Research Article

IN VITRO ASSESSMENT OF ANTIBACTERIAL ACTIVITY OF STEM AND ROOT OF RAUWOLFIA SERPENTINA AGAINST DIFFERENT BACTERIA

Virendra Vaishnav ^{*1}, Debasish Sahoo ¹, Tanushree Chatterjee ²

¹ Ph.D. Scholar, Chhattisgarh Swami Vivekanand Technical University, Bhilai, Chhattisgarh, India

² Assistant Professor, Raipur Institute of Technology, Raipur, Chhattisgarh, India

*Corresponding Author Email: virendravaishnav7@gmail.com

Article Received on: 23/05/21 Approved for publication: 30/06/21

DOI: 10.7897/2230-8407.1206148

ABSTRACT

Medicinal Plants are the good source of natural antimicrobial agents. The main aim of present study was to evaluate the antibacterial activity of stem and root of *Rauwolfia serpentina* against six microorganism, Powdered stem and root of plant were extracted with acetone, chloroform and methanol and streptomycin used as positive control. The antibacterial activity of *Rauwolfia serpentina* was detected by using disc diffusion method and agar well diffusion method on the following bacteria- *Bacillus cereus*, *Staphylococcus aureus*, *Bacillus fusiformis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *P. luminescens*. The experiment reported that *R. serpentina* Root methanol extract shown 14.86 ± 1.11 highest antibacterial activity against *Pseudomonas aeruginosa* through well diffusion method. Whereas root chloroform recorded 13.46 ± 1.28 highest antibacterial activity against *E. coli* through disc diffusion method, maximum zone of inhibition 22.66 ± 0.52 mm was found for the positive control, streptomycin through well diffusion method. Further studies should be undertaken to reveal the correct mechanism of action of antimicrobial effect to identify the active ingredients which can be used in drug development program.

Keywords: *Staphylococcus aureus*, Antimicrobial, Streptomycin, Diffusion.

INTRODUCTION

Medicinal plant products and their medicinal properties have been widely used as therapeutic agent. The medicinal plants still play an essential role to treatment of microbial pathogens in emergent countries. The use of natural remedies has been rising in the developed countries in the recent decades. Medicinal plants are very essential source for the development of novel chemotherapeutic agents for multi drug resistance pathogens¹.

In Ayurvedic, the powdered form of root of *Rauwolfia serpentina* has been used for treatment of mental illness, snake bites and feverish illnesses². It is also used for following properties anti-inflammatory, antimicrobial, anti diuretic, antioxidant, anti proliferative, anti-cancerous, anti-fibrillar, anti-arrhythmic, anti-cholinergic, anti-dysentery, anti-hypotensive, anti diarrhoeal, sympathomimetic, anti-contractile and tranquillizing activity^{3,4,5,6}. It is also have immense therapeutic properties for curing different diseases due of the presence of flavonoids, alkaloids, glycosides, phenols, phlobatannins, saponins, sterols, tannins, terpenes and resins⁷.

Bioactive metabolites extracted from medicinal plants have a wide range of biological activities like antimicrobial, anticancer and antiviral^{8,9}. *Rauwolfia serpentina* (L.) belongs to Apocynaceae family normally known as Sarpagandha is a significant therapeutic plant of Indian subcontinent and Asian countries^{10,11}. *R. serpentina* is used as therapeutic agent to treat insomnia, high blood pressure, anxiety and epilepsy. Reserpine is an effective indole alkaloid first isolated from Sarpagandha plant which is widely using as an antihypertensive¹². In *Rauwolfia serpentina* following alkaloids are present such as ajmalicine, ajmaline, ajmalimine, indobine, deserpidine, indobinine,

reserpiline, reserpine, rescinnamine, serpentinine rescinnamidine, yohimbine and serpentine¹³. In this study the plant was evaluated for antibacterial activities against different pathogenic and non-pathogenic bacteria.

MATERIALS AND METHODS

Collection of medicinal plants for the study

Root and stem of *R. serpentina* was procured from ayurvedic shop of Raipur Chhattisgarh. The plant material (stem and roots) of *R. serpentina* was dried. Chemicals and reagents were purchased from Himedia and Merck.

Preparation of Extract

The dried root and stem were grounded using a mechanical grinder. Extraction was carried out using the solvents acetone, chloroform and methanol.

Test Microorganisms

The following bacteria such as *Bacillus cereus* (MTCC 430), *Staphylococcus aureus* (MTCC 737), *Bacillus fusiformis* (MTCC 441), *Escherichia coli* (MTCC 1687), *Pseudomonas aeruginosa* (MTCC 1688) and *P. luminescens* were collected from microbial type culture and collection (MTCC) Chandigarh, India.

