

Antibacterial activity of rhizomes and leaf of *Tectaria gemmifera* (Fee.) Alston

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Abstract

The antimicrobial properties of acetone extract of *Tectaria gemmifera* (Fee) Alston rhizomes and leaves were assayed *in vitro* against human pathogenic bacteria represented by *Pseudomonas aeruginosa*, *Salmonella typhi*, *Staphylococcus aureus*, *Escherichia coli* and *Shigella flexneri* by 96 well-plate method. Extracts exhibited varying degree of inhibitory effect against all tested pathogenic bacteria. Leaf extract shown maximum inhibition and minimum inhibitory concentration (MIC) for *S. flexneri* and *P. aeruginosa* (2 µl), *S. typhi* and *E. coli* (2, 6 and 8 µl) and *S. arueus* (10 µl). Whereas rhizome extract shown (MIC) of *S. flexneri* and *P. aeruginosa* (2 µl); *S. typhi* (6 µl); *E. coli* (8 µl) and *S. arueus* (10 µl). The antibacterial activity may due to presence of secondary metabolites in the plant. Phytochemical tests showed the presence of steroid, glycoside, flavonoid, tannin, phenol, terpenoids, phytosterol and saponin in rhizome while absent in leaf extract. The results of pharmacognostic analysis will be helpful in developing standards for purity, quality and identification of the crude drugs.

Keywords: *tectaria gemmifera*, rhizome, leaf, antibacterial, phytochemical

Introduction

The natural plant materials have served as an important source of pharmaceutical products since time immemorial; the modern medicines for human use are required to meet exacting standards that relate to their efficacy, quality and safety. Some of antibiotics have failed to discourage the growth of many bacteria that have genetic ability to resist to particular drugs, and these antibiotics may have the various side effects on human body which can harm to vital organs of body like kidney, liver, pancreas and their impact on the immune system. Plants are rich source of natural products used to cure various kinds of diseases, as it have a wide variety of secondary metabolites, such as alkaloids, flavonoid, phenols, tannins, terpenoids, phytosterol and steroids. As per World Health Organization (WHO) report, approximately 80% of the global population relies on traditional herbal medicines as part of standard healthcare system.

Yet there is a less work has been done on the antimicrobial activity of pteridophytes, some workers have investigated ethno-botanical importance of these plants. (Parihar *et al.* 2010) [15] some 13 fern species are studied recently by Parihar *et al.* for antibacterial activity. Some ferns species are used by tribals of Gondia District, Vidarbha region of Maharashtra (Cherian & Ramteke 2010) [9].

Young fronds of *Tectaria gemmifera* are used as vegetable curry or salad. Extract of fresh rhizomes is used for preventing diarrhea in children in Darjeeling District (Dixit & Vohra 1984). Dried rhizome, stem and stipe extract is used in respiratory disorders like cold, cough, asthma and bronchitis. Fresh rhizome and fronds paste is used in insect bites or getting relief in centipede bite (Gond *et al.*, 2014) [11]. Whole plant is used in eczema and scabies (Singh & Upadhyay 2014) [14]. Leaves are used as anthelmintic, decoction is used

against asthma and bronchitis, decoction of rhizome is given in stomachache of children (Shaikh *et al.* 2014) [13]. In Konkan (Maharashtra) rhizomes are called as 'Katemuli' and used in pediatric diseases.

Material and Methods

The samples of *Tectaria gemmifera* (Fee.) Alston were collected from various localities of Maharashtra and identified by using reliable literature (Beddome 1863, 1866, 1883; Manickam & Irudayaraj 1992; Blatter & d' Almeida 1922) [1, 12, 8]. The herbarium specimen deposited in VH Herbarium, department of Botany, Vivekanand Arts, Sardar Dalipsingh Commerce and Science College, Samarth Nagar, Aurangabad. The plant materials were shade dried and used for further analysis.

Preparation of crude extracts

Powder samples of dried rhizome and leaf were extracted in a Soxhlet apparatus by using acetone as solvent, extracted at about 55^o C for 18-24 hrs or till sample become colourless. Prepared extracts were stored in amber coloured bottle for the further study.

