

# Antibacterial potentials of *adiantum* species against the UTI pathogens

## Abstract

The present study was aimed to screen the anti-bacterial properties of medicinally important ferns viz., *Adiantum caudatum* L., *Adiantum latifolium* Lam. and *Adiantum lunulatum* Burm against the selected UTI pathogens. Anti-bacterial study was carried out by disc diffusion method against the pathogens viz., *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus* maximum degree of antibacterial activity was observed in *A. latifolium* followed by *A. caudatum* whereas *A. lunulatum* showed comparatively less degree of antibacterial activity. Further work will accentuate the isolation and characterization of active principles responsible for bio-efficacy.

**Keywords:** bio-efficacy, pteridophytes, phytochemistry

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## Introduction

Ferns are distributed abundantly in various habitats of the world. Globally, the floristic wealth of pteridophytes is recorded with 12,000 species.<sup>1</sup> Like flowering plants, pteridophytes are also used by tribals in India, China, Philippines and other countries of the world for medicinal utility. As folk medicine, the pteridophytes are known to man for more than 2000 years.<sup>2-5</sup> May<sup>6</sup> published a detailed review of the various uses of ferns and listed 105 medicinal ferns. In a recent compilation, Singh<sup>7</sup> reported 160 species of useful pteridophytes in India on the basis of phytochemical, pharmacological and ethnobotanical studies. It has been observed that pteridophytes are not infected by microbial pathogens, which may be one of the important factors for the evolutionary success of pteridophytes and the fact that they survived for more than 350 million years. A systematic survey of the antibiotic activity of pteridophytes has been scarcely undertaken. The antimicrobial potential of some ferns has been studied by previous researchers.<sup>8-15</sup> Khare<sup>16</sup> & Vasudeva<sup>17</sup> discussed the traditional uses of some potential *Adiantum* species for the treatment of various infectious diseases. Because of increasing resistance to antibiotics by many bacteria, plant extracts are of new interest as antiseptics and antimicrobial agents.<sup>18</sup> The whole plants of *A. caudatum* possess antibacterial, hypoglycaemic antispasmodic and antiasthmatic properties. The leaves of *A. caudatum* are used for cough and fever. *A. latifolium* has been used in Latin American traditional medicine as analgesic and anti-inflammatory. Nonato et al.,<sup>19</sup> confirmed the antinociceptive and anti-inflammatory activities of *A. latifolium*. Amrutha Lakshmi,<sup>20</sup> also confirmed the antimicrobial properties of *A. latifolium*. Compounds derived from *A. lunulatum* have been shown antibacterial activity against Gram positive and negative bacteria<sup>21</sup> and anti-fertility on reproductive organs of male albino rats. Parihar & Bohra<sup>22</sup> screened the anti-salmonella activity of three species of *Adiantum* from Rajasthan. Parihar & Parihar<sup>23</sup> examined the antibacterial activity of three species of *Adiantum*. Parihar et al.,<sup>24</sup> studied the anti-bacterial activity of aqueous and ethanolic extracts of thirteen species of pteridophytes. Of which *A. lunulatum*, *A. incisum* and *A. capillus-veneris* are also included. With this knowledge, the present study was undertaken to screen the antibacterial potential of *Adiantum caudatum* L., *Adiantum latifolium* Lam. and *Adiantum lunulatum* Burm against the selected UTI pathogens.

