In vitro antibacterial activity of crude extracts of *Jatropha* species

Deepmala A. Gaikwad

Botany Laboratory, Swami Vivekanand Senior College, Mantha, Dist. Jalna- 431504 (M.S.) India
Email: drrsgaikwad@ gmail.com

ABSTRACT

Flower extracts and fruit extract of *Jatropha curcas, J. glandulufera, J. integerrima and J. gossypofolia* were screened in order to study their effect on plant pathogenic bacteria like *Erwinia carotovora pv. Carotovora, Pseudomonas aeruginosa, Xanthomonas campestris pv. Citri* and *Xanthomonas campestris pv. mangiferaeindicae*. Degree of variation of antibacterial activity of different parts of *Jatropha* sp. was observed. It was found that flower and fruit extract of *Jatropha* sp. were significantly reduced the growth of bacteria. Only flower extract of *J. integerrima* at 50 µl was proved to inhibitory for growth of *Erwinia carotovora pv. Carotovora.* At 100 µl concentration flower extract of *J. integerrima* was found to be most inhibitory against all bacteria. *J. curcas* fruit extract at 50 µl and 100 µl concentrations was found to be most effective against plant pathogenic bacteria. Fruit extract of all *Jatropha* species at 50 µl and 100 µl concentration was found to be inhibitory for the growth of *Erwinia carotovora pv. Carotovora* and *Pseudomonas*. *Xanthomonas campestris pv. mangiferaeindicae* growth was only inhibited in fruit extract of all *Jatropha* species at 100 µl concentration, while, at 50 µl concentration it did not show inhibition.

Key words: Flower and fruit extract, *Jatropha* species, plant pathogenic bacteria and antimicrobial activity

INTRODUCTION

Plants are good source of anti-infective agents with compounds which are highly effective instruments in the fight against microbial infections. Infectious diseases are the leading cause of death world-wide. Phytochemicals of plant origin have treated infectious diseases. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. Now a day's antibiotic resistance has become a global concern as the clinical efficacy of many existing antibiotics is being threatened by the emergence of multidrug-resistant pathogens (Bandow *et al.,* 2003). Many infectious diseases have been known to be treated with herbal remedies throughout the history of mankind (Rojas *et al.*, 2003). Therefore, researchers are increasingly turning their attention to folk medicine and looking for new leads day by day to develop better drugs against microbial infections (Benkeblia, 2004). In recent years, secondary plant metabolites (phytochemicals), previously with unknown pharmacological activities, have been extensively investigated as a source of medicinal agents (Krishnaraju, 2005). Thus, it is anticipated that phytochemicals with adequate antibacterial efficacy will be used for the treatment of bacterial infections (Balandrin *et al*., 1985) in near future. Phytochemical is a natural bioactive compound found in plants, such as vegetables, fruits, medicinal plants, flowers, leaves and roots that work with nutrients and fibers to act as an defense system against disease or more accurately, to protect against disease (Mittal *et al*., 2012).

Jatropha curcas is a medicinal crop that belongs to the family Euphorbiaceae and has a long history of cultivation in tropical America, Africa, and Asia (Ravindranath *et al.,* 2004). The inhibitory activity of plant extracts is generally depends upon the concentration, type of parts used and microbes tested (Balandrin *et al*., 1985). The accumulation and concentration of secondary metabolites which are responsible for inhibitory activity is varied according the plant parts (Essawi and Srours, 2000; Rekha Rajendran, 2010).

It may be a reason for the variation in the inhibitory activity of extracts of *J. curcas*. Extracts from various parts of *Jatropha curcas*, such as seeds and leaves, have shown molluscicidal, insecticidal, and fungicidal properties (Liu *et al*., 1997, Meshram, 1996; Nwosu and Okafor, 1995, Rug and Ruppel, 2000; Solsoloy and Solsoloy, 1997). *Jatropha curcas* seed extracts were found to inhibit the mycelial growth of *Colletotrichum musae* that causes anthracnose disease in bananas (Thangavelu, 2004). Its leaf extract was effective in controlling the fungal pathogen *Sclerotium* sp., which causes Azolla disease (Garcia and Lawas, 1990). *J. gossypifolia* is used as a therapeutic agent in different ways. The leaf bath is used for sores, sprains, rash and bewitchment in Latin America and the Caribbean (Morton, 1981; Omoregbe, 1996).

