BIOACTIVE COMPOUNDS FROM MARINE ORGANISMS

With Emphasis on the Indian Ocean

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Editors

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Biotoxicity in Marine Organisms

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The results from the screening of 118 marine organisms (corals, alcyoniarians, molluscs, echinoderms, flagellates) found in the coastal waters of India for their toxicity on fish and mice fingerlings as well as their hemolytic activities are presented.

INTRODUCTION

Marine organisms exhibit a wide range of bioactivity (Hashimoto 1979, Baslow 1969, Burkholder et al. 1969, Kaul et al. 1977, Kamat et al. 1981, Naqvi et al. 1980). The secondary metabolites from these organisms have recently gained importance in the pharmaceutical and pesticide industries. The screening of 26 marine organisms for bioactivity was reported by Naqvi et al. (1980). To date, there have been no reports on the toxicity and hemolytic activities of marine organisms found along the Indian coast. An effort was made to screen as many organisms as possible for their toxicity and hemolytic activities. The results of our studies on 118 marine organisms are presented

MATERIALS AND METHODS

Marine organisms were collected from the near coastal areas of Vizhinjam, Tuticorin, and Mandapam during June and July. The specimens were mainly sponges, gorgonids, alcyoniarians, corals, molluscs, echinoderms, and flagellates. The flagellates tested were collected from monocultures produced in the phytoplankton culture hatchery of the Institute at Tuticorin.

The following organisms were collected from all three locations to determine whether there were any regional differences in their biotoxicities: *Spirastrella inconstans* (Dendy), *Porites lutea* (Med-H), *Pocillopora*

damicornis (Lin), *Favites abdita* (Ellis and Solander), *Montipora digitata*, and *Nodilittorina pyramidalis*.

The specimens were extracted with ethanol and the method of Bakus (1974) as described in Rao et al. (1985) was followed for both fish and mice toxicity as well as hemolytic activity bioassays. *Tilapia* fingerlings (34–43 mm, 0.75–1.00 gm) and mice (20 gm) were used in the toxicity studies.

RESULTS AND DISCUSSION

The positive results are summarised in table 1. The following organisms showed no toxicity or hemolytic activity to fish and mice. The sponges: *Tedonia anhelans, Dendrilla migra, Iricinia fusca, Fasciospongia cavernosa, Sigmadocia pumila, Haliclona pigmentifera, H. tenuiramosa, Biemna fortis, Psamnaplysilla purpurea, Hyattela cribriformis, Clathria procera, Paratetilla bacca, Mycale mytilorum, Cinachrya cavernosa, Hemiclonia viridis, and Petrosia nigricans.* The corals: *Goniopora nigra, Montipora exserta, M. digitata, Favia favus and F. pallida.* The flagellates: *Monochrysis and Isochrysis.* The molluscs: *Xancus pyrum, Murex virginius, Turbo intercostalis, Hydroid* sp., *Patella, Pyrine zebra, Pinna bicolor, Cerithidia fluvialitis, Pinctada annamoides, Lithophagia laevigata, Gafrarium tumidum, G. divericata, Littorina undulata, Nodilittorina tuberculata, N. pyramidalis, Crassostrea cocculata, Umbonium vastiarum, Mesodesma glabaratum, Arca fusca, Donax faba, Cymatium pileare* and *Haliotis varia*

The following organisms exhibited only weak hemolytic activities: The sponges: *Aulospongus tubulatus, Axinella donnani, Spongia officinalis* var. *ceylonensis, Spirastrella inconstans, S. inconstans* var. *digitata, S. cuspidifera, Sigmadocia fibulata, Adocia pigmentifera, Callyspongia fibrosa, C. diffusa and Mycale grandis.* The corals: *Pocillopora eudouxi, Porites lutea, Montipora divaricata, M. foliosa, Acropora corymbosa, A. nobilis, A. humilis, and Goniastrea retiformis.* The molluscs: Alcyoniarian No. 3 (not identified), *Nerita, N. polita, Drupa tuberculata, Eurythoe complanata, Isognomon isognomon, Onchydium verruculatum* and *Trochus stellatus.*

It can be seen from table 1 that the echinoderms are toxic to both fish and mice. They also exhibit strong hemolytic activity. The flagellates such as *Dunaliella salina* (both varieties) and *Chromulina* are toxic to fish although not lethal to fish and mice and also exhibit strong hemolytic activity. The Alcyoniarians were toxic to fish and mice but weak in hemolytic activity. The molluscs—*Patelia chathalamus, Trochus* sp., *Conus* sp., *Siganus* sp., and *Conus textile*— were toxic to fish only and showed hemolytic activity whereas *Drupa heptagonalis* was lethal and toxic only to mice and had weak hemolytic activity.

