

Vibriocidal Activity of Selected Medicinal Plants Used by Nicobarese Tribe of Andaman and Nicobar Islands, India

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Abstract: The aim of the study was to investigate the vibriocidal activity of crude extracts of 18 ethnomedicinal plants used by Nicobarese tribe. Plants were collected from the villages of Car Nicobar Island with the help of TKPs (traditional knowledge practitioners). The methanol extracts were obtained by cold percolation method and the antimicrobial activity of the extracts was observed by agar well diffusion method. Results indicated that out of 18 plants, seven plants exhibited vibriocidal activity. *Morinda citrifolia*, *Ganophyllum falcatum* and *Leea aequata* were most active among the plants tested. This study thus can be further utilized to formulate the new antimicrobial agents to fight against *Vibrio cholerae*.

Key words: Nicobarese, TKPs (traditional knowledge practitioners), microorganisms.

1. Introduction

Morbidity and mortality, due to diarrhea, continue to be a major problem among children in many developing countries, including India [1]. Within these areas, *Vibrio cholerae* (*V. cholerae*) followed by *Escherichia coli* are most prevalent bacterial pathogens [2]. *V. cholerae* is the causative agent of cholera, a life-threatening diarrheal disease that cause large pandemics, occur naturally in the environment and cause illness through contaminated food or water [3]. According to WHO (World Health Organization) reports, the annual acute diarrheal cases for *V. cholerae* infection were estimated more than a million people [4].

Systematic screening of plants used in traditional medicines could pave the way for the discovery of novel and effective compounds [5]. In the contemporary, alarming incidence of multidrug resistant strains of bacteria is being frequently noticed, and quite recently, this phenomenon has been critically analyzed and documented [6]. It indicated the necessity to continue the search for newer compounds to combat

new infections.

The oral tradition is still prevalent among the tribes of India, where local communities in every ecosystem have discovered the medicinal uses of thousands of plants. Precious ancient knowledge of traditional methods is now limited to some of the closed communities particularly the remote tribal populations and is part of their culture, traditional beliefs, patterns of ecological adaptation for maintaining health and preventing disease and injury in its members [7].

Andaman and Nicobar Islands are a home to two distinct racial groups of primitive tribes' viz., Negretoes in the Andaman (Great Andamanese, Onges, Jarawas and Sentinelese) and Mongoloid in the Nicobar (Nicobarese and Shompens). More than 97% of the tribal populations are Nicobarese, settled in different islands of Nicobar district. The Nicobarese are coastal dwellers and enjoy the vicinity of exuberant and verdant tropical forests [8].

Nicobarese are still living their customary way of life, especially those in Little Nicobar, Chowra and Teresa Islands, while the life in Nancowry, Kamorta, Katchal, Great Nicobar and Car Nicobar is on the verge of extinction due to modernization [9]. Tribal

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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.

Previous research articles report the results of a survey that was done based on ethnomedicinal practices among the Nicobarese tribes of the Andaman and Nicobar Islands [9-11], along with a bioassay tests for antimicrobial and antimalarial activities [12, 13]. In the present study, a total of 18 plants were studied to determine and analyze the vibriocidal activity.

2. Materials and Methods

2.1 Plant Material

Plants were selected for this study based on their medicinal use, endemicity and availability to the TKPs during the field survey. Fresh plant parts were collected from the tribal villages of Car Nicobar Island. Table 1 provides the botanical name, family of the plant, local name (Nicobarese language) for 18 ethnomedicinal plants used for the present study.

2.2 Extraction

The leaves of plants were separately dried under shade, pulverized by a mechanical grinder to obtain a fine powder. Coarsely powdered leaves material were extracted by cold percolation method with 95% methanol as solvent, for 72 h at room temperature. Extract was collected, filtered and the solvent was evaporated under reduced pressure in an evaporator at 40-45 °C. The residues were stored at 4 °C for future use.

2.3 Microorganism

The microorganism *Vibrio cholerae* (MTCC (Microbial Type Culture Collection) 3906) used in this study was procured from Microbial Type Culture Collection, Chandigarh, India.

2.4 Antimicrobial Susceptibility

The agar well diffusion method was used to screen the vibriocidal activity [14]. The Mueller Hinton Agar plates were prepared by pouring 15 mL of molten media into sterile petriplates. To this 0.1% inoculum suspension of *V. cholerae* was swabbed uniformly, and allowed to dry for 5 min. Wells were dug in agar plates

Table 1 Ethnomedicinal plants collected for antimicrobial activity [10].