Test microorganisms

The authentic culture of human pathogenic gram negative and gram positive bacteria viz. *Shigella flexneri* (NCIM-5265), *Salmonella typhi* (NCIM-2501), *Pseudomonas aeruginosa* (NCIM-5029), *Staphylococcus aureus* (NCIM-5021) and *E. coli* (NCIM - 2931) were obtained from the department of Microbiology, Vivekanand Arts, Sardar Dalipsingh Commerce & Science College, Samarth Nagar, Aurangabad, Maharashtra.

Antibacterial Assay

96-well plates method

About 100µl sterile Nutrient broths was added onto each well along with 2µl serial diluted human pathogenic bacteria suspension in each well. Different concentrations of rhizome and leaf extracts, viz. 2, 4, 6, 8 and 10µl were loaded in each well. Control was prepared by nutrient broth and bacterial suspension without adding plant extract. The prepared 96-well plate was sealed with parafilm and incubated at 37°C for 24 hours in incubator. Finally, the optical density was measured at 540 nm on the spectrophotometer.

Phytochemical study

The methods of (Singh *et al.*, 2015; Rao *et al.*, 2016) were adopted for the preliminary detection of various phytochemical constituents of rhizome and leaf extract of

Tectaria gemmifera (Fee.) Alston.

Results and Discussion

The acetone leaf extract of *Tectaria gemmifera* (Fee.) Alston., in different concentrations were tested against human pathogenic bacteria, it was cleared from the results, that maximum inhibition and minimum inhibitory concentration (MIC) of *S. flexneri* and *P. aeruginosa* (2 µl) whereas *S. typhi* and *E. coli* shown the maximum inhibition at (2,6 and 8 µl) whereas in case of *S. arueus* it was 10 µl (table 1). The acetone rhizome extract of *Tectaria gemmifera* (Fee.) Alston, shown maximum inhibition and minimum inhibitory concentration (MIC) of *S. flexneri* and *P. aeruginosa* (2 µl) whereas *S. typhi* (6 µl), *E. coli* (8 µl) whereas in case of *S. arueus* it was 10 µl (table 2).

Table 1: Antibacterial activity of *Tectaria gemmifera* (Fee.) Alston. leaf against human pathogens

S. No	<i>T. gemmifera</i> leaf (conc. µl)	Pathogenic Bacteria (2µl)				
		<i>S. flexneri</i>	<i>S. typhi</i>	<i>P. aeruginosa</i>	<i>E. coli</i>	<i>S. arueus</i>
1	2 µl	0.04	0.01	0.01	0.01	0.05
2	4 µl	0.05	0.03	0.03	0.01	0.04
3	6 µl	0.06	0.01	0.05	0.02	0.05
4	8 µl	0.06	0.01	0.07	0.01	0.04
5	10 µl	0.07	0.02	0.05	0.04	0.03
	MIC	2 µl	2, 6, 8 µl	2 µl	2, 6, 8 µl	10 µl

Table 2: Antibacterial activity of *Tectaria gemmifera* (Fee.) Alston. rhizome against human pathogens

S. No	<i>T. gemmifera</i> rhizome (conc. µl)	Pathogenic Bacteria (2µl)				
		<i>S. flexneri</i>	<i>S. typhi</i>	<i>P. aeruginosa</i>	<i>E. coli</i>	<i>S. arueus</i>
1	2 µl	0.15	0.22	0.14	0.16	0.19
2	4 µl	0.19	0.16	0.22	0.20	0.22
3	6 µl	0.22	0.13	0.18	0.20	0.21
4	8 µl	0.26	0.26	0.21	0.09	0.24
5	10 µl	0.28	0.31	0.24	0.22	0.16
	MIC	2 µl	6 µl	2 µl	8 µl	10 µl

