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Research Article

ANTIBACTERIAL ACTIVITY OF SOME SELECTED SEAWEEDS FROM THE GULF OF MANNAR COAST, SOUTH INDIA

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ABSTRACT

Five different type of seaweeds (*Sargassum wightii, Padina tetrastomatica*, *Caulerpa racemosa, Agardhiella subulata* and *Stoechospermum marginatum*) were collected from the Gulf of Mannar Coast and their antibacterial activities were screened against four pathogens namely *Escherichia coli, Klebsiella pneumonia*, *Salmonella typhi and Vibrio cholerae*. The zone of inhibition ranged between 9.2 – 1mm in methanol extract. The maximum activity (9.2 mm) was recorded from *Agardhiella subulata* and *Stocheospermum marginatum* against *Klebsiella pneumonia* and *Caulerpa racemosa* against *Vibrio cholerae*, while *Sargassum* showed no activity against *E.coli* and *Klebsiella pneumonia* .

Keywords: Seaweeds, antibacterial activity, methanol extracts.

INTRODUCTION

Seaweeds are considered as a source of bioactive compounds with cystostatic, antiviral, antihelminthic, antifungal and antibacterial activities. They have also been used to treat some diseases like cancer, arthritis etc. Seaweeds are the renewable living sources which are also used as food, feed and fertilizer in many parts of the world. They have been screened extensively to isolate life saving drugs or biologically active substances all over the world.

Marine sources are receiving much attention mainly because of the contents of functional ingredients such as polyunsaturated acids, β-carotene and their pigment carotenoids, sulphated polysaccharide and sterol. Among different compounds with functional properties, anti oxidants and antibacterials are mostly widely studied.

Several works have been carried out on the extracts from seaweeds and their extracts were reported to exhibit antibacterial activity. Antimicrobial activities on bacteria and fungi were reported by Hellio *et al*.,(1). Researchers mentioned that the cell extracts and active constituents of various algae have been shown to have antibacterial activity invitro against gram positive and gram negative bacteria. Extracted substances from seaweeds have antibacterial actions.

The present study was designed to study the antibacterial activity of some species of seaweeds collected along the Gulf of Mannar Coast.

MATERIALS AND METHODS

Seaweeds (*Gracilaria edulis, Sargassum wightii, Ulva lactuca*) samples which were healthy and fully grown and submerged underwater from the tidepools were collected from Tuticorin coast. The samples were washed with seawater and freshwater to remove salt, epiphytic microorganisms and other suspended materials. The clean algae were frozen and lycophilized. The dry material was stored at -20°C.

Preparation of extract

Extracts of the freeze dried and powdered biomass were prepared using methanol as solvent using a soxhlet . The resultant crude extracts were filtered and then concentrated in a rotary evaporator at a temperature less than 40°C. The crude extracts were weighed and deep frozen (-20°C) until further use.

Antibacterial activity of seaweeds extracts using Disc Diffusion Method

The bacterial pathogens like *Vibrio cholerae, Salmonella typhii, Escherichia coli* and *Klebsiella pneumonia* were obtained from the Department of Microbiology, Kamaraj College, Tuticorin.

The inoculum was prepared from 24 hours old cultures in nutrient broth. Nutrient agar plates were prepared and the inocula were seeded by spread plating method. Whatman No. 1 filter paper disc of 6 mm diameter were sterilized and saturated with the extracts and air dried before placing on the seeded agar plate. Controls soaked in the same solvent and dried were also run simultaneously. After 24 hours of incubation at 37°C, the inhibition zone from the edge of the disc to the inner margin of the surrounding bacterial growth was measured in mm by using graduated scale and recorded.

RESULT

Marine algae are considered as source of bioactive compounds to produce great variety of secondary metabolites characterized by a broad spectrum of biological activities. In the present study antibacterial activity of different type of seaweeds collected along the Gulf of Mannar were carried out. All the extracts were taken using methanol as solvent.

There was no response when *Sargassum* was tested against *E.coli* and *Klebsiella pneumonia* where as it showed a high activity (4.2 mm) against *Vibrio cholerae*. No activity was found against *Salmonella typhii*.

