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Research Article

Antibacterial activity of *Athyrium pectinatum* (Wall.) Presl.

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Abstract

Aqueous and alcoholic extracts of plant parts of ***Athyrium pectinatum* (Wall.) Presl.** were tested against the growth of some human and plant pathogenic bacteria like, *Agrobacterium tumefaciens, Escherichia coli, Salmonella arizonae, Salmonella typhi* and *Staphylococcus aureus*. Nearly all the extracts were found effective against these bacteria. The positive results so obtained were compared with that of the reference standard antibiotic (Tetracycline). It was found that extracts when mixed in equal proportion with the antibiotic were more effective against bacteria than the antibiotic alone.

Keywords: Antibacterial activity, *Athyrium pectinatum*, Ferns, Pteridophytes.

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Introduction

Pteridophytes (fern and fern allies) by virtue of their possessing great variety and fascinating foliage have drawn the attention and admiration of horticulturists and plant lovers for centuries. About 191 genera and more than 1000 species of pteridophytes are reported from India[1]. Medicinal value of them is known to man for more than 2000 years. Sushruta and Charaka (ca. 100 A.D.) mentioned medicinal uses of ***Marsilea minuta* Linn.** and ***Adiantum capillus-veneris* Linn.** in their Samhitas.

Sharma and Vyas[2] studied ethnobotanical aspects of various pteridophytes of Rajasthan. They found that tribal people use various species of ***Athyrium*** for curing diseases. Gehlot and Bohra[3] studied antibacterial activities of leaf extracts of some ferns from Pachmarhi hills. Kaushik and Dhiman[4] conducted ethnobotanical studies of some common medicinal pteridophytes. Antibacterial and antifungal activities of various species of pteridophytes against various human pathogenic organisms were studied by the authors[5-8]. The screening and scientific evaluation of plant extract for their antimicrobial substance may prove beneficial for the mankind. Further, synergistic interaction among crude extracts or phytoconstituents *in vitro* may be useful in the preparation of improved polyherbal or drugs formulations. In the present investigation an attempt has been made to test *in vitro* antibacterial activity of ***Athyrium pectinatum*** found in Rajasthan against some human and plant pathogenic bacteria like, *Agrobacterium tumefaciens, Escherichia coli, Salmonella arizonae, Salmonella typhi* and *Staphylococcus aureus*.

