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Antibacterial activity of selected species of pteridophytes in Western Ghats

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Abstract

The aim at the present study, preliminary phytochemical identification and antibacterial activity of six rhizomes of *Adiantum capillus*-veneris, *A. lunulatum*, *A. raddianum* Presl., *A. incisum* Forssk., *Christella parasitica* (L.) Holttum, and *Tectaria zeylanica* (Houtt.) Sledge, were investigated by disc diffusion method. The tested bacteria *Aeromonas hydrophila, Bacillus subtilis, Escherichia coli, Staphylococcus aureus* and *Psesudomonas aeruginosa,* were tested and zone of inhibition formation of 24 hrs observed. The selected bacteria are very harmful to fish and human. The results of selected pteridophytes possess better antibacterial properties of all ferns species.

Keywords: Pteridophyte, rhizome, Antibacterial activity, disc diffusion method, phytochemicals

Introduction

Pteridophytes are primitive vascular plants, which is constitutes a significant and important group in the plant kingdom. They are alive in a long geological history on our planet and known from as far back as 380 million years. Fossils of pteridophytes have been obtained from rock strata belonging to Silurian and Devonian periods of the Palaeozoic era. The medicinal purposes of different parts of ferns have been used for more than 2000 years. Theophrastus (372-287 B.C) described in the medicinal values of ferns in his book of Historia Plantarum. Several researchers reported to medicinal uses of ferns (Nayer, 1959; Dhiman,1998; Singh *et al*.,2001; Kumar *et al*.,2003). Kirtikar and Basu (1935) reported that 27 species of ferns used for medicinal purposes. Nair (1959) recorded to 29 medicinal ferns are reported. According to May (1978) published a detailed review the uses of ferns and listed 105 medicinal ferns. Benjamin and Manickam (2007) reported that 61 species of pteridophytes used for medicinal purposes. In the present study, preliminary phytochemical identification and antibacterial activity of the selected rhizomes of *Adiantum capillus*-veneris, *A. lunulatum*, *A. raddianum*, *Adiantum incisum* , *Christella parasitica* and *Tectaria zeylanica* were investigated.

Materials and Methods

Collection of Plant Materials

The rhizomes of *A. capillus*-veneris, *A. lunulatum*, *A. raddianum*, *A. incisum*, *C. parasitica* and *T. zeylanica* were collected from Southern Western Ghats of Tirunelveli and Kanyakumari District of Tamilnadu. Fresh rhizomes of selected pteridophytes were cleaned with running tap water and cut into small pieces and shade dried. Then the dried rhizomes were ground into fine powder and preserved in the air tight containers.

Extracts preparation

Powdered materials of rhizomes were extracted with acetone in a Soxhlet apparatus for 5hrs. These extracts were evaporated under reduced pressure. Obtained the crude extracts were further analysis of phytochemical analysis and antibacterial activity.

Phytochemical Analysis

The extracts analyzed for identification of active compounds of alkaloid, terpenoid, flavonoid, tannin and saponin (Sofowora, 1993; Harborne, 1973).

Table-1: Preliminary phytochemicals and antibacterial activity of selected pteridophyte species

Sl. No.	Pteridophytes	Family
1	*Tectaria zeylanica* (Houtt.) Sledge	Dryopteridaceae
2	*Christella parasitica* (L.) Holttum	Thelypteridaceae
3	*Adiantum capillus-veneris* L.	Pteridaceae
4	*Adiantum lunulatum* Burm. f.	Pteridaceae
5	*Adiantum raddianum* C. Presl	Pteridaceae
6	*Adiantum incisum* Forssk	Pteridaceae

Antibacterial assay

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The tested bacteria, *Psesudomonas aeruginosa, Bacillus subtilis, Escherichia coli, Staphylococcus aureus* and *Aeromonas hydrophila* were procured from the Institute of Microbial Technology (IMTECH), India. Antibacterial activity of all extracts done by disc diffusion method (Bauer *et al*., 1966). The bacterial cultures were grown into nutrient broth medium at 37°C. After 12hrs of growth of selected bacteria was evenly swapped on the Nutrient Agar Medium. Dried and sterilized filter paper discs (6 mm diameter) were then impregnated with 25µL were placed on surface of each inoculated plate. known amounts of the test substances using micropipette. Discs containing the test materials were placed on nutrient agar medium uniformly seeded with the test microorganisms. Standard antibiotic discs and blank discs (impregnated with solvents) were used as a positive and negative control. These plates were then kept at room temperature for 24hr. There was a gradual change in concentration of the media surrounding discs. The plates were then incubated at 37ºC for 24 h to allow maximum growth of the bacteria. The test materials having antibacterial activity inhibited the growth of the bacteria and a clear, distinct zone of inhibition was visualized surrounding the medium. The antibacterial activity of the test agent was determined by measuring the diameter of zone of inhibition expressed in millimeter. The experiment was carried out three times and the results were the mean of three replicate.