Serial No.	Botanical name	Family	Part used
1	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	Leaves
2	<i>Ageratum conyzoides</i> L.	Asteraceae	Leaves
3	<i>Annona squamosa</i> L.	Annonaceae	Leaves
4	<i>Boesenbergia rotunda</i> (L.) Mansf.	Zingiberaceae	Rhizome
5	<i>Cleome viscosa</i> L.	Capparaceae	Leaves
6	<i>Ganophyllum falcatum</i> Blume.	Sapindaceae	Leaves
7	<i>Glyptopetalum calocarpum</i> (Kurz.) Prain	Celastraceae	Leaves
8	<i>Ipomea obscura</i> (L.) Ker.- Gawl.	Convolvulaceae	Leaves
9	<i>Leea aequata</i> L.	Leeaceae	Leaves
10	<i>Leea indica</i> (Burm.f.) Merr.	Leeaceae	Leaves
11	<i>Macranga peltata</i> (Roxb.) Muell.-Arg.	Euphorbiaceae	Leaves
12	<i>Morinda citrifolia</i> L.	Rubiaceae	Leaves
13	<i>Moringa oleifera</i> Lam.	Moringaceae	Leaves
14	<i>Premna corymbosa</i> (Burm.f.) Rottl. et Willd.	Verbenaceae	Leaves
15	<i>Senna alata</i> (L.) Roxb.	Caesapiniaceae	Leaves
16	<i>Tabernaemontana crispa</i> Roxb.	Apocynaceae	Leaves
17	<i>Urena lobata</i> L.	Malvaceae	Leaves
18	<i>Wedelia biflora</i> (L.) DC.	Asteraceae	Leaves

Table 2 Vibriocidal activity of the ethnomedicinal plants used by Nicobarese in Car Nicobar.

Botanical name	Inhibition zone (mm)	Relative percentage inhibition (%)
<i>A. indicum</i>	10.33 ± 0.58	59.61
<i>A. conyzoides</i>	–	–
<i>A. squamosa</i>	–	–
<i>B. rotunda</i>	–	–
<i>C. viscosa</i>	–	–
<i>G. falcatum</i>	13.67 ± 0.58	78.88
<i>G. calocarpum</i>	13.00 ± 1.00	75.01
<i>I. obscura</i>	–	–
<i>L. aequata</i>	13.33 ± 0.58	76.91
<i>L. indica</i>	–	–
<i>M. peltata</i>	–	–
<i>M. citrifolia</i>	18.00 ± 1.00	103.87
<i>M. oleifera</i>	–	–
<i>P. corymbosa</i>	–	–
<i>S. alata</i>	–	–
<i>T. crispa</i>	–	–
<i>U. lobata</i>	10.00 ± 1.00	57.70
<i>W. biflora</i>	11.67 ± 0.58	67.34
Gentamycin	17.33 ± 0.58	NA

“–” indicates no activity;

NA: not applicable.

with the help of sterile metallic borer (diameter = 6 mm). 50 µL of crude methanol extract of various plants were poured into the wells which were marked previously. The plates were kept for incubation at 37 °C aerobically for 18 h. At the end of incubation period, inhibition zones formed around the disc were measured in millimeter, using a transparent scale.

2.5 Determination of Relative Percentage Inhibition

The relative percentage inhibition of the test extract with respect to positive control was calculated by using the following formula mentioned by Chander et al. [15] with minor modification.

$$\text{Relative percentage inhibition of the test extract} = (X - Y) / (Z - Y) \times 100$$

where:

X: average inhibition zone of the test extract;

Y: average inhibition zone of the solvent;

Z: average inhibition zone of the standard.

3. Results and Discussion

In the assay, seven plant extracts showed vibriocidal

activity against the strain used for the study. Among the plants screened *Mcitrifoli citrifolia*, *Ganophyllum falcatum* and *Leea aequata* were showed promising activity against tested microorganisms relative to standard drugs (Table 2).

The result of vibriocidal activity of crude extracts was compared with the positive control for evaluating their relative percentage inhibition (Table 2). The methanol extract of *M. citrifolia* exhibited maximum relative percentage inhibition (103.87%) followed by *G. falcatum* (78.88%), *L. aequata* (76.91%), *G. calocarpum* (75.01%), respectively.

Recent research reports clearly indicate that the *M. citrifolia* has immune modulatory properties, anti-cancer properties, anti-oxidant properties, anti-inflammatory activity and cardioprotective activity [16-20].

4. Conclusions

Further phytochemical studies are required to determine the bioactive compounds responsible for the vibriocidal activities of these species. The results also

indicate that scientific studies carried out on medicinal plants having traditional claims of effectiveness might warrant fruitful results. These plants could serve as useful sources for new antimicrobial agents.

Conflict of Interest

The authors declare that they have no competing interests.

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