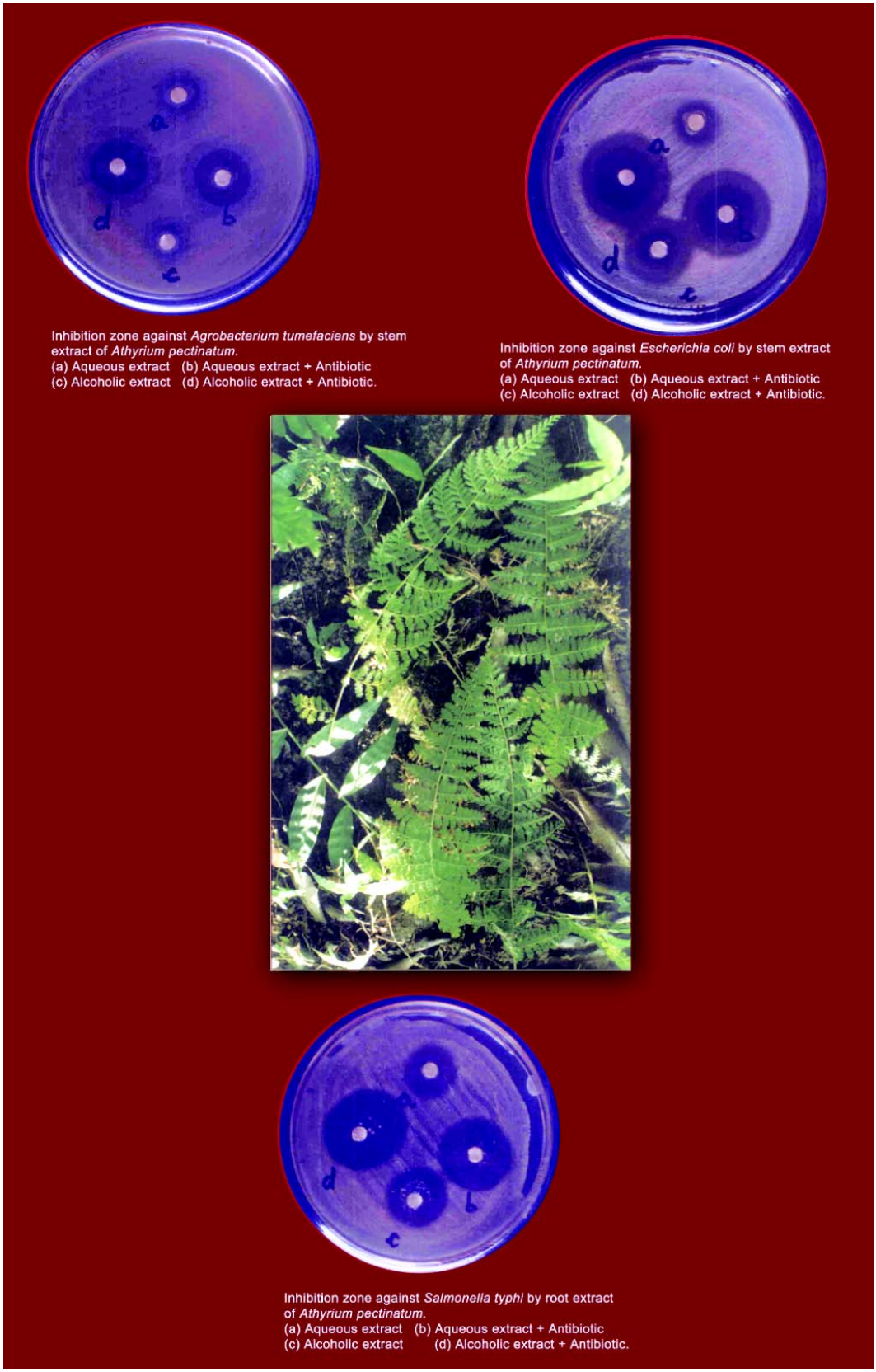
***Athyrium pectinatum* (Wall.) Presl.** (Family — *Athyriaceae*) has creeping and branched rhizome; scales brown, lanceolate and up to 7 to 15 mm in length; stipes fragile, straw coloured, 10-35 cm long, lamina variable, broadly lanceolate to sub-deltoid with acuminate apex, decompoundly pinnate and finely dissected, pinnae stalked, distantly placed, 6-15 × 2-4.5 cm ascending with slender, naked, greenish rachides, pinnules, up to 15 × 6 mm, sub-deltoid, cut down into ultimate oblong, narrow segments with dentate margin, secondary rachides minutely pubescent, veins forked; sori minute, indusium thin, membranous; spores dark brown.

The plant is common in Mt. Abu area and is frequently used by the Bheels for medicinal purpose. The young leaves are used as vegetable. The rhizome is considered as a strong anthelmintic[2].

Materials and Methods

Collection and identification of plants

The specimens of plant were collected from Mt. Abu in Rajasthan during the month of August 2001 and their identity was confirmed through literature available in the Department of Botany, J.N. Vyas University, Jodhpur.



Inhibition zone against *Agrobacterium tumefaciens* by stem extract of *Athyrium pectinatum*.
(a) Aqueous extract (b) Aqueous extract + Antibiotic
(c) Alcoholic extract (d) Alcoholic extract + Antibiotic.

Inhibition zone against *Escherichia coli* by stem extract of *Athyrium pectinatum*.
(a) Aqueous extract (b) Aqueous extract + Antibiotic
(c) Alcoholic extract (d) Alcoholic extract + Antibiotic.

Inhibition zone against *Salmonella typhi* by root extract of *Athyrium pectinatum*.
(a) Aqueous extract (b) Aqueous extract + Antibiotic
(c) Alcoholic extract (d) Alcoholic extract + Antibiotic.

