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Antimicrobial Properties of Ethnomedicinal Plants against Selected Human Pathogens

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Abstract

The aim of the study was to investigate the antimicrobial activity of crude extracts of 18 ethnomedicinal plant used by Nicobarese tribe against three bacterial and one fungal strain. Plants were collected from Traditional Knowledge Practitioners (TKPs) of Car Nicobar Island. The methanol extracts were obtained by cold percolation method and the antimicrobial activity of the extracts was observed by agar well diffusion method. Results also indicated that out of 18 plants, seven plants exhibited antimicrobial activity against one or more tested microorganisms. *M. citrifolia* and *B. rotunda* were most active among the plants tested. This study thus can be further utilized to formulate the new antimicrobial agents to fight against several diseases.

Keywords: Nicobarese; Microorganisms; *M. citrifolia; B. rotunda*

Introduction

Traditional herbal medicines play an important role in the health care systems of many countries. In India, the natives implement various herbs formulation for curing various ailments. The preparation and administration of drugs varies from place to place [1]. An Ethnomedicinal study offers immense opportunities to develop new drugs. Being closer to nature, traditional societies had gained knowledge regarding the use of wild flora and fauna, mostly unknown to the urban, who are away from the natural ecosystem [2].

Nicobarese are still living their customary way of life, especially those in Little Nicobar, Chowra and Teressa Islands, while the life in Nancowry, Kamorta, Katchal, Great Nicobar and Car Nicobar is on the verge of extinction due to modernization [3]. Tribal communities of Andaman and Nicobar Islands, especially the Nicobarese, depend on plant resources to prepare herbal medicines, for food, making household implements, as a sleeping mat and for fire. The former possess a great emporium of ethnobotanical wealth, as they are still isolated from the modern way of life and are still closer to nature [4].

This article reports the results of antimicrobial properties of eighteen medicinal plants elected from previous surveys that was done based on ethnomedicinal practices among the Nicobarese tribes of the Andaman and Nicobar Islands [3,5]. These results are continuation work of bioassay tests for antimicrobial and antimalarial activities medicinal plants of Andaman and Nicobar Islands [6,7].

Materials and Methods

Plant materials

Plants were selected for this study based on their medicinal use and availability to the TKPs during the field survey. Fresh plant parts were collected from the tribal villages of Car Nicobar with the help of TKPs (Table 1).

Microorganisms

The microorganisms used in this study included three bacterial strains and one fungal strain. These were *Proteus mirabilis* (MTCC 425), *Shigella flexneri* (MTCC 1457), *Salmonella enterica typhi* (MTCC 733), and fungal strain *Aspergillus niger* (MTCC 282), which were procured from Microbial Type Culture Collection, Chandigarh, India.

Botanical Name	Family	Part Used
Abutilon indicum (L.) Sweet	Malvaceae	Leaves
Ageratum conyzoides L.	Asteraceae	Leaves
Annona squamosa L.	Annonaceae	Leaves
Boesenbergia rotunda (L.) Mansf.	Zingiberaceae	Rhizome
Cleome viscosa L.	Capparaceae	Leaves
Ganophyllum falcatum Blume.	Sapindaceae	Leaves
Glyptopetalum calocarpum (Kurz.) Prain	Celastraceae	Leaves
Ipomea obscura (L.) Ker.- Gawl.	Convolvulaceae	Leaves
Leea aequata L.	Leeaceae	Leaves
Leea indica (Burm.f.) Merr.	Leeaceae	Leaves
Macranga peltata (Roxb.) Muell.-Arg.	Euphorbiaceae	Leaves
Morinda citrifolia L.	Rubiaceae	Leaves
Moringa oleifera Lam.	Moringaceae	Leaves
Premna corymbosa (Burm.f.) Rottl. et Willd.	Verbenaceae	Leaves
Senna alata (L.) Roxb.	Caesapiniaceae	Leaves
Tabernaemontana crispa Roxb.	Apocynaceae	Leaves
Urena lobata L.	Malvaceae	Leaves
Wedelia biflora (L.) DC.	Asteraceae	Leaves

Table 1: List of ethnomedicinal plants collected for antimicrobial screening.