Acropora formosa and *A. millepora* forma *surculosa* had hemolytic activity and were the only corals toxic to mice. The former was not lethal to

Table 1. Toxicities and hemolytic activities of ethanol extracts of marine organisms.

Species	Toxicity on *Tilapia* Fingerlings	Toxicity on Mice	Hemolytic Activity
Gorgonids			
Subergorgia suberosa (Pallas)	restless, distress, loss of equilibrium, death in 15 minutes	nil	strong
Acropora formosa (Dana)	nil	comatose for 40 minutes, then recovery	weak
Acropora millepora forma *surculosa* (Ehr)	nil	weakness and death in 2 hours	strong
Flaqellates			
Dunaliella salina	restless after 10 minutes for 12 minutes and then normal	nil	strong
Dunaliella salina (var. yellow)	restless after 10 minutes for 5 minutes and then normal	nil	weak
Chromulina	restless after 10 minutes for 20 minutes and then normal	nil	strong
Alcyoniarians			
Alcyoniarian No. 1 (not identified)	restless after 15 minutes and death in 30 minutes	breathing reduced, lying still for 15 minutes, then recovery	weak
Alcyoniarian No. 2 (not identified)	restless after 15 minutes and death in 30 minutes	comatose, weak for 40 minutes, then recovery	weak
Pterois esperi	restless after 15 minutes and death in 30 minutes	same as Alcyoniarian No. 1	weak
Molluscs and others			
Patelia chathalamus	restless intermittently for 30 minutes, then normal	nil	weak
Trochus	restless intermittently for 20 minutes, then normal	nil	weak
Tetradon sp.	nil	nil	strong
Trochus sp.	restless for 15 minutes and then normal	nil	weak
Trochus radiatus	restless for 20 minutes and then normal	nil	weak
Drupa heptagonalis	nil	comatose, death after 60 minutes	weak

Table 1. continued.

Species	Toxicity on *Tilapia* Fingerlings	Toxicity on Mice	Hemolytic Activity
Conus sp.	restless for 20 minutes, loss of balance, death in 30 minutes	nil	weak
		nil	strong
Siganus sp.	restless intermittently for 30 minutes, then normal		
Lysiosquilla sp.	nil	nil	strong
Conus textile	restless for 20 minutes, loss of balance, death in 45 minutes.	nil	strong
Laqanum sp.	nil	nil	weak
Echinoderms		nil	weak
Sea Lilly (yellow)	restless intermittently for 20 minutes, then normal		
Holothuria spinifera	distress, loss of balance, death in 30 minutes	Paralysis of legs, normal after 90 minutes	strong
Red star fish with five arms	restless, loss of balance, death in 45 minutes	Paralysis of legs, breathing accelerated, death after 60 minutes	strong
Pentocerater regulus	nil	breathing accelerated, death after 60 minutes	strong
Lindia maculata	restless for 20 minutes, then normal	nil	strong
Holothuria leucospilota (aqueous washings)	distress, sinking, death in 45 minutes	breathing slow, death in 45 minutes	strong
Holothuria leucospilota (Cuverian tubules)	distress, sinking, death in 40 minutes	restless, breathing slow, death in 60 minutes	strong
Holothuria leucospilota (respiration tree)	same as for Cuverian tubules	Same as *H. leucospilota* aqueous washings	strong
Ophiarachnilla sp.	restless for 15 minutes then normal	breathing accelerated for 10 minutes, then normal	strong
Stichopus variegata	restless, loss of balance for 20 minutes, recovery after 50 minutes	paralysis of legs, lying still for 30 minutes, recovery in 70 minutes	strong

mice, and did not show any toxicity to fish. *Acropora humilis* had only weak hemolytic activity. The only gorgonid specimen collected, *Subergorgia suberosa* (Pallas), had a lethal toxicity effect on fish as well as strong hemolytic activity. The sponges had no toxic reactions in fish and mice but some showed weak hemolytic activity. The specimens collected at all three sites did not show any differences in their biotoxicities.

Further work on the isolation and characterization of the relevant chemical compounds from the organisms showing toxicity is in progress.

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