Preparation of plant extracts

Fresh plant parts (5 g) were washed 2-3 times with tap water and distilled water and then surface sterilized with 90% alcohol. Subsequently, the plant materials were grounded in 50 ml of distilled water and alcohol separately for aqueous and alcoholic extracts, respectively. The alcoholic macerates were kept for 24 hours at room temperature to evaporate the alcohol. In the remaining residue, 50 ml of distilled water was added. Macerates were squeezed through double-layered muslin cloth and filtered through filter paper. After filtration, aliquot was centrifuged at 10,000 rpm for 20 minutes. The supernatants were filtered through Whatman No. 1 filter paper and then sterilized by passing through 0.2-micron disposable filters. The extracts (10%) thus obtained were used for the *in vitro* studies[9].

Antibacterial activity of plant extracts

The bacterial cultures were obtained from the Institute of Microbial Technology (IMTECH), Chandigarh, India and maintained on a nutrient agar. The disc diffusion method[10]

was used for testing antibacterial activity. The media (25ml) inoculated with suspension of experimental organism was poured into sterilized petri dishes and left to gel at room temperature. Whatman's No.1 filter paper discs (7mm diam) were soaked in 0.2 ml aqueous and alcoholic extracts as well as a 10-ppm solution of Tetracycline. The filter paper discs were placed equidistantly on inoculated media and diffusion of solution was allowed to occur for 30 minutes at room temperature. Plates were incubated at 37°C for 24 hours. Three plates were employed per treatment and the average zone of inhibition was recorded. Extracts were also mixed in equal proportions of antibiotic and tested against the test organisms.

Results and Discussion

Table 1 reveals the antibacterial activity of ***A. pectinatum***. The rhizome and roots extracts inhibited the microorganism growth whereas the leaves extract did not show any inhibition except *Salmonella arizonae*. It was observed that root extract + antibiotic showed maximum inhibition against *Agrobacterium tumefaciens* than the reference standard antibiotic alone. The leaves and roots extracts did not show any inhibition against *E. coli* and the rhizome and root extracts against *S. arizonae.* The aqueous extract of root + antibiotic has shown higher inhibition against *Staphylococcus aureus* than the antibiotic alone. The rhizome extracts were found to be more effective than antibiotic.

Table 1 : Antibacterial activity of plant part extracts of *Athyrium pectinatum* by disc diffusion method

Plant Parts	Extracts		Diameter of Inhibition Zone (in mm)				
			Agrobacterium tumefaciens	*Escherichia coli*	*Salmonella arizonae*	*Salmonella typhi*	*Staphylococcus aureus*
Leaves	Extract	Aqueous	00	00	09	00	00
		Alcoholic	00	00	09	00	00
	Extract + Antibiotic	Aqueous	23	16	21	23	23
		Alcoholic	19	17	19	22	21
Rhizome	Extract	Aqueous	11	13	00	09	08
		Alcoholic	08	15	00	11	10
	Extract + Antibiotic	Aqueous	22	18	18	24	23*
		Alcoholic	24	19	18	25	23*
Roots	Extract	Aqueous	07	00	00	15	12
		Alcoholic	09	00	00	18	13
	Extract + Antibiotic	Aqueous	25*	17	20	26	25*
		Alcoholic	26*	17	19	23	23*
Reference standard antibiotic (Tetracycline)			**24**	**21**	**23**	**40**	**22**

Controls:
Inhibition Zone against the bacteria by distilled water = 0 mm
Inhibition Zone against the bacteria by alcohol = 0 mm
*More effective than standard antibiotic (Tetracycline)

Conclusion

It is concluded that antibacterial activity of ***A. pectinatum*** and its active constituents would be helpful in treating various kinds of diseases. Crude extracts and their interactions with different active fractions of the plants are needed to explore the exact mechanism of the interaction among the active phyto-constituents. Similarly, the efficacy of crude extracts or polyherbal preparations needs to be studied *in vitro* to assess their therapeutic utility.

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