf, root and seed oil of this plant have been used for the treatment of the inflammation and liver disorders [10], Hypoglycaemic [11], Laxative [12]. In the present study we have investigated antimicrobial potential of Indian *Ricinus communis* extracts against several bacteria.

MATERIALS AND METHODS

Collection and identification of the plant

The plants of the *Ricinus communis* were collected from the local areas of the surroundings of the Bhopal (M.P) and were brought to the laboratory after proper identification by a senior Botanist Dr. Jagrati Tripathi, Head of the Department of Biotechnology, Unique College Bhopal (M.P).

Preparation of Solvent Extracts (drug)

The Fresh plant leaves were brought to the laboratory and were washed under running tap water, air dried and then homogenized to fine powder and stored in airtight bottles. The dried powdered of *Ricinus communis* was successively Soxhlet extracted using Petroleum Ether, Ethyl acetate and Methanol for 72 hr. The extracts were dried under reduced pressure using rotator evaporator to get the crude. A dark green semi-solid mass was obtained. It was stored below 4ºC until further used.

Test organisms used

The test microorganism like P. aeruginosa, S.aureus, K. Pneumonia and P.vulgaris were used. These microorganisms were collected from Gandhi Medical College Bhopal (M.P).

Determination of Antimicrobial assay

Plant extracts of leaves of Ricinus *communis* L. which was prepared with different solvents like petroleum ether, ethyl acetate and methanol extracts were used to test their antimicrobial activity. Antimicrobial activity was demonstrated by Disc Diffusion Method [13] which is widely used for the antimicrobial susceptibility testing. Liquid nutrient agar media and the Petri plates were sterilized by autoclaving at 120^0C for 30 minutes. Under aseptic conditions in the laminar airflow chamber, about 20ml of the agar medium was dispensed into each petriplate to yield a uniform depth of 4mm. The filter paper discs of 4.5mm were prepared with different concentration, i.e. 20mg/ml, 40mg/ml, 60mg/ml, 80mg/ml and 100mg/ml of petroleum ether, ethyl acetate and methanol extracts. The sterile discs were introduced on to the surface of nutrient agar medium (pH 6.8-7.2). It was then incubated at 37^0C for 24 hours. The discs of chloramphenicol (10µg/disc) were used as a comparative drug and DMSO was used as a control. After incubation, the zone of inhibition was measured in mm.

Statistical Analysis

All the results were expressed as mean ± SEM. The significance of difference was evaluated by AVNOVA. The significance of probability was considered $p< 0.001$ by using software Origin 8.

RESULTS AND DISCUSSION

The *Ricinus communis* showed good activity against *P. aeruginosa*, *S.aureus*, *K. Pneumonia* and *Proteus vulgaris.* The antimicrobial assay revealed that the methanol and ethyl acetate extracts of leaves of *Ricinus communis* possess good zone of inhibition where as petroleum ether extract having antimicrobial activity only on higher concentration. (Table 1-5). Significant susceptibility was recorded by most of the organisms tested to the ethyl acetate, methanol and petroleum ether extract of leaves of *Ricinus communis*, which showed a comparatively reduced susceptibility pattern. The susceptibility pattern exhibited by the tested organisms to these extracts could be exploited for probably medicinal purposes in chemotherapy among humans. With the current spread of antibiotic resistance almost at geometric scale [14] and obvious challenges confronted with by medical practitioners in the treatment of infectious diseases [15], proper attention should be given to such plants to reap the potential antimicrobial benefits inherent in them, However actual antimicrobial ingredients need to be extracted and identified , also its tolerable levels in the human body as well as any toxic effects on human and animal tissues be investigated accordingly.

TABLE 1: Antimicrobial effect of various extracts of *Ricinus communis* at concentration 20mg/ml.

Test organism	Diameter of zone of Inhibition (mm) Extract concentration (20mg/ml)				Standard Reference
	Pet.ether	Methanol	E.acetate	DMSO	Chloramphenicol
P. aeruginosa	8.4±1.9*	13.2±1.1***	9.6±0.8**	----	15.5±1.4***
S.aureus	10.6±1.3**	7.5±0.6*	15.4±1.5***	----	17.2±1.4***
K.pneumonia	2.4±0.7*	4.6±0.4*	14.6±1.2***	----	17.1±1.1***
P.vulgaris	11.40±0.3**	9.2±1.2*	11.3±0.8***	----	16.6±2.1***

*---- = No zone of inhibition. Values are Mean ± SEM.*P<0.05, **P<0.01 and ***P<0.001*

TABLE 2: Antimicrobial effect of various extracts of *Ricinus communis* at concentration 40mg/ml.