Results and Discussion

Table-2: Phytochemicals constituents of rhizome of selected pteridophytes

Sl.No.	Pteridophytes	Active Compounds				
		Alkaloids	Flovonids	Terpenoids	Saponin	Tannin
1	*T. zeylanica*	+	++	+	-	+++
2	*C. parasitica*	+	+	+	-	+++
3	*A. capillus-veneris*	+	+++	+	-	+++
4	A. lunulatum	+	+++	+	-	+++
5	*A. raddianum*	+	+++	+	-	+++
6	*A. incisum*	+	+	+	+	+++

Table-3: Antibacterial activity of rhizome of some pteridophytes

Sl. No.	Pteridophytes	Zone of Inhibition (mm)				
		P. aeruginosa	*B. subtilis*	*E. coli*	*S. aureus*	*A. hydrophila*
1	*T. zeylanica*	14	16	16	15	12
2	*C. parasitica*	11	8	9	12	11
3	*A. capillus-veneris*	14	18	17	18	17
4	A. lunulatum	12	12	11	13	15
5	*A. raddianum*	9	13	11	8	8
6	*A. incisum*	13	11	15	9	18

The present study observed that preliminary identification of phytochemical constituents of rhizomes given in the table-1. Alkaloids, terpenoids, flavonoids, and tannins were present in the *T. zeylanica, C. parasitica, A. capillus-veneris, A. lunulatum, A. raddianum* and *A. incisum* Forssk were observed while, saponin did not observed. According to Okwu, (2005) reported that active constituents of alkaloids, essential oils, glycosides, mucilage, gums, saponins and tannins were used for medicinal purposes. Earlier studies, the medicinal properties of herbal plants have been documented in ancient Indian literature and the preparations methods (Kirtikar and Basu, 1935). Previously, analysis of phytochemical studies on several ferns of *B. orientale, C. thalictroides, D. heterophyllum, D. linearis, H. arifolia, L. ensifolia, N. multiflora, P. calomelanos, P. confusa* and *D. quercifolia* (Mithraja *et al*., 2012).

Results of the antibacterial activity given in the Table-3. Extracts obtained from selected species ferns has active against *Staphylococcus aureus* and *Bacillus subtilis, E. coli* and *Pseudomonas aeruginosa*. Earlier studies, alcoholic extracts obtained from rhizome and roots of *Athyrium pectinatum* active against *Staphylococcus aureus* (Parihar *et al*.,2006). Kathakali Nath *et al*., (2016) reported that rhizomes of *Drynaria quercifolia, Microsorum pteropus,* and *Tectaria variolosa* were observed by good antibacterial activity.

The present study rhizome of *A. capillus* - veneris was active against maximum activity of *B. subtilis* and *Staphylococcus aureus*. Previously, leaf extract of *A. capillus*-veneris L. be used against fever cough and bronchial disorders (Dixit,

1984; Chopra *et al*., 1956; Jain, 1991). According to Ghosh *et al*., (2005) reported that antifungal activity of *A. capillus* - veneris and *A. lunulatum.* In the present study, acetone extract of *A. raddianum* rhizome was minimum active against *S. aureus* and *A. hydphila*. Santhosh Kumar and Nagarajan, (2014) reported that silver nanoparticles whole plant parts of *A. capillus*-veneris L. active against *S. aereus* and *E. coli*. The conclusion of the present study, good antibacterial activity was observed by the selected ferns of *T. zeylanica*, *C. parasitica*, *A. capillus-veneris*, *A. lunulatum*, *A. raddianum* and *A. incisum* Forssk. The active compounds alkaloids, terpenoids, flavonoids and tannin for acted as antibacterial compounds of these selected ferns of Western Ghats.

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