

Antibacterial Activity of Aqueous and Ethanolic Extracts of *Scindapsus officinalis* (Roxb.) Schott

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Abstract: Aqueous and ethanolic extracts of medicinal plant *Scindapsus officinalis* (Roxb.) Schott. were evaluated for their antibacterial activity against clinical isolates, *Escherichia coli*, *Salmonella typhi*, *Klebsiella pneumoniae* and *Staphylococcus aureus*. Both the ethanolic and aqueous extracts inhibited the growth of the test organisms, while *S. typhi* showing the highest susceptibility. This research supports the local use of the fruits of the plant *Scindapsus officinalis* for prophylactic and therapeutic purposes against bacterial infection.

Key words: *Sciasndapsus officinalis* • Antibacterial activity • Activity index • Therapeutic purpose

INTRODUCTION

Scindapsus officinalis (Roxb.) Schott., known as 'Gajapeepal' in Hindi, is a member of the family; Araceae. Gajapeepal consists of dried, transversely cut pieces of mature female spadix of *Scindapsus officinalis* Schott., a large epiphytic climber, found all along the sub-Himalayan tract between an altitude of 330-1000 m in West Bengal, Orissa andhra Pradesh and the Andaman Islands. Fruit occurs in transversely cut circular pieces of about 2.0-3.0 cm in diameter and 2.0-3.5 cm thick, brownish-grey, rough and scaly, cut surface has a central core, surrounded by fruits enclosing the seed covered partly by aril; odour and taste not distinct. Fruit shows more or less loosely arranged, thin-walled, parenchymatous cells having more or less isodiametric cells filled with brown content and numerous acicular crystals of calcium oxalate [1]. Ethanolic extract (50%) and ethyl acetate extracts of *Scindapsus officinalis* fruit were found to be significant antioxidant property. This antioxidant property may be due to the presence of

flavonoids and phenolics compounds [2]. *Scindapsus officinalis* may be used as an alternative or supplementary herbal remedy for the treatment of analgesic and inflammatory diseases. Because of its analgesic and anti-inflammatory effects, ethanol extract of *Scindapsus officinalis* fruit may have beneficial effects together with drugs known for a strong analgesic as well as anti-inflammatory effects [3].

Methanolic extract of *Scindapsus officinalis* (MESO) has been also shown the significant increase in preconvulsion time due to pretreatment with MESO at the dose of 50, 100 and 200 mg/kg of bodyweight of guinea pigs, when the guinea pigs were exposed to histamine. The results of MESO suggested that it is effective in reducing the symptoms of bronchial asthma and also improve the lung function parameters of asthmatic subjects [4].

Exhaustive literature survey indicated that systematic pharmacological work has not been done so far on this plant. Hence, this plant was selected to find its antimicrobial activity.

MATERIALS AND METHODS

Plant Material: The fruits of the plant *Scindapsus officinalis* for the proposed study were collected from the Kuwari River, Gormi, Bhind, MP, India, in the month of July 2009. It was identified the help of available literature and authenticated at the Department of Pharmaceutical Sciences, Dr. H.S. Gaur University, Sagar (MP). The voucher specimen of the plant and fruit has deposited in departmental herbarium (voucher specimen no. J-88).

Preparation of Extracts: The fruit of the plant *Scindapsus officinalis* was shade dried and coarsely were powdered and added to distilled water and boiled on slow heat for 2 hr. It was then filtered through 8 layers of muslin cloth and centrifuged at 5000 rpm for 10 min. The supernatant was collected. This procedure was repeated twice. After 6 hours, the supernatant collected at an interval of every 2 hours was pooled together and concentrated to make the final volume one-fourth of the original volume. It was then autoclaved at 121°C and at 15 lbs pressure and stored at 4°C. For solvent extraction, the air-dried powder was taken in ethanol in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 190-220 rpm for 24 hours. After 24 hours the supernatant was collected and the solvent was evaporated to make the final volume and stored at 4°C in airtight bottle [5].

Microorganisms: The species of bacterial organisms were *S. aureus*, *E. coli*, *K. pneumoniae* and *S. typhi*. They were clinical isolates obtained from institute of Microbial Technology, Chandigarh, India. The cultures of bacteria were maintained on nutrient agar slants at 4°C, re-identified by biochemical tests and sub-cultured on nutrient broth for 24 h prior to testing [6, 7].