Test organism	Diameter of zone of Inhibition (mm) Extract concentration (40mg/ml)				Standard Reference
	Pet.ether	Methanol	E.acetate	DMSO	Chloramphenicol
P.aeruginosa	14.4±1.5**	9.6±1.4*	18.4±2.4***	----	13.7±4.1**
S.aureus	11.5±1.3**	8.1±2.4*	18.7±1.4***	----	17.5±2.3***
K.pneumonia	8.8±0.8*	10.3±1.6**	16.6±1.3***	----	17.9±1.4***
P.vulgaris	10.6±2.4*	11.6±2.4**	16.3±0.5***	----	16.6±1.6***

*---- = No zone of inhibition. Values are Mean ± SEM.*P<0.05, **P<0.01 and ***P<0.001*

TABLE 3: Antimicrobial effect of various extracts of *Ricinus communis* at concentration 60mg/ml.

Test organism	Diameter of zone of Inhibition (mm) Extract concentration (60mg/ml)				Standard Reference
	Pet.ether	Methanol	E. acetate	DMSO	Chloramphenicol
P.aeruginosa	7.4±1.5**	12.5±1.1*	11.5±3.4**	----	15.4±2.2***
S.aureus	11.36±1.2**	8.5±1.2*	11.7±1.2***	----	15.8±2.3***
K.pneumonia	9.6±1.9**	8.5±0.6*	16.2±1.3***	----	16.3±1.8***
P.vulgaris	7.82±0.9**	10.6±1.2**	11.8±2.4**	----	17.3±0.5***

*---- = No zone of inhibition. Values are Mean ± SEM.*P<0.05, **P<0.01 and ***P<0.001*

TABLE 4: Antimicrobial effect of various extracts of *Ricinus communis* at concentration 80mg/ml.

Test organism	Diameter of zone of Inhibition (mm) Extract concentration (80mg/ml)				Standard Reference
	Pet. ether	Methanol	E.acetate	DMSO	Chloramphenicol
P.aeruginosa	10.3±1.3*	9.3±1.2*	16.4±1.1**	----	18.2±2.3***
S.aureus	6.80±0.2*	8.3±0.2*	10.2±2.3**	----	18.1±1.2***
K.pneumonia	12.3±10.2*	6.6±0.7*	13.2±2.6**	----	16.3±2.2***
P.vulgaris	10.11±0.9**	6.8±2.1*	11.9±1.6**	----	11.3±1.9***

*---- = No zone of inhibition. Values are Mean ± SEM.*P<0.05, **P<0.01 and ***P<0.001*

TABLE 5: Antimicrobial effect of various extracts of *Ricinus communis* at concentration 100mg/ml.

Test organism	Diameter of zone of Inhibition (mm) Extract concentration (100mg/ml)				Standard Reference
	Pet. ether	Methanol	E.acetate	DMSO	Chloramphenicol
P.aeruginosa	10.5±1.2**	9.7±0.8*	16.2±0.5***	----	17.8±1.2***
S.aureus	9.3±2.1*	9.2±1.3*	14.2±1.4**	----	15.3±2.2**
K.pneumonia	10.3±1.2**	16.2±1.2**	16.0±1.1***	----	18.3±1.2***
P.vulgaris	9.4±1.6**	10.4±2.1*	15.3±2.1**	----	16.9±2.1***

*---- = No zone of inhibition. Values are Mean ± SEM.*P<0.05, **P<0.01 and ***P<0.001*

CONCLUSION

Scientists have realized an immense potential in natural products from medicinal plants to serve as alternate source of combating infections in human beings which may also be of lower cost and lesser toxicity. Further investigations are required in order to isolate more new compounds from the plant extracts and to test their bioactivities with the aim of increasing the drug arsenal currently used in the treatment and prophylaxis of human and animal diseases. This plant can be further subjected to isolation of the therapeutic antimicrobial and carry out further pharmacological evaluation.This investigation has opened up the possibility of the use of this plant in drug development for human consumption possible for the treatment of gastrointestinal, urinary tract and wound infections and typhoid fever. In conclusion, methanol and ethyl acetate extracts of leaves of *Ricinus communis* were found to be substantially active against microbes. However, before coming to conclusive statement further research is needed to investigate the antimicrobial ingredients.

Acknowledgement
Author(s) would like to pass sincere thanks to faculty of Bhoj Mahavidyalaya Bhopal (M.P) for humble support and providing necessary facilities and encouraging us throughout the work. We thank them for the freedom of thought, trust and expression which he bestowed upon us. We are greatly thankful to our friends for their valuable help.

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