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Antibacterial Properties of Some Marine Algae of Sri Lanka*

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INTRODUCTION

IT has been shown in the past that some of the phytoplanktonic organisms exhibit antibacterial properties. Pratt (1948) reported the presence of an inhibitory substance cholorellin in cultures of *Chlorella vulgaris* and *Chlorella pyrenoidosa*. Similar inhibitory action among fresh water algae is found in the antibiosis observed between *Chlamydomonas* and *Haematococcus* (Proctor 1957). Work carried out by Marcel (1963) indicated that liquid cultures of *Phormidium uncinatum* and *Scenedesmus quadricauda* produced extra cellular growth inhibiting substances. Ramamurthy (1967) made observations on the antibacterial activity exhibited by the marine blue green alga *Trichodesmium erythraeum*. Occurrence of antibiotic substances in the marine macroscopic algae commonly known as sea weeds has been shown by many workers. Pratt (1951), Sieburth and Burkholders (1959), Chesters (1956) have studied the antibiotic properties of several species of sea weeds belonging to Chlorophyceae, Phaeophyceae and Rhodophyceae. Nadal (1965) isolated two antibiotic substances *Sarganin* and *Chonalgin* from sea weeds. *Sarganin* is a broad spectrum antibiotic substance isolated originally from *Sargassum natans*. *Chonalgin* is obtained from *Chondria littoralis*. Several other antibiotic substances have been isolated and their chemical nature have been determined. No previous attempts have been made to investigate the antibiotic properties of algae of Sri Lanka. This paper reports on the observation made on the antibacterial activity of some marine algae growing in waters around Sri Lanka.

Materials and Methods

Eleven marine algae belonging to Chlorophyceae, Phaeophyceae and Rhodophyceae were collected from shore off Colombo and Galle and were tested for their antibiosis. The algal species tested were *Ulva reticulata, Ulva fasciata, Chaetomorpha aerea, Halimeda macroloba, Valoniopsis, pachynema, Padina pavonia, Sargassum cervicone, Gracilaria sp. Sarcodia ceylanica, Laurencia sp.* and *Jania natalensis*. The extracts of these algae were prepared in water, ethanol, benzene and petroleum ethers. 100g. of clean algae were extracted in 250 ml. of the solvent. The filtered extracts were concentrated by vacuum distillation.

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Sterile filter paper disks of 5 mm. diameter were soaked over night in the extracts and were dried at room temperature. Six known type cultures (Table I) and six unknown isolates from the marine environment were tested against the algal extracts. Cultures were grown in medium (Lab. lemco 0·1%, yeast extract 0·2%, peptone 0·5%, NaCl. 0·5% and agar 1·5%) prepared with distilled water for the six known types and with aged sea water for the six unknown isolates from the marine environment. The dried filter paper disks were placed in seeded plates and the inhibition zones, if any, were measured in *mm* distance from the edge of the filter paper disks to the inner margin of the microbial growth after 24-hour incubation at 37°C.

TABLE I

Culture types used as test organisms

Known Types	*Unknown Types*	*Shape*	*Motility*	*Gram reaction*
Peeudomonas pyocyanea	Culture No. 4	rod	—	—
Escherichia coli	Culture No. 6	coccus	—	—
Staphylococcus aureus	Culture No. 7	coccus	—	—
Sarcina lutea	Culture No. 8	coccus	—	—
Bacillus subtilis	Culture No. 9	coccus	—	—
Candida albicans	Culture No.10	rod	—	—

Results

The extent of inhibition and the results for the different algal extracts are given in table II.

DISCUSSION

Table II clearly indicates the existence of antibacterial activity in the algal extracts. Different extracts show varying degrees of antimicrobial activity. Among the algal types *Ulva fasciata* shows considerable degree of antibacterial activity. The ether extract of this alga appears to be very effective against all the culture types. Among the other algal types *Sargassum cervicone* and *Halimeda macroloba* show marked activity. The culture type No. 8 seems to be very susceptible to all the algal extracts. The present study is only a preliminary observation to investigate the antibiotic properties of marine algae of Sri Lanka. Work carried out by Almodovar (1963) indicates that there is seasonal variation in the antibiotic properties of algae. Further detail studies are necessary to determine the seasonal variation in the antibiolic activity of the difierent species of algae and to determine the chemical nature of the extract that causes antibiosis.