Antimicrobial Susceptibility Test: The spreading method was used. Twenty four hours old cultures of the organisms to be tested were used. A loopful of the cultures was uniformly spread over the surface of a sterile Muller-Hilton agar with a sterile bent rod. The extract was diluted to obtain different concentration of, 62.5, 125, 250 and 500 mg/ml using sterile peptone water. Various concentrations of the prepared extracts were used to fill hole bored by 5 mm cork borer in the inoculated agar. The plates were made in triplicate with one for the test organism- Gentamycin, standard drug. All plates were incubated at 37°C for 24 h. The diameter of the zones of inhibition in the triplicate plates was measured by calculating the difference between core borer (5 mm) and

the diameters of inhibition [8] and their mean designated as ZI. The activity indices, designated as AI, were calculated as the division of zone of inhibition of the extract by that of the standard drug i.e. Gentamycin [9].

Tube Dilution Method: The extracts were diluted into different concentrations of 62.5, 125, 250 and 500 mg/ml with sterile peptone water in test tubes. Ethanol and water were used as the control. To each of the dilution was added 0.2 ml broth culture of the test organism. The tubes were incubated at 37°C for 24 h after which turbidity reading was taken using turbidimeter. Extracts added with peptone water served as control.

RESULTS

Both crude ethanolic and aqueous forms of the extracts of *Scindapsus officinalis* exhibited varying degree of antimicrobial activities against the test organisms. On a general note, ethanolic extracts exhibited higher degree of antibacterial activities than the aqueous extracts. At 62.5 mg/ml, crude ethanolic extract had higher antibacterial activity with mean zones of inhibition 3.8 ± 0.1 mm (A.I = 0.5) and 4.0 ± 0.5 mm (A.I = 0.4) than crude aqueous extract with mean zones of inhibition 3.0 ± 0.3 mm (A.I = 0.4) and 3.5 ± 0.6 mm (A.I = 0.4) against *E. coli* and *S. aureus*, respectively. Besides that, aqueous extract had higher antibacterial activities [mean zone of inhibition 4.4 ± 1.0 mm (A.I = 0.6) and 4.0 ± 0.6 mm (A.I = 0.6) and 4.0 ± 0.6 mm (A.I = 0.7)] than ethanolic extract [4.0 ± 0.3 mm (A.I = 0.5) and 3.0 ± 0.6 mm (A.I = 0.5)] against *S. typhi* and *K. pneumoniae*, respectively.

Equal or sometimes higher activities were observed at concentration of 250, 500 mg/ml by the crude ethanolic extracts than the standard drug, gentamycin. Hence, the activity index, A.I = 1 against *E. coli*, *S. typhi* and *K.pneumoniae*. Consistently high activity indices were observed against the etiology of pneumonia at crude concentration of 125 and 250 mg/ml (Table 1).

The high activity indices were enduring with decrease in concentration from 62.5 to 500 mg/ml. Just low reduction in activities were observed as the crude extract concentration were reduced gradually from 62.5 to 500 mg/ml in both the agar diffusion set up (Table 1) and tube dilution method (Table 2). The same trend of activity in agar dilution was equally observed in tube dilution method. Ethanolic extract inhibited the growth of the four bacteria with lower turbidity than the aqueous extract. For instance at 500 mg/ml, the turbidity readings

Table 1: Antibacterial activity of *Scindapsus officinalis* extracts using the agar diffusion technique (mm)

Isolate	Gentamycin	62.5 mg/ml				125 mg/ml				250 mg/ml				500 mg/ml			
		A		B		A		B		A		B		A		B	
		Z.I	A.I	Z.I	A.I	Z.I	A.I	Z.I	A.I	Z.I	A.I	Z.I	A.I	Z.I	A.I	Z.I	A.I
<i>E. coli</i>	7.5±1.0	3.8±0.1	0.5	3.0±0.3	0.5	5.0±1.0	0.7	4.0±0.2	0.5	6.0±0.5	0.8	4.8±0.3	0.6	9.5±1.0	1.3	6.0±0.5	0.8
<i>Staph. aureus</i>	9.5±1.0	4.0±0.5	0.4	3.5±0.6	0.4	6.4±1.0	0.7	4.0±1.0	0.4	6.5±1.0	1.0	5.5±0.6	0.6	8.0±1.1	0.8	6.5±1.0	0.7
<i>Sal. Typhi</i>	7.8±1.1	4.0±0.3	0.5	4.4±1.0	0.5	6.8±0.5	0.9	5.8±0.5	0.5	8.5±1.0	1.1	6.6±1.0	0.9	9.0±1.0	1.2	7.5±1.2	1.0
<i>K. pneumonia</i>	6.1±1.1	3.0±0.6	0.5	4.0±0.6	0.5	6.0±0.2	1.0	5.0±0.6	0.8	6.6±0.7	1.1	5.2±0.3	0.9	7.0±1.0	1.2	6.6±0.5	1.1

