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# Research Paper Antifungal and antibacterial activity of marine sponges from Ratnagiri coast of India

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#### Abstract

Marine sponges have proved to be a rich source of bioactive metabolites with multiple pharmacological properties. In this study, we have investigated the antifungal and <u>antibacterial activities</u> of methanol extracts of *Cliona*, <u>Haliclona</u> *cratera*, *Hyrtios cavernosus*, *Spongia obscura*, *Sarcotragus foetidus*, and <u>Xestospongia</u> *carbonaria* and fractions from *X. carbonaria S. obscura* and *H. cratera*. The antibacterial activity was determined by <u>agar disc diffusion</u> method against clinical gram-positive- <u>Staphylococcus aureus</u>. <u>Bacillus subtilis</u> and gram negative-*Escherichia coli*, <u>Pseudomonas aeruginosa</u> bacteria. The <u>antifungal activity</u> of the extracts and fractions was determined against <u>Candida</u> <u>albicans</u> and <u>Aspergillus niger</u>. *S. obscura*, *X. carbonaria*, *H. cavernosus*, and *H. cratera* exhibited good antibacterial activity against the tested gram-positive bacteria with larger <u>zones of inhibition</u> at 19±6 mm, 19.5±5.5mm, 20±0 mm and 23±0 mm. *S. foetidus* gave good inhibition of gram-negative bacteria at 19±0 mm. They showed moderate antifungal activities against *C. albicans* and *A. niger*. *Cliona*, *H. cratera* and *H. cratera* 

#### Introduction

Antimicrobial Resistance is a growing concern among patients with invasive bacterial and fungal infections of severe form and affects the bloodstream, soft tissues, meninges, heart, brain, eyes, or other parts of the body [23]. The limited number of antimicrobials to treat these conditions with a growing concern of resistant microorganisms has led to worsen the situation. Recently, clinicians observed higher incidences of invasive mycoses in Covid patients. Aspergillosis, candidiasis, mucormycosis, and cryptococcosis were also noticed as co-morbidities in COVID-19 patients. The epidemiological data, from past and recent experiences strongly specify the bacterial, fungal and viral diseases to represent major complications in humans and animals in the immediate future [9]. There is an urgent need for new antimicrobials in pipeline, especially antifungal and antiviral agents and to explore the untapped sources for new discoveries.

Marine sponges belong to the phylum Porifera which are one of the earlier life forms and have been able to survive as marine filters and feeders. They are simple, sessile and porous body invertebrates with a complex and efficient defense mechanisms to protect themselves from predators [21]. A growing interest in novel biomolecules from unexplored sources has led researchers to a wide range of pharmacologically active compounds from marine sponges and from sponge-associated microbes for their antimicrobial activity. These secondary metabolites are understood to be produced by their functional enzyme clusters [13, 19, 26]. The phyla Porifera (mostly sponge) and Coelenterate (mostly coral) have yielded approximately 75% of the novel marine natural compounds until 2008 [17]; marine sponges have contributed to 30% of the total marine natural compounds [14]. Lakwal etal. (2018) identified total 12 marine sponge species belonging to Demospongiae class, 8 orders and 10 families from Ratnagiri coast. They reported greater sponge biodiversity at Alawa and Wayangani sites than Undi. [20]. In our study, we collected marine sponges from these coastal areas, and aim bioprospecting as there is little information on their antibacterial and antifungal potential and bioactive compounds. The study was planned with the main objective to investigate antibacterial and antifungal

activities of methanol extract and its fractionated fractions and further to characterize the type of compounds which might be responsible for the bioactivity.

#### Section snippets

## Collection of sample and identification

Biological samples of *Amphimedon viridus* (Av), *Cliona* (Cl), *Haliclona cratera* (Hc), *Hyrtios cavernosus* (Hyc), *Spongia obscura* (Sob), *Sarcotragus foetidus* (Sf), and *Xestospongia carbonaria* (Xc) (class Demospongiae) were collected in the months of January, March and May 2017 from the Ratnagiri coast of Alawa (GPS coordinates: 17°00′15.2′′ N, 73°16′41.3″ E); Aare-ware (GPS coordinates: 17°05′17.1′′ N, 73°17′10.3′′ E) and Wayangani (GPS coordinates: 16°08′26.0′′ N, 73°27′05.8′′ E) (Fig.1). The...

## Results

The biochemical tests indicated the presence of alkaloids in Cl, Hyc, Sob, Xc and Sf. Steroids were found to be present in Cl, Sob, Hc, and Sf. Terpenoids were found to be present in the January collection samples of Cl, Hyc, Sob and Xc; Sf and Hc samples also exhibited in the May collected samples. The variation in the yield of methanol extract was observed (Table 1) majorly due to the month of collection. January collected samples are of good growth because of better sea water quality in the...

## Discussion

Marine sponges are one of the oldest and prolific producers of anticancer, anti-inflammatory, antimicrobial, anti-thrombotic, antifeedant and anti-HIV compounds [5, 18]. The sponges used in our study have been reported for few antimicrobial compounds earlier. A bioactive metabolite sesterstatin 5 was extracted from sponge *Hyrtios erectus* and inhibited the growth of gram-positive *Micrococcus luteus* [26]. *Haliclona* genus is reported to contain range of bioactive compounds like alkaloids,...

## Supplementary files

GC MS spectra of compounds characterized in sponge's methanol extracts....

## Declaration of Competing Interest

The authors declare that they have no conflicts of interest concerning this article....

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