Inoculum preparation

Ten ml of Nutrient broth was taken into the screw cap test tube and pure colony of bacteria was added into the tube and vortex

was done. The OD (optical density) was measured with the colorimeter¹⁴.

Antimicrobial screening

The agar well diffusion technique was performed for antimicrobial susceptibility test for crude extracts and streptomycin used as a positive control. On other hand agar disc diffusion method was performed for antimicrobial susceptibility test for standard antibiotic disc. The extracts were dissolved in respective solvents to get the known concentrations of 100 mg/ml. The activity was compared with streptomycin disc. After 24 h of incubation at 37 °C the zone of inhibition was measured by using an antibiotic zone reader scale (Hi Antibiotic Zone Scale-c) and tabulated¹⁵.

RESULTS AND DISCUSSIONS

In vitro antibacterial activities of the acetone, chloroform and methanol root and stem extract of *R. serpentina* was screened by the presence or absence of zone of inhibition. Table 1 and Table 2 presented antibacterial activity of *R. serpentina* plant stem and root against gram negative and gram-positive bacteria. Root methanol extract shown 14.86 ± 1.11 highest antibacterial activity against *Pseudomonas aeruginosa* through well diffusion method (Fig.1). On other hand, root chloroform recorded 13.46 ± 1.28 highest antibacterial activity against *E. coli* through disc diffusion method. (Fig. 2)

Table 1: In vitro antimicrobial activity of stem and root extracts of *R. serpentina* plant through well diffusion method

Extract Name	<i>B. cereus</i>	<i>S. aureus</i>	<i>B. fusiformis</i>	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>P. luminescens</i>
Stem Acetone	10.96±1.53	11.78±1.60	08.33±1.23	09.13±1.13	11.10±0.50	09.66±1.60
Stem Methanol	10.10±1.35	11.65±1.43	11.76±1.50	11.66±1.50	12.89±1.53	10.68±1.40
Stem Chloroform	12.23±1.24	12.76±1.12	08.26±0.26	09.23±0.26	13.63±1.12	09.70±1.50
Root Acetone	11.24±1.45	11.66±1.93	10.23±1.44	10.33±1.34	11.33±1.83	10.73±1.61
Root Methanol	10.56±1.40	12.20±1.21	11.23±1.78	11.23±1.88	14.86±1.11	11.60±1.52
Root Chloroform	13.12±1.24	12.10±1.65	10.65±0.46	10.66±0.46	12.33±1.69	10.66±1.32
Positive control	20.33±1.52	18.66±0.67	21.33±0.72	19.00±1.82	22.66±0.52	20.66±0.89

Fig.1: In vitro antimicrobial activity of stem and root extracts of *R. serpentina* plant through well diffusion method

Fig.2: Anti-Bacterial Activity of root chloroform against *B. cereus*

Fig. 3: Anti-Bacterial Activity of root methanol against *Pseudomonas aeruginosa*

Table 2: *In vitro* antimicrobial activity of stem and root extracts of *R. serpentina* plant through disc diffusion method

Extract Name	<i>B. cereus</i>	<i>S. aureus</i>	<i>B. fusiformis</i>	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>P. luminescens</i>
Stem Acetone	10.66 ± 0.60	10.33 ± 1.23	11.60 ± 1.36	12.34 ± 1.56	10.16 ± 1.60	11.34 ± 0.52
Stem Methanol	11.56 ± 1.53	12.30 ± 1.50	11.66 ± 1.87	10.45 ± 1.39	10.66 ± 1.40	12.53 ± 1.50
Stem Chloroform	12.86 ± 1.12	7.89 ± 0.26	12.43 ± 1.66	11.33 ± 1.29	10.00 ± 1.60	11.66 ± 1.54
Root Acetone	10.36 ± 1.93	10.32 ± 1.54	12.20 ± 1.26	12.36 ± 1.51	11.33 ± 1.61	12.66 ± 0.26
Root Methanol	12.40 ± 1.11	10.56 ± 1.78	10.66 ± 1.84	11.46 ± 1.40	11.40 ± 1.92	12.76 ± 0.46
Root Chloroform	11.30 ± 1.69	11.56 ± 0.46	11.00 ± 1.73	13.46 ± 1.28	10.66 ± 1.32	12.33 ± 1.76
Positive Control	18.33 ± 1.52	18.66 ± 0.67	18.33 ± 0.72	19.00 ± 1.82	19.66 ± 0.52	18.66 ± 0.89