## Materials and methods

Healthy, disease free whole plants of *Adiantum caudatum* L., *Adiantum latifolium* Lam. and *Adiantum lunulatum* Burm were harvested from wild. The whole plants were air and shade dried for two weeks at room temperature (30°C) and pulverized to powder using mechanical grinder. The powdered materials (50 g) were extracted with 300 ml of acetone and methanol (1:6 ratios) using Soxhlet extractor for 8 h at a temperature not exceeding the boiling point of the solvent. The crude extracts were filtered using What-man filter paper (No. 1) and then concentrated in vacuum at 40°C using rotary evaporator. The residues obtained were stored in a freezer until further tests. Anti-bacterial studies were carried out by disc diffusion method<sup>25</sup> against the UTI pathogens viz., *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*. 30 µl = 30 µg (1mg/ml) of crude extracts of selected *Adiantum* species were loaded aseptically on a sterile disc of diameter 5 mm (made from What-man No. 1 filter paper previously sterilized in autoclave). The plant extract loaded discs were placed over the seeded agar plates. The antibiotic amikacin (30 µg/disc) was used as standard for bacteria to compare its effect on test organisms with the plant extracts. The plates were kept at room temperature for 2h to allow diffusion of the test solution into the agar; they were incubated for 24h at 37°C. After the incubation period was over, the plates were observed for zone of inhibition measured in millimeters (mm). The inhibition zone and anti-bacterial activity against the pathogenic bacteria were recorded. The experiments were repeated in triplicates and the results were documented.

## Results

The acetone and methanolic extract of all the selected *Adiantum* species showed the antibacterial activity against three UTI bacterial pathogens with varied frequency (Table 1). The methanolic extracts of selected *Adiantum* species exhibited maximum zone of inhibition against the studied UTI pathogens (Table 1). The methanolic extracts of *A. lunulatum* demonstrated 14.7 ± 0.37 mm zone of inhibition against *S. aureus*. The methanolic extracts of *Adiantum latifolium* displayed the maximum zone of inhibition with 16.2 ± 0.46 mm against *E. coli*, similarly the methanolic extracts of *A. caudatum* illustrated the maximum zone of inhibition (17.4 ± 0.56 mm) against *K. pneumoniae* (Table 1).

**Table 1** Antibacterial activity of *Adiantum* species against pathogenic strains

Microorganisms	Zone of Inhibition in Mm						Amikacin
	<i>Adiantum Caudatum</i>		<i>Adiantum Latifolium</i>		<i>Adiantum Lunulatum</i>		
	Acetone	Methanol	Acetone	Methanol	Acetone	Methanol	
<i>Escherichia coli</i>	9.1 ± 0.67	12.3 ± 0.38	13.9± 0.36	<b>16.2 ± 0.46</b>	7.3 ± 0.21	11.3 ± 0.39	15
<i>Klebsiella pneumoniae</i>	14.2 ± 0.83	<b>17.4 ± 0.56</b>	12.4± 0.34	13.4 ± 0.38	8.4 ± 0.34	12.4 ± 0.42	18
<i>Staphylococcus aureus</i>	9.4 ± 0.42	11.3 ± 0.71	8.7 ± 0.52	13.6 ± 0.47	7.2 ± 0.23	<b>14.7 ± 0.37</b>	22

## Discussion

There are some reports on Phytochemistry and pharmacology of pteridophytes from Western Ghats of Tirunelveli hills, but there is no report on Western Ghats of Kerala.<sup>11,15,26,27</sup> Many naturally occurring compounds found in plants have been shown to possess antimicrobial functions and could serve as a source of both traditional and orthodox medicine.<sup>28</sup> Plant derived natural products such as phenolics, tannins, steroids, saponins etc. have received considerable attention in recent years due to their diverse pharmacological properties including antioxidant and antitumor activity. The degree of antibacterial activity of the selected ferns was as follows: *A. latifolium* > *A. caudatum* > *A. lunulatum*. The antibacterial potentials of the studied three maiden hair ferns may be due to the occurrence of phenolics, tannins, saponins and steroids. The occurrence of metabolites was confirmed by Mithraja et al.,<sup>29</sup> The results of the present study also correlated with the phytochemical observations of Mithraja et al. In the present study, we examined the anti-bacterial activity of *A. caudatum*, *A. latifolium* and *A. lunulatum*. The results of the present study supplemented the previous studies on the bio-efficacy of pteridophytes. Further research on these plants was recommended to quantify the concentration of active compounds. It will accentuate the isolation and characterization of active principles responsible for bio-efficacy and bioactivity.

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## Conflicts of interest

None.

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