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A study on antimicrobial activity of *Bacopa monnieri* Linn. aerial parts

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Abstract

Objective: To study the antimicrobial activity of the ethanolic extract of aerial parts of *Bacopa monnieri* Linn. Materials and methods: Minimum inhibitory concentration of the extract was performed by broth dilution method and the zone of inhibition was studied by agar disc diffusion method at concentrations of 2, 5 and 10 mg/ml in DMSO. Ciprofloxacin (5 µg/ml) and Cotrimazole (25 µg/ml) were used as reference controls for the antibacterial and antifungal studies respectively. Results: The results of MIC study revealed the antimicrobial activity of the extract against the tested strains of microorganisms between concentration ranges of 50 and 400 µg/ml. The results of zone of inhibition study revealed concentration dependant nature of the extract with better effectiveness against gram-positive bacteria than gram-negative bacteria. Conclusion: The present study indicates the potential usefulness of *B. monnieri* aerial parts in the treatment of various pathogenic diseases as mentioned in the Ayurvedic literature.

Key words: *Bacopa monnieri* Linn., Antibacterial activity, Antifungal activity, Minimum inhibitory concentration, Zone of inhibition.

1. Introduction

Bacopa monnieri Linn. (Fam-Scrophulariaceae), popularly known as Brahmi, is a creeping, glabrous, succulent herb, rooting at nodes, distributed throughout India in plains, ascending to an altitude of 1,320 m. [1] In Ayurveda, *Bacopa monnieri* has been reported to be used in the treatment of insanity, epilepsy, asthma and skin diseases [2].

Its popular use is however attributed to its memory enhancing property. The plant is also reported to possess sedative [3], antiepileptic [4], vasoconstrictor [5], anti-inflammatory [6] and anthelmintic [7] activities. Presence of tetracyclic triterpenoid saponins, bacosides A and B [8], hersaponin [9], alkaloids *viz*. herpestine and brahmine and some flavonoids [10] have been reported earlier. In the present study, we report the antimicrobial activity of ethanol extract of the aerial parts.

2. Materials and Methods

2.1. Plant material

The plant was identified by the taxonomists of Botanical Survey of India, Shibpur, Howrah.

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After authentication, fresh aerial parts were collected in bulk from young matured plants at the rural belt of Salipur during early summer, washed, shade dried and then milled in to coarse powder by a mechanical grinder. The powder was passed through sieve number 40 and used for further studies.

2.2. Preparation of extract

The powdered plant material was defatted with petroleum ether (60-80°C) and then extracted with 95% ethanol using Soxhlet apparatus. The solvent was removed under reduced pressure, which gave a greenish-black coloured sticky residue (yield- 11.6% w/w on dried material basis). The dried extract was then mixed with dimethyl sulfoxide (DMSO) for antimicrobial study. Preliminary phytochemical screening [11] of the extract gave positive tests for presence of saponins, flavonoids and alkaloids.

2.3. Drugs used

Ciprofloxacin and Cotrimazole were used as reference standards for the antibacterial and antifungal studies respectively.

2.4. Microorganisms used

For the present study, the microorganisms used include *Staphylococcus aureus, Bacillus subtilis, Bacillus polymexia, Streptococcus faecalis, Pseudomonas aerugenosa, Salmonella typhi, Vibrio cholerae, Shigella dysenteriae, Escherichia coli, Penicillum notatum and Aspergillus niger respectively*. Suitable strains of these microorganisms were procured from the microbiology laboratory of our institute.

Table.1
MIC (µg/ml) and zone of inhibition (mm) of ethanolic extract of *B. monnieri* aerial parts.

Microorganisms	**MIC (µg/ml)**	**Zone of inhibition (mm)[a]**			
		Extracts (mg/ml)			**Standards[b]**
		2	**5**	**10**	
Gram-positive bacteria					
Staphylococcus aureus ATCC 25923	50	8.7	17.3	18.7	27.3
Bacillus subtilis UC 564	50	9.0	17.7	20.3	25.0
Bacillus polymexia 474	75	7.3	12.0	15.3	22.3
Streptococcus faecalis ATCC 29212	200	8.3	10.7	15.7	26.7
Gram-negative bacteria					
Pseudomonas aerugenosa 25619	400	7.0	10.0	12.7	24.3
Salmonella typhi 57	75	9.0	16.3	18.3	23.3
Vibrio cholerae 824	150	8.7	11.3	15.3	22.3
Shigella dysenteriae ATCC C3	100	7.7	14.0	17.0	25.3
Escherichia coli NCTC 8196	250	8.0	11.7	15.7	21.0
Fungi					
Penicillum notatum ATCC 11625	300	8.0	11.0	14.3	20.3
Aspergillus niger AB 41	225	7.3	12.7	16.3	23.7
Candida albicans ATCC 18804	150	8.7	16.3	20.0	28.3

[a] Values are mean of three readings
[b] Standards: Antibacterial studies- Ciprofloxacin- 5 µg/ml; Antifungal studies- Cotrimazole- 25 µg/ml.

2.5. Antimicrobial Activity

2.5.1. Determination of Minimum inhibitory concentration (MIC)

Minimum inhibitory concentration (MIC) of the extract was performed by broth dilution method [12] at concentrations of the extract ranging from 25 µg/ml to 500 µg/ml in DMSO against all the test microorganisms.

2.5.2. Determination of zone of inhibition

The zone of inhibition of the extract was performed by agar disc diffusion method [13] at concentrations of 2, 5 and 10 mg/ml of the extract in DMSO. Ciprofloxacin (5 µg/ml) and Cotrimazole (25 µg/ml) were used as reference controls for the antibacterial and antifungal studies respectively. Solvent control (only DMSO) was also maintained throughout the experiment.

3. Result and discussion

Table 1 depicts the antimicrobial activity of the ethanolic extract of *B. monnieri* aerial parts. The results of MIC study revealed the antimicrobial activity of the extract against the tested strains of microorganisms between concentration ranges of 50 and 400 µg/ml. The results of zone of inhibition study revealed that the extract possess antimicrobial activity in a concentration dependent manner against the test organisms and was comparable with the standard drugs.

The gram-positive bacteria were observed to be more susceptible than gram-negative bacteria. These observations are more likely to be due to an outer membrane in gram negative bacteria which acts as a barrier to many environmental substances including antibiotics [14]. Among the tested strains of bacteria, the extract was most effective against *B. subtilis* and least against *P. aeruginosa*, which is naturally resistant to antibacterial agents [15].

Our results from the present study indicate the potential usefulness of *B. monnieri* in the treatment of various pathogenic diseases as mentioned in the Ayurvedic literature. Further study regarding the isolation and characterisation of the active constituents responsible for such activity is currently under progress.

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