Fig. 4: *In vitro* antimicrobial activity of stem and root extracts of *R. serpentina* plant through disc diffusion method

CONCLUSION

In this study we concluded that among the root and stem extracts of *R. serpentina*, Root extract possess highest antibacterial activity against pathogenic and nonpathogenic bacteria than other extracts showed moderate antimicrobial activity, whereas stem extracts shown least antimicrobial activity. Results demonstrated that root extracts of *R. serpentina* have great antibacterial activity against the tested organisms. Further studies should be

undertaken to which active ingredients can be used in drug development program for safe health care services.

REFERENCES

1. Srinivasan D, Nathan S, Suresh T, Perumalsamy PL (2001). Antimicrobial activity of certain Indian medicinal plants used in folkloric medicine. *Journal of Ethnopharmacology* 74(3):217-220.

2. Chopra, R.N.; Nayar, S.L.; Chopra, I.C. *Glossary of Indian Medicinal Plants*. National Institute of Science Communication and Information Resources; CSIR: Delhi, 2002.
3. Arts, I.C.; Hollman, P.C. Polyphenols and disease risk in epidemiologic studies. *American Journal of Clinical Nutrition*, 2005, 81(1) (Suppl.), 317S-325S. [PMID: 15640497]
4. Ezeigbo, I.I.; Ezeja, M.I.; Madubuike, K.G.; Ifenkwe, D.C.; Ukwani, I.A.; Udeh, N.E.; Akomas, S.C. Antidiarrhoeal activity of leaf methanolic extract of *Rauwolfia serpentina*. *Asian Pacific Journal of Tropical Biomedicine*, 2012, 2(6), 430-432.
5. Harisaranraj, R.; Suresh, K.; Babu, S.S. Phytochemical based strategies for pathogen control and antioxidant capacities of *Rauwolfia serpentina* Extracts. *Recent Res. Sci. Technol*, 2009, 1, 67-73.
6. Scalbert, A.; Manach, C.; Morand, C.; Révész, C.; Jiménez, L. Dietary polyphenols and the prevention of diseases. *Critical Reviews in Food Science and Nutrition*, 2005, 45(4), 287-306.
7. Harisaranraj, R.; Suresh, K.; Saravanababu, S. Evaluation of the chemical composition *Rauwolfia serpentina* and *Ephedra vulgaris*. *Advances in Biological Regulation (Faisalabad)*, 2009, 3(5-6), 174-178.
8. Strobel, G.A. Rainforest endophytes and bioactive products. *Critical Reviews in Biotechnology*, 2002, 22(4), 315-333.
9. Wiyakrutta, S.; Sriubolmas, N.; Panphut, W. Endophytic fungi with anti-microbial, anti-cancer and anti-malarial activities isolated from Thai medicinal plants. *World Journal of Microbiology and Biotechnology*, 2004, 20, 265-272.
10. Bhatt R, Arif M, Gaur AK and Rao PB. *Rauwolfia serpentina*: Protocol optimization for *in vitro* propagation. *African Journal of Biotechnology*. 2008; 7(23): 4265-4268.
11. Dey A and De JN. *Rauwolfia serpentina* (L). Benth. ex Kurz. -A Review. *Asian Journal. Plant Science*. 2010; 9(6): 285-298.
12. Anonymous. The wealth of India: A Dictionary of Indian Raw Materials and Industrial Products. SIR, New Delhi, India. 2003.
13. Vakil, R.J. *Rauwolfia serpentina* in the treatment of high blood pressure. *American Heart Association, Incorporation*, 1955.
14. S. Gur, D. Turgut-Balik, N. Gur, *World Journal of Agricultural Science*, 2, 2006, 439
15. Devi, P.; D'Souza, L.; Kamat, T. Batch culture fermentation of *Penicillium chrysogenum* and a report on the isolation, purification, identification and antibiotic activity of citrinin. *Indian Journal of Marine Sciences* 2009, 38, 38-44.

Cite this article as:

Virendra Vaishnav et al. *In vitro* assessment of antibacterial activity of stem and root of *Rauwolfia serpentina* against different bacteria. *Int. Res. J. Pharm.* 2021;12(6):87-90.
<http://dx.doi.org/10.7897/2230-8407.1206148>

Source of support: Nil, Conflict of interest: None Declared

Disclaimer: IRJP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publishing quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IRJP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IRJP editor or editorial board members.