In vitro Antibacterial Activity of Ethanolic Extract of *Equisetum arvense* L

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Abstract
The ethanolic extract of stem from *Equisetum arvense* L was analyzed to find out the antibacterial activity against two Gram positive (*Bacillus subtilis* and *Micrococcus luteus*) and four Gram negative (*Vibrio cholerae*, *Escherichia coli*, *Shigella flexneri* and *Shigella dysenteriae*) bacteria. The antibacterial activity (measured by zone of inhibition) for the extract increased with the increasing concentration of the extract. *E. coli* showed maximum sensitivity (inhibition zone 32 mm) among all the bacteria studied. Both Gram positive and Gram negative bacteria were found to be sensitive indicating the broad spectrum activity of the extract. *Shigella dysenteriae* and *Vibrio cholerae* were insensitive to the extract. Preliminary phytochemical screening indicated the presence of phenolics, tannins, glycosides, alkaloids, saponins, terpenoids and flavonoids.

Keywords: Antibacterial activity, *Equisetum arvense*, phytochemicals, ethanolic extract

Introduction
In recent times there is a growing interest in the pharmacological evaluation of various plants used in Indian traditional system of medicine. A mixture of different chemical compounds are present in medicinal plants which may act individually, additively or synergistically for the improvement of health. Interest in medicinal plants with antibacterial properties has revived due to several problems associated with the use of antibiotics. As a result new prototype antibacterial agents are required to address this scenario.

*Equisetum arvense* (Equisetaceae) is a well-known and wide-spread pteridophyte distributed throughout the northern hemisphere. It is commonly known as horsetail which is an herbal remedy dating back to at least ancient Roman and Greek medicine. It was used traditionally to stop bleeding, heal ulcers and wounds and treat tuberculosis and kidney problems. It is also used for the treatment of osteoporosis, as a diuretic. Therapeutic use of *Equisetum* preparations are related to the reputed aquaretic and antihaemorrhagic properties of the plant. Field horstail contains sterols, ascorbic acids, silicic acid, phenolic acid and flavonoids.

With respect to this, the antibacterial activity of ethanolic extract of *Equisetum arvense* stems has been investigated in the present study.

Material and methods

Plant material
The stems of *Equisetum arvense* were collected in the month of October, 2010 from Darjeeling, West Bengal, India and authenticated by Prof. G. G. Maiti, Taxonomy and Biosystematics laboratory, Department of Botany, University of Kalyani. A voucher specimen (ESNS 17) was deposited in the herbarium of the department.

Extraction procedure
Stems of the plant was thoroughly washed and dried under shade at the room temperature. The dried material was powdered in an electric grinder.

The 500g of powder were successively extracted with ethanol in a soxhlet extractor. The ethanolic extract was dried under vacuum in a rotary evaporator. The extract obtained was stored in refrigerator for further use.

Bacteria used
Two Gram positive (*Bacillus subtilis* and *Micrococcus luteus*) and four Gram negative (*Vibrio cholerae*, *Escherichia coli*, *Shigella flexneri* and *Shigella dysenteriae*) bacteria, procured from ID and BG hospitals, Kolkata,
were used in this investigation. All bacterial strains were maintained and preserved on Mueller Hinton agar slant throughout the antibacterial study.

**Screening of antibacterial activity**

*In vitro* antibacterial tests of selected bacteria were carried out using agar well diffusion method. The different concentrations of ethnolic extracts (50, 100, 200 and 400 µg/ml) were made using Dimethyl sulphoxide (DMSO) which was poured into the respective wells and incubated at 37°C for 24h. Ampicillin (10 µg) was used as a positive Control

**Phytochemical screening**

This was done following the standard methodologies. The extracts were screened for glycosides, alkaloids, Sugars, saponins, Resins, phenols, tannins, terpenoids and flavonoids.

**Results and discussion**

**Antibacterial activity**

The result of antibacterial activity of *Equisetum arvense* ethanolic extract of stem is presented in table 1. Out of six bacterial species four were found to be very sensitive to plant extract at all concentrations. The mean zone of inhibition for the extract against Gram positive and Gram negative bacteria increased with the increasing concentration of the extract. The highest mean zone of inhibition (32mm) was recorded against *Escherichia coli*. The control (5% dimethyl sulfoxide) did not produce any zone of inhibition whereas the positive control ampicillin produced the zone of inhibition. Gram positive and Gram negative bacteria both were found to be sensitive indicating the broad spectrum activity of the etract. *Shigella dysenteriae* and *Vibrio cholerae* were found to be insensitive to the extract.

**Phytochemical screening**

The presence of phenolics, tannins, terpenoids, alkaloids and flavonoids of ethanolic extract of stem of *Equisetum arvense* was analyzed and tabulated in Table 2. The presence of wide variety of secondary metabolites such as tannins, terpenoids, alkaloids, flavonoids etc. contribute to the antimicrobial efficacy of plant species. In view of the fact that since *E. arvense* stem possesses good phenolics, tannins and flavonoid content, it could be presumed that it might have an antibacterial activity.

**Conclusion**

*Equisetum arvense* showed a potent antibacterial activity against a large number of pathogenic Gram positive and Gram negative bacteria and may be used as accessible source of natural drug. Extensive research in the area of isolation and characterization of the active principles of this plant is required so that a better, safe and cost effective drugs treating bacterial infections can be developed.

**References**


Table 1: Antibacterial activity of *Equisetum arvense* L

<table>
<thead>
<tr>
<th>Extract concentration (µg/ml)</th>
<th>Bs</th>
<th>Ml</th>
<th>Ec</th>
<th>Sf</th>
<th>Sd</th>
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Table 2: Phytochemicals of *Equisetum arvense* L

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Glycosides</th>
<th>Alkaloids</th>
<th>Sugar</th>
<th>Saponin</th>
<th>Resin</th>
<th>Phenol</th>
<th>Tannin</th>
<th>Terpenoid</th>
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<td>+</td>
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+ indicates absence or presence of positive reactions, - indicates negative reactions.