An increased activity of 5 mm was shown by *Padina tetrastomatica* against *Vibrio cholerae* and its activity reduced gradually against *E.coli, Klebsiella pneumonia* and *Salmonella typhii.*

Table 1 : Showing Antibacterial Activity Of Selected Seaweeds

Seaweeds	E.coli	K.pneumonia	S.typhii	V.cholerae
Sargassum wightii	0 ± 0.9	0 ± 0.3	0 ± 0.7	4.2 ± 1
Padina tetrastomatica	4.2 ± 0.7	3 ± 0.2	2.1 ± 0.4	5.3 ± 1.2
Caulerpa racemosa	1 ± 0.4	0 ± 0.3	0 ± 0.3	9.1 ± 0.9
Agardhiella subulata	3.6 ± 0.7	9.2 ± 0.6	6.1 ± 0.5	5.4 ± 1.3
Stoechospermum marginatum	3.7 ± 0.5	9.2 ± 0.7	5.3 ± 0.5	7.3 ± 0.7

A peak value of 9 mm zone of inhibition was observed against *Vibrio cholerae* with *Caulerpa racemosa* extract, where as it showed no activity against *Klebsiella pneumonia* and *Salmonella typhii*, and a minimum activity was observed against *E.coli*.

The extract of *Agardhiella subulata* showed minimum activity (3.6 mm and 54 mm) against *E.coli* and *Vibrio cholerae* respectively. Maximum activity (9.2 mm) was observed against *Klebsiella pneumonia* and S.typhii.

The methanolic extract of *Stocheospermum* showed good activity against all four pathogens screened. The maximum activity was observed in *K.pneumonia* (9.2 mm) and *Vibrio cholerae* (7.3 mm) while *S.typhii* and *E.coli* showed minimum activity of 5.3 mm and 3.7 mm respectively.

DISCUSSION

Antimicrobial activity depends on both algal species and the solvents used for their extraction. Studies were carried out on antimicrobial activity in different parts of the world by Ely et al.,(2) in India, Freile-Pelegri`n and Morales (3)in Mexico, Tuney *et al*.,(4) in Turkey, Reichelt and Borowitzka(5) in Australia, Mtolera and Semesi (6) in Tanzania and Vlachos *et al*., (7) in South Africa to name a few. They have selected the seaweeds such as *Caulerpa*, *Ulva*, *Laminaria*, *Asparagopsis* etc for their studies. Salvador *et al*.,(8) studied the antibacterial activity of 82 marine algae as fresh and lyophilized forms. Methanolic and Chloroform extracts of *Jania rubens* had significant antimicrobial activity according to Karabay-Yavasoglu *et al*., (9).

Taskin *et al*.,(10) studied the antibacterial activity of methanolic extracts of 6 marine algae, 3 gram positive and 3 gram negative in vitro. They observed a highest inhibition activity by *Corallina officinalis* against *Enterobacter aerogenes*.

Bansemir *et al*.,(11) investigated 26 algal species for their antimicrobial activity by 3 different extracts like dichloromethane, methanol and water. Highest activity was found in dichloromethane extracts.

Seenivasan. *et al*.,(12) performed antibacterial activity studies invitro with 3 extracts namely acetone, methanol and ethanol. They observed that *Ulva fasciata* in selective media produced good results against *E.coli*.

Cox *et al*., (13) screened the antimicrobial activity of 6 species of edible Irish seaweeds. All methanolic extracts of seaweeds inhibited food spoilage and food pathogenic bacteria tested such as *Listeria monocytogenes, Salmonella abony, Enterococcus faecalis* and *Pseudomonas aerogenosa*. They found that dried methanolic extracts of red and green seaweeds had significantly lower antimicrobial activity than brown seaweeds. Red and green seaweed extracts showed significantly high antimicrobial activity with ethanol and acetone.

Highest inhibition zone of 18.1 mm was observed in methanol extract of green algae *Pithophora oedogonia* against gram +ve bacteria *Bacillus subtilis* and *Staphyllococcus aureus* by Anand Praksh Singh and Chaudhary (14).

Our priliminary results suggest that brown seaweed had high antibacterial activity of the 5 seaweeds screened, *Agardhiella* showed high activity against *Klebsiella*. There was no significant difference in the activity when they were analysed statistically (ANOVA – Table 2). So Gulf of Mannar Coast in India is a high potential source of bioactive compounds and their nature and biochemical properties of these antibiotics must be investigated in future.

Table 2 : Showing One-Way Anova Between Seaweeds And Bacterial Pathogens

ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	42.8	3	14.2666667	1.67350929	0.21260363	3.23887152
Within Groups	136.4	16	8.525			
Total	179.2	19				

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