TABLE II

Antibacterial activity of different extracts of algae tested against twelve culture types

Algae	Aquous extract												Ethanolic extract											
	C. albicans	E. coli	S. aureus	B. subtilis	S. lutea	P. pyocyanea	Culture No. 10	Culture No. 9	Culture No. 8	Culture No. 7	Culture No. 6	Culture No. 4	C. albicans	E. coli	S. aureus	B. subtilis	S. lutea	P. pyocyanea	Culture No. 10	Culture No. 9	Culture No. 8	Culture No. 7	Culture No. 6	Culture No. 4
Ulva reticulata ..	T	1	T	1	2	2	T	T	N	N	N	N	1	2	N	2	1	1	1	N	T	1	T	1
Ulva fasciata ..	N	1	N	N	T	T	N	N	T	N	1	T	T	2	T	1	N	3	1	T	2	T	1	N
Chaetomorpha aerea	1	4	N	1	N	1	T	T	T	N	N	1	—	—	—	—	—	—	—	—	—	—	—	—
Halimeda macroloba	N	N	N	N	N	T	1	N	N	T	N	N	T	T	1	N	T	T	N	3	T	T	T	N
Valoniopsis pachynema	T	N	T	3	N	2	1	N	N	T	1	1	N	N	1	2	N	1	T	N	2	—	T	T
Padina pavonia	N	T	N	T	N	T	T	N	N	N	N	T	T	T	1	T	T	T	T	1	2	T	T	N
Sargassum cervicone	1	N	T	T	T	N	N	N	N	N	T	T	N	N	T	N	2	T	N	T	3	N	T	1
Gracilaria sp. ..	N	N	N	N	N	3	N	N	N	T	N	T	N	N	1	T	N	T	T	T	T	T	N	T
Sarcodia ceylanica	N	N	T	N	N	3	T	T	N	—	T	—	N	N	N	N	N	N	N	T	N	N	T	—
Laurencia sp. ..	N	4	N	N	2	N	T	T	N	N	N	N	1	4	T	N	N	1	2	3	1	2	3	N
Jania natalensis	N	N	N	N	N	3	T	N	N	T	N	N	N	N	N	T	N	N	N	N	T	N	T	N

Algae	Benzene extract												Petroleum ether extract											
	C. albicans	E. coli	S. aureus	B. subtilis	S. lutea	P. pyocyanea	Culture No. 10	Culture No. 9	Culture No. 8	Culture No. 7	Culture No. 6	Culture No. 4	C. albicans	E. coli	S. aureus	S. subtilis	S. lutea	P. pyocynea	Culture No. 10	Culture No. 9	Culture No. 8	Culture No. 7	Culture No. 6	Culture No. 4
Ulva reticulata ..	T	1	2	T	T	2	1	N	N	T	2	T	T	N	N	N	N	N	T	1	N	N	T	2
Ulva fasciata ..	3	N	3	1	N	2	3	1	5	2	2	3	2	3	2	1	1	1	2	N	3	1	2	2
Chaetomorpha aerea	N	T	1	T	T	N	N	1	T	T	1	N	N	N	1	1	N	N	N	1	T	T	1	T
Halimeda macroloba	1	5	1	2	T	2	N	T	T	N	T	T	2	4	3	T	2	N	N	T	T—	T	T	
Valoniopsis pachynema	1	3	2	1	1	T	T	T	T	T	T	2	1	2	T	T	T	N	T	T	T	T	T	2
Padina pavonia	1	2	N	1	N	1	1	1	N—	1	N		T	2	T	T	T	T	1	1	N—	1	2	
Sargassum cervicone	1	2	T	3	3	2	2—	1	T	T	T		2	2	2	3	2	1	2	T	N	T	T	N
Gracilaria sp. ..	N	T	T	N	N	T	N	T	T	N	2	N	N	N	N	1	T	N	T	T	N	2	N—	
Sarcodia ceylanica	T	T	T	N	N	2	T	N	—	—	N	N	N	T	T	N	2	N	N	T	N	N	T	N
Laurencia sp. ..	N	T	1	1	N	N	N	1	T	N	2	T	N	3	T	T	N	N	N	1	T	N	T—	
Jania natalensis	N	N	N	N	N	T	T	N	T	N	T	N	N	N	N	T	N	N	N	N	N	T	N	N—

The numbers indicate the zone of inhibition measured in mm. T = Trace, N= Nil, — = No test.

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