Hrishikesh and Meena (2011) studied antimicrobial activity of *Acacia concinna, Chrysopogon zizanioides, Alardostachys jatamashi, Cyperus rotundus, Phyllanthus emblica, Curcuma zedoria, Santalum album* and *Aloe vera* against bacteria like *Staphylococcus aureus* and *Escherichia coli* and reported that different concentrations of mixture of *Phyllanthus emblica* and *Cyperus rotundus* exhibited antimicrobial activity for all microorganisms. Patil and Jane (2013) reported the antibacterial effects of *Moringa oleifera* alone as well as in combination with *Cleome viscosa* against *Klebsiella pneumonia, Staphylococcus aureus, Pseudomonas aeruginosa, Streptococcus pneumoniae* and *Escherichia coli.* Several studies have confirmed the antimicrobial efficacy of different *Jatropha* species; however, there is insufficient information regarding the antimicrobial activities of *J. curcas* Linn. Whatever limited information available on the medicinal properties of *J. curcas* is mostly on the leaf extracts of the plant. In this paper, the antimicrobial property of crude extracts of the stem bark extract, root extract, latex and oil of *Jatropha* sp. has been studied as part of the exploration for new and novel bio-active compounds. There is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures and novel mechanisms of action for new and re-emerging infectious diseases. The aim of this study is to investigate the antimicrobial activity of *Jatropha* sp.

MATERIALS AND METHODS

Antibacterial activity

For evaluating antibacterial activity of different samples extracts, agar well diffusion assay (Navarro *et al*., 1996) was used. Crude water extracts of flower and fruit of *Jatropha* sp. were prepared. 10 gm of each sample was extracted with 100 ml of solvents. Allow the maturation of extracts for overnight. On the next day extracts were filtered then used as test samples. Test microorganisms used were plant pathogenic bacteria like *Erwinia carotovora pv. Carotovora, Pseudomonas aeruginosa, Xanthomonas compestris pv. Citri, Xanthomonas compestris pv. Mangiferae indicae.* First all test organisms were inoculated in a 10 ml of nutrient broth and incubated for overnight at 37^{o}C. On the next day the 2 ml aliquot of inoculum mixed with nutrient agar and poured in sterile petriplates. The medium was allowed to cool. After solidification wells of 6mm diameter were prepared with cork borer. 50 µl and 100 µl of each test samples were added in the well. All procedures were carried out in sterile conditions. Then plates were incubated at 37^{o}C for 24 hrs. Water was used as negative control. Each sample was done in triplicate. Antibacterial activity was evaluated by quantifying zones of inhibition of bacterial growth after 24 hrs.

RESULTS AND DISCUSSION

Bioactivity of *Jatropha* species flower extract against plant pathogenic bacteria

Bioactivity of *Jatropha* species flower extract was tested against plant pathogenic bacteria and results are summarized in Table 1. It has been found that, 100 µl concentration of all *Jatropha* species showed zone of inhibition against tested bacteria. Only flower extract of *J. integerrima* at 50 µl was proved to inhibitory for growth of *Erwinia carotovora pv. Carotovora.* Flower extract of *J. integerrima* at 100 µl concentration was found to be most effective against all bacteria as compared to other *Jatropha* species. *Xanthomonas campestris pv. Mangiferaeindicae* and *Pseudomonas aeruginosa* showed zone of inhibition in flower extract of all *Jatropha* species.

Bioactivity of *Jatropha* species fruit extract against plant pathogenic bacteria

Bioactivity of *Jatropha* species fruit extract was screened against plant pathogenic bacteria and results are given in Table2.

As compared to other *Jatropha* species, fruit extract of *J. curcas* was found to be most effective against plant pathogenic bacteria at 50 µl and 100 µl concentration. Growth of *Erwinia carotovora pv. Carotovora* and *Pseudomonas aeruginosa* was found to be inhibited in fruit extract of all *Jatropha* species at 50 µl and 100 µl concentration. Growth of *Xanthomonas campestris pv. mangiferaeindicae* was only inhibited at 100 µl concentration fruit extract of all *Jatropha* species, while, at 50 µl concentration it did not show inhibition.