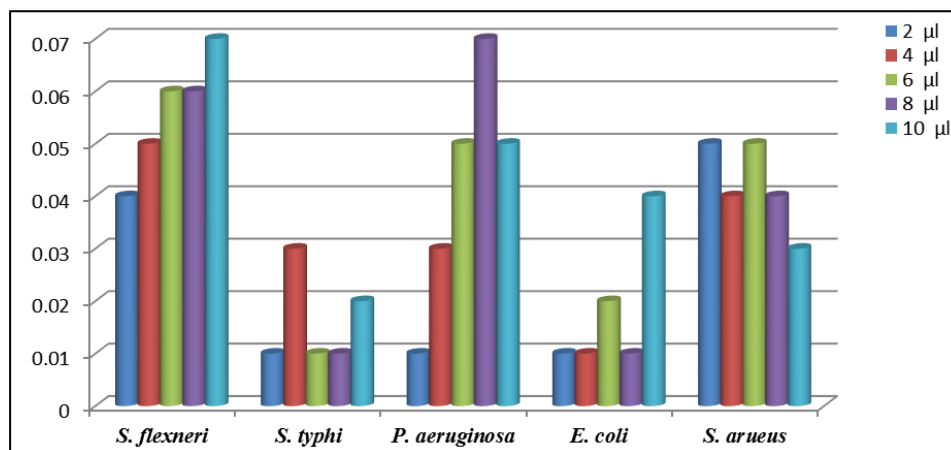


Fig 1: Antibacterial activity of *Tectaria gemmifera* (Fee.) Alston. leaf against human pathogens

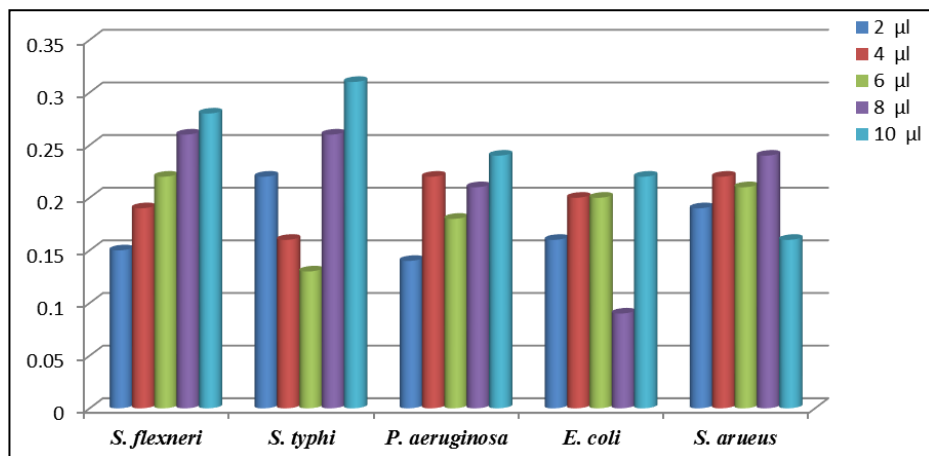


Fig 2: Antibacterial activity of *Tectaria gemmifera* (Fee.) Alston. rhizome against human pathogens

Quantitative chemical parameters

Different phytochemical tests were carried out for the detection of various secondary metabolites and results were tabulated (Table 3).

Table 3: Phytochemical test of the rhizome and leaf extract of *Tectaria gemmifera* (Fee.) Alston.

S. No.	Phytoconstituents	Rhizome extract	Leaf extract
1	Amino Acid	--	--
2	Steroid	++	--
3	Glycoside	++	--
4	Flavonoid	++	--
5	Tannin	++	--
6	Alkaloid	--	--
7	Phenol	++	--
8	Terpenoids	++	--
9	Phytosterol	++	--
10	Saponin	++	--

++ Presence, -- Absence



Fig 3: *Tectaria gemmifera* (Fee.) Alston.

Conclusion

The rhizome and leaf extract of *Tectaria gemmifera* (Fee.) Alston have potential antibacterial properties against various human pathogenic bacteria and it may be due to the presence of different kinds of secondary metabolites. Phytochemical properties have immense value in the medicine. The obtained results are the basis for selection of *Tectaria gemmifera* for further investigation in the potential discovery of new herbal bioactive compounds which may leads to find out a novel drug.

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