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Antimicrobial Activity of Some Marine Algae of Porto Novo and Pondicherry Waters, East Coast of India

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Toluene-methanol extracts of 15 species of marine algae were screened for their antimicrobial property against 6 bacterial and 2 fungal pathogens. Significant activity was recorded in 6 of the 15 algal extracts assayed. Of these *Ulva lactuca*, *Gracilaria verrucosa* and *Polysiphonia* sp. possessed high antibacterial activity. *G. verrucosa* inhibited the growth of fungus *Aspergillus fumigatus* at higher concentrations.

Marine algae are found to be rich in pharmacologically active substances like antibiotic[1-8], anticoagulant[9], antineoplastic[10], etc. The present paper reports antimicrobial activity of marine algae of Porto Novo and Pondicherry waters.

Fifteen species of algae (7 of Chlorophyceae, 2 of Phaeophyceae and 6 of Rhodophyceae) were tested. Fresh algal samples were collected from the marine zone of Vellar estuary, Porto Novo (lat. 11°29'N; long. 79°47'E) and from partially submerged dilapidated jetty of Pondicherry harbour (lat. 11°47'N; long. 79°50'E) during April-November 1982 and brought to the laboratory within 4 h of collection. The samples were washed first with fresh water and then with distilled water. The epiphytes and other extraneous matter were removed and partially air-dried.

The algal extracts were obtained using a slightly modified method of Caccamese and Azzolina[3] to get maximum yield. Algal sample (25 g) was homogenised in 75 ml of toluene-methanol (1:3) and then centrifuged to remove the insoluble materials. Aliquots of these extracts (0.3, 0.5, 0.7, 0.9, 1 ml) were transferred to 17 mm paper discs and air-dried.

The activity of algal extracts was tested against 4 gram-negative (*Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella typhi*, *Shigella flexneri*) and 2 gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) strains of bacteria. ZoBell 2216E agar plates were prepared with the inocula by adding 1 ml of diluted cultures. The extracts were assayed at different concentrations (0.3, 0.5, 0.7, 0.9, 1 ml) by disc diffusion method. Two morphologically different strains, *Aspergillus fumigatus* and *Candida albicans*, were used for antifungal assay. For *C. albicans* an inoculum was prepared in nutrient broth and then added with Rose Bengal agar. For *A. fumigatus*, dried spores were distributed uniformly to the surface of Rose Bengal agar. The inhibition zone was measured after incubation (24 h for bacteria and 72 h for fungi) at room temperature.

Of the 15 algal species tested, only 6 exhibited antimicrobial activity (Table 1). None of these showed any activity against *Klebsiella pneumoniae* and

Table 1—Antimicrobial Activity of Algal Extracts
(Results indicate zone of inhibition in mm with standard errors of deviation in parentheses)

Algae	Lowest active conc. of extract (ml)	Active on	Zone of inhibition (mm)
Enteromorpha intestinalis	0.3	Sa	3.0
Ulva lactuca	0.3	Bs	3.8 (0.1)
	0.3	Sf	2.9 (0.1)
	0.7	Sa	3.0
	0.7	St	3.9 (0.1)
	0.7	Ec	1.9 (0.2)
Gracilaria verrucosa	0.3	Bs	1.9 (0.16)
	0.3	Sa	2.9 (0.13)
	0.3	Ec	2.0
	0.9	St	1.9 (0.16)
	1.0	Af	4.0
Hypnea musciformis	0.3	Bs	4.0
	0.3	Sa	4.6 (0.1)
Hypnea valentiae	0.9	Sf	2.0
Polysiphonia sp.	0.3	Bs	6.8 (0.1)
	0.3	Sa	4.9 (0.1)
	0.7	Ec	3.1 (0.1)

Bs - *Bacillus subtilis* Sf - *Shigella flexneri*
Sa - *Staphylococcus aureus* St - *Salmonella typhi*
Ec - *Escherichia coli* Af - *Aspergillus fumigatus*.

Candida albicans. *H. valentiae* inhibited only *Shigella flexneri*. Only *Gracilaria verrucosa* inhibited the growth of *Aspergillus fumigatus* at higher concentration.

The algae *Chaetomorpha linum*, *C. media*, *Cladophora* sp., *Enteromorpha clathrata*, *Ulva fasciata*, *Padina gymnospora*, *Rosenvingea intricata*, *Acanthophora spicifera* and *Ceramium* sp. did not exhibit any activity against the bacterial and fungal strains tested. Species belonging to Rhodophyceae exhibited broad spectrum activity when compared to Chlorophyceae and Phaeophyceae.

Hornsey and Hide[2] reported that the acetone extracts of *E. intestinalis* were not active on *B. subtilis*, *S. aureus* and *E. coli*. Petroleum ether extracts[12] of *U. lactuca* and *E. intestinalis* did not inhibit *B. subtilis* and *S. aureus*. Ether and ethanolic extracts of *G. verrucosa* tested by Biard *et al.*[4], were not active on *S. aureus* and *E. coli*. Naqvi *et al.*[11], found that 50% aqueous ethanolic extracts of *E. intestinalis*, *U. lactuca* and *H. musciformis* were not effective against *B. subtilis*, *S. aureus*, *E. coli* and *S. typhi*. But in the present study, the toluene-methanol extracts of *E. intestinalis*, *U. lactuca*, *H. musciformis* and *G. verrucosa* inhibited the bacterial pathogens used by the above authors. The absence of activity observed by these workers may be due to the different solvents used for the extraction and/or to the loss of activity on storage of extracts.

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