Table 1: Bioactivity of *Jatropha* species flower extract against plant pathogenic bacteria

Plant pathogenic bacteria	Flower extract of *Jatropha* species								Control (GN)
	J. curcas		*J. gossypifolia*		*J. glandulifera*		*J. integerrima*		
	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl	
	Zone of inhibition in mm								
Erwinia carotovora pv. carotovora	00	09	00	00	00	00	09	11	00
Pseudomonas aeruginosa	00	10	00	09	00	09	00	12	00
Xanthomonas campestris pv. citri	00	09	00	00	00	00	00	10	00
Xanthomonas campestris pv. mangiferaeindicae	00	11	00	09	00	10	00	09	00
S.E.	00	0.48	00	2.60	00	2.75	2.25	0.65	00
C.D.	00	1.23	00	6.68	00	7.07	5.78	1.66	00

Table 2: Bioactivity of *Jatropha* species fruit extract against plant pathogenic bacteria

Plant pathogenic bacteria	Fruit extract of *Jatropha* species								Control (GN)
	J. curcas		*J. gossypifolia*		*J. glandulifera*		*J. integerrima*		
	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl	50 µl	100 µl	
	Zone of inhibition in mm								
Erwinia carotovora pv. carotovora	12	14	09	13	10	13	09	11	00
Pseudomonas aeruginosa	12	18	10	14	10	12	09	12	00
Xanthomonas campestris pv. citri	09	13	11	12	09	10	00	10	00
Xanthomonas campestris pv. mangiferaeindicae	00	12	00	13	00	09	00	11	00
S.E.	2.84	1.31	0.48	0.41	2.43	2.98	2.60	0.41	00
C.D.	7.30	3.38	1.23	1.05	6.24	7.67	6.68	1.05	00

Fruit extract of *Jatropha* species was proved to more inhibitory than flower extract which indicate that fruit of *Jatropha* species contain more active principle than flower. These active principles might have inhibited the growth of plant pathogenic bacteria at both 50 µl and 100 µl concentration. Igbinosa *et al.,* (2009) investigated the in vitro antimicrobial activity of crude ethanolic, methanolic and water extracts of the stem bark of *Jatropha curcas* against *Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli Streptococcus faecalis, Staphylococcus epidermidis, Shigella dysenteriae, Micrococcus kristinae, Klebsiella pneumonia, Bacillus cereus, Bacillus subtilis, Proteus vulgaris* and *Serratia marcescens.* Sriprang *et al.,* (2010) found that *E. coli, P. aeruginosa, S. aureus, B. cereus, B. megaterium* and *B. megaterium* were inhibited in crude extract of *Jatropha curcas*. On the contrary of that, *Salmonella typhi* was not inhibited by any of the crude extracts. Gaikwad *et al.*, (2012) tested leaf, stem, root extract, latex and oil of *Jatropha curcas, J. glandulufera, J. integerrima* and *J. gossypofolia* were screened against plant pathogenic bacteria like *Erwinia carotovora pv. Carotovora, Pseudomonas aeruginosa, Xanthomonas campestris pv. Citri* and *Xanthomonas campestris pv. Mangiferaeindicae* and found that these extract were significantly affected the growth of plat pathogenic bacteria.

ACKNOWLEDGEMENT

Author is grateful to the Principal and Head, Department of Botany, Swami Vivekanand Senior College Mantha, Dist. Jalna (M. S.) India for providing necessary facilities.

LITERATURE CITED

Balandrin MF, Jocke AJ, Wurtele E, 1985. Natural plant chemicals: sources of industrial and mechanical materials. *Science*. **228**: 1154-1160.

Balandrin MF, Kjocke AJ, Wurtele ES and Bollinger WH, 1985. *Science*. **228**(4704): 1154-1160.

Bandow JE, Brotz HL, Labischinski IOH and Hecker M, 2003. Antimicrobial Agents and Chemotherapy. **47**(3): 948-955.

Benkeblia N, 2004. Lebensmittel-Wissenschaft und-Technologie- Food Science and Technology. **37**(2): 263-268.

Essawi T and Srours M, 2000. Screening some Palestinian medicinal plants for antibacterial activity. *J. Ethanopharmacol*. **70**: 343-349.

Garcia RP and Lawas P, 1990. Potential plant extracts for the control of *Azolla* fungal pathogens. *Philipp. Agri*. **73**: 343-348.

Gaikwad RS, Kakde RB, Kulkarni AU, Gaikwad DR and Panchal VH, 2012. In vitro antimicrobial activity of crude extracts of *Jatropha* species. *Current Botany*. **3**(3): 09-15.