Extraction of plant materials

The leaves of plants were separately dried under shade, pulverized by a mechanical grinder and passed through 40-mesh sieve to obtain a fine powder. Hundred grams of coarsely powdered dry leaves were extracted by cold percolation method with 95% methanol as solvent, for 72 hours at room temperature. The whole plant extract was collected in a conical flask, filtered and the solvent was evaporated to dryness under reduced pressure in an Evaporator (Eppendroff 5304) at 40-45°C. The residues were stored at 4°C for future use.

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Botanical Name	*P. mirabilis*	*S. flexeneri*	*S. typhi*	*A. niger*
A. indicum	–	–	–	–
A. conyzoides	–	–	–	–
A. squamosa	–	–	–	–
B. rotunda	10.67 ± 1.15	11.00 ± 0.00	16.00 ± 0.00	–
C. viscosa	–	–	–	–
G. falcatum	–		–	–
G. calocarpum	–	11.67 ± 0.58	15.33 ± 0.58	–
I. obscura	–	–	–	–
L. aequata	–	–	–	–
L. indica	–	–	–	–
M. peltata	–	–	–	–
M. citrifolia	14.00 ± 1.00	16.00 ± 1.00	23.00 ± 1.00	–
M. oleifera	–	–	11.67 ± 0.58	–
P. corymbosa	11.33 ± 0.58	10.33 ± 0.58	–	–
S. alata	–	–	–	12.67 ± 0.58
T. crispa	–	–	–	–
U. lobata	–		13.00 ± 1.00	–
W. biflora	–	–	–	–
Gentamycin	12.67 ± 0.58	19.67 ± 1.53	15.33 ± 1.15	–
Nystatin	–	–	–	21.33 ± 1.53
'–' indicates No activity.				

Table 2: Antimicrobial activities of the selected ethnomedicinal plants.

Antimicrobial susceptibility

The agar well diffusion method was used to screen the antimicrobial activity [8]. The Mueller Hinton Agar plates and Saboard Dextrose Agar were prepared by pouring 15 ml of molten media into sterile petriplates for bacterial and fungal strains respectively. The plates were allowed to solidify for 5 minutes. To this 0.1% inoculum suspension was swabbed uniformly, and allowed to dry for 5 minutes. Wells were dug in agar plates with the help of sterile metallic borer (diameter=8 mm). 50 µl of various extracts were poured into the wells which were marked previously and kept for incubation at 37°C aerobically for 18 h bacteria and 48 h for fungi. At the end of incubation period, inhibition zones formed around the disc were measured in millimeter, using a transparent scale. Data are expressed as the means ± SEM.

Results

In the assay against four pathogenic microorganisms, 7 plants extracts showed antimicrobial activity by inhibiting one or more microorganisms. Among the plants screened, *M. citrifolia*, and *B. rotunda* showed promising activity against tested microorganisms (Table 2).

M. citrifolia, B. rotunda and *G. calocarpum* produced largest zones of inhibition against *S. typhi* and *S. flexeneri*. The most sensitive bacterium was *S. typhi* which was inhibited by methanol extract of five plants followed by *S. flexeneri* and *P. mirabilis*.

Methanol extracts of *G. calocarpum, M. oleifera, P. corymbosa* and *U. lobata,* also showed anti-bacterial activity. Only the methanol extract of leaves of *S. alata* showed antifungal activity but no activity against bacterial strains used in the study.

Discussion

Research reports clearly indicate that the *M. citrifolia* plant has antitubercular effect, anti-cancer properties, anti-oxidant properties, anti-inflammatory activity, antidiabetic activity etc. [9]. *B. rotunda* used in Nicobarese traditional medicine for the treatment of stomachache, diarrhoea and fever. It is also reported the presence of polyphenols constituents, antioxidants and anticancer activities [10,11].

Antibacterial activity of *G. calocarpum* is reported for the first time. No previous report on the antibacterial activity of this plant could be found in the literature.

Senna alata showed antifungal activity against *A. niger*. In the previous findings roots and the leaves of *S. alata* showed a range of activity against several bacteria and fungi. In this study methanol extract of leaves of *S. alata* showed only antifungal activity and no activity against bacterial strains used in the study.

The results indicate that scientific studies carried out on medicinal plants having traditional claims of effectiveness might warrant fruitful results. Several plants exhibit some degree of antimicrobial activity towards the human pathogens used in the study. Phytochemical studies are required to determine the types of compounds responsible for the antibacterial effects of these species.

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