A = ethanolic extract, B = aqueous extract, Z.I = mean zone of inhibition in mm ± SD, A.I = activity index with respect to Gentamycin.

Table 2: Antibacterial activity of *Scindapsus officinalis* extracts using the tube dilution method

Isolate	62.5 mg/ml		125 mg/ml		250 mg/ml		500 mg/ml	
	A	B	A	B	A	B	A	B
<i>E. coli</i>	4.60	5.60	3.70	4.22	2.80	3.10	1.50	2.21
<i>Staph. aureus</i>	5.90	5.90	4.60	4.40	3.85	3.60	2.30	2.90
<i>Sal. typhi</i>	4.82	4.76	3.70	3.60	2.40	2.80	1.20	1.90
<i>K. pneumonia</i>	6.60	6.20	5.62	5.82	4.20	4.35	3.10	3.85
Control	5.10	5.20	4.94	5.14	4.76	4.92	4.00	4.12

A = ethanolic extract and B = aqueous extract.

were 1.50, 2.30, 1.20, 3.10 and 4.00 NTU for crude ethanolic extract, while the reading for crude aqueous extracts were 2.21, 2.90, 1.90, 3.85 and 4.12 NTU against *S. aureus*, *E. coli*, *S. typhi* and *K. pneumoniae*, respectively. The slight higher potency observed in ethanol (control) than water was expected due to antimicrobial activity of alcohol in general.

Like the agar diffusion set up, the trend of antimicrobial activity continues until the crude extract concentration of 62.5 mg/ml where both ethanolic and aqueous extracts had equal turbidity of 5.90 against *E. coli*. Meanwhile at this same concentration of 62.5 mg/ml, higher turbidity was observed in ethanolic extract tube i.e. 4.82 and 6.60 than in aqueous extract tube i.e. 4.76 and 6.20 against *S. typhi* and *K. pneumonia* in that order.

DISCUSSION

The results obtained from this work revealed that the plants contained bioactive agents which are connected with antimicrobial properties in plants. These agents are alkaloids, saponins, flavonoids, tannins. Research work revealed that tannins from the fruits, barks, roots etc of many plants especially Araceae are used to treat cells that have gone neoplastic [10]. It is obviously interesting to observe the result of high antibacterial effects of both ethanolic and aqueous extracts the four potential

pathogens of public health importance. *S. aureus*, no doubt, is frequently connected to cases of bacteraemia, septicaemia, endocarditis, osteomyelitis, furuncle, etc. It is also frequently involved in both nosocomial and community acquired infections. The successful inhibition of this bacteria and its contemporary etiology of gastroenteritis (*E. coli*) is a good development, especially when we consider the records of resistance to various conventional antibiotics by them over the years. This extract could therefore be of use in management of opportunistic infection in HIV/AIDS involving these two isolates. Similarly, the extract showed appreciable level of potency against the commonest etiology of enteric fever. Records have it that the enteric fever had mortality rate of 10-15% in developing countries [11]. Both the ethanolic and aqueous extracts could be put into fixed dosage combination therapy for treating the salmonella infection. This extracts is already in use by the traditional medicine practitioners. By virtue of high activity indices above unitary value even in crude forms, the extracts have more promising therapeutic advantages than the likes of gentamycin and its amino glycoside relations when refined to produce antibiotics. In conclusion, this finding justifies the traditional use of this plant, *Scindapsus officinalis* for prophylactic and therapeutic purposes. The findings could also be of commercial interest to both pharmaceutical companies and research institutes in the production of new drugs.

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