Vitekari H and Pillai M, 2011. Antimicrobial Activity of Some Selected Medicinal Plants on Skin Pathogens. *Res. J. Biotech*. **6** (3): 67-72.

Igbinosa OO, Igbinosa EO and Aiyegoro OA, 2009. Antimicrobial activity and phytochemical screening of stem bark extracts from *Jatropha curcas* (Linn). *African Journal of Pharmacy and Pharmacology*. **3**(2): 058-062.

Krishnaraju AV, Rao T, Sundararaju VN, Vanisree DM and Subbaraju GV, 2005. *International Journal of Applied Sciences and Engineering*. **3**(2): 125-134.

Liu SY, Sporer F, Wink M, Jourdane J, Henning R, Li Y and Ruppel A, 1997. Anthraquinones in *Rheum palmantum* and *Rumex dentatus* (Polygonaceae), and phorbol esters in *Jatropha curcas* (Euphorbiaceae) with molluscicidal activity against the *Schistosome vectorsnails Oncomelania, Biornphalaria* and *Bulinus*. *Trop. Med. Int. Health*. **2**: 179-188.

Meshram PB, Kulkarni N and Joshi KC, 1996. Antifeedant activity of *Azadirachta indica* and *Jatropha curcas* against Papiliodemoleus L. *J. Environ. Biol*. **17**: 295-298.

Morton JF, 1981. Atlas of medicinal plants of Middle America: Bahamas to Yucatan. Charles C. Thomas Pub Ltd, Springfield, Illinois, xxviii. 1981. 1-1420.

Navarro V, Villarreal ML, Rojas G and Lozoya X, 1996. Antimicrobial evaluation of some plants used in Mexican traditional medicines for the treatment of infectious diseases. *J. Ethanopharmacol*. **53**: 143-147.

Nwosu MO and Okafor JI, 1995. Preliminary studies of the antifungal activities of some medicinal plants against Basidiobolus and some other pathogenic fungi. *Mycoses*. **38**: 191-195.

Omoregbe RE, Ikuebe OM and Ihimire IG, 1996. *African Journal of Medicine and Medical Science*. **25**(4): 373 –375.

Ravindranath N, Reddy MR, Ramesh C, Ramu R, Prabhakar A, Jagadeesh B and Das B, 2004. New lathyrane and podocarpane diterpenoids from *Jatropha curcas*. *Chem. Pharm. Bull*. **52**: 608-611.

Rekha Rajendran, 2010. Antimicrobial Activity of Different Bark.and Wood of *Premna serratifolia* Lin., *I. J of Pharma and Bio Sciences*. **1**(1): 1-9.

Rojas R, Bustamante B, Bauer J, Fernandez I, Alban J and Lock O, 2003. *Journal of Ethnopharmacology*. **88**(2-3): 199-204.

Rug M and Ruppel A, 2000. Toxic activities of the plant *Jatropha curcas* against intermediate snail hosts and larvae of schistosomes. *Trop. Med. Int. Health*. **5**: 423-430.

Solsoloy AD and Solsoloy TS, 1997. Pesticidal efficacy of formulated *Jatropha curcas* oil on pests of selected field crops, pp. 216-226. In G. M. Gübitz, M. Mittelbach, and M. Trabi (eds.). Biofuels and Industrial Products from *Jatropha curcas*. DBV Graz.

Sriprang S, Sriprang N, Sumpradit T and Shimbhu D, 2010. Antibacterial activities of crude extracts from physic nut (*Jatropha curcas*) seed residues. Science Asia. **36**: 346–348.

Mittal SS, Rao N, Soni M and Menghani E, 2012. Phytochemical Potentials of *Gymnema Sylvestre, Adiantum Lunulatum, Bryonia Laciniosa*. *Asia J Biochem and Pharma Res*. **3** (2): 8-13.

Thangavelu R, Sundararaju P and Sathiamoorthy S, 2004. Management of anthracnose disease of banana caused by *Colletotrichum musae* using plant extracts. *Jatropha* Hort. *Sci. Biotechnol*. **79**: 664-668.

How to Cite this Article:

Deepmala A. Gaikwad, 2013. In vitro antibacterial activity of crude extracts of *Jatropha* species. *Sci. Res. Rept.,* **3**(2): 159-163.