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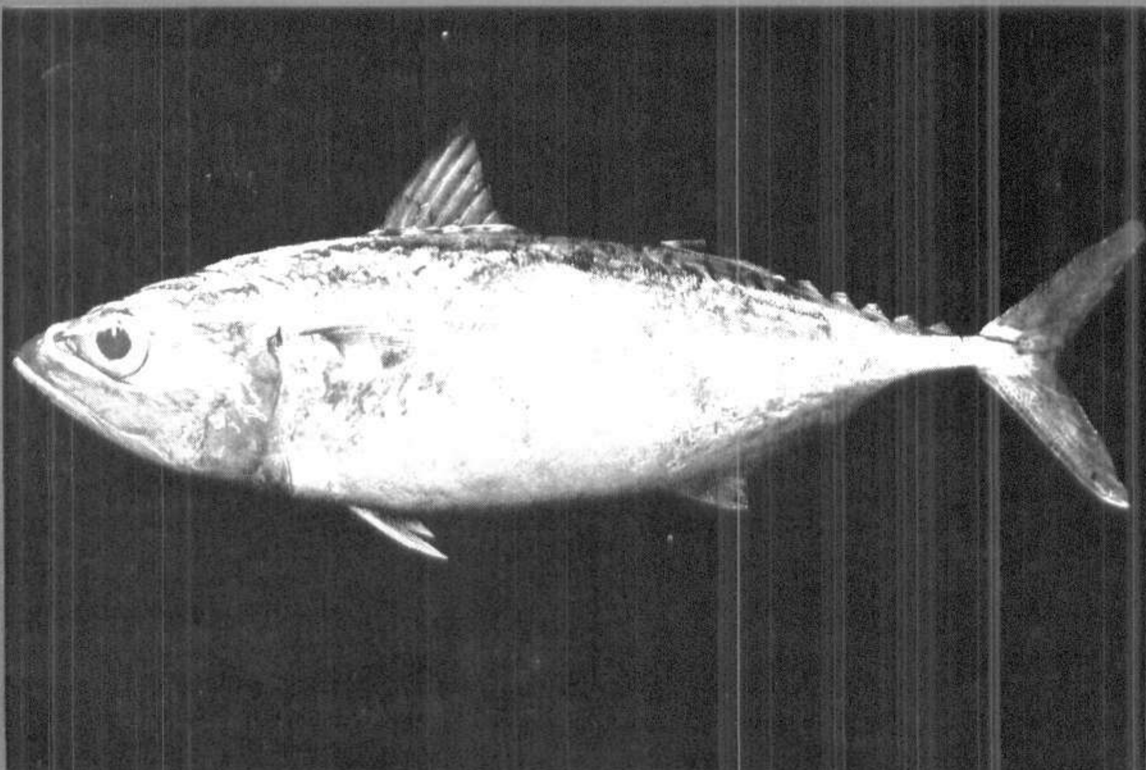

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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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BIOACTIVITY IN ECHINODERMS*

Man in his pursuit for knowledge of newer and better drugs for eradicating diseases to which he is prone to has turned to the sea, which is a more potential treasure house of drugs due to its vast and diverse range of marine life. Many marine organisms exhibit toxicity as well as bioactivity. Some are toxic and lethal to terrestrial animals as well as to the man. These contain hitherto unknown chemical compounds which are pharmacologically active either against cancer, bacteria, virus, worms, ulcer, fertility, pains, cough and spasms, high and low blood pressure or promoting or inhibiting growth. In the recent years marine organisms are being screened for these activities and the causative chemical compounds isolated and studied in detail.

The Phylum Echinodermata consists of sea cucumbers (holothurians), star fishes and sea urchins. These are known for their toxicity. Primitive man used bits of some species of holothurians to stupefy fish from rocky pools and catch them. Some species of sea cucumbers are known to produce nausea to man when eaten. Baughinan (1951) had reported that crude star fish meal contained factors which inhibited growth of chicken. Hippocrates (Halstead, 1956) stated that ingestion of sea urchin may produce diarrhoea. Fürth (1903) quotes an old record that dogs and cats died from eating cooked starfish. The pedicellariae of sea urchin *Tripneustes gratilla* have been reported to produce swellings of the lips or mouth in Japan and that the ovaries of this urchin also produce the same reaction if they are not sufficiently washed before consuming (Yoshiro, 1979). It is also reported that dried starfish meal has long been used for extermination of harmful insects and fly maggots in Hokkaido and they have found that this meal inhibits ecdysis of fly maggots. The ovaries of the sea urchin, *Paracentrotus lividus* during their reproductive period are as lethal as puffer poison and the ovaries of the white sea urchin, *Tripneustes ventricosus* produce severe allergic symptoms when eaten.

The toxicity in a few holothurians to fishes has recently been studied by Bakus (1974) and by Bakus and Green (1974). They have found that the toxicity is inversely related to latitude. James (1980) has tried the toxin of *H. atra* to eradicate undesirable organisms from fish farms successfully at Mandapam.

This report deals with the results of the screening of 10 species of echinoderms collected from Gulf of Mannar area for biotoxicity to fishes and mice and also

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for hemolytic activity. Of the 10 echinoderms, five were holothurians, viz. *Holothuria atra, H. scabra, H. spinifera, Bahadschia marmorata* and *Actiuocucumis typicus;* three star fishes, *Pentoceraster regulus, Astropecten indicus* and *Goniodiscaster scaber;* one sea feather, *Tropiometra carinata*, and one sea urchin, *Stomopneustes variolaris.*

The specimens were collected, and the bioassays for toxicity and hemolytic activity were started within one hour of collection. For each bioassay, 2 g of the part of the animal to be tested were extracted within boiling ethanol, solvent removed and the residue was dissolved in either sea water or distilled water or phosphate-buffered saline at pH7 depending on the type of assay involved such as fish toxicity, mice toxicity or hemolytic activity respectively. The parts of the animal used were body wall, viscera and cuverian tubules according to availability. In some cases, where weight of a part was not sufficient, the part available was used and the weights taken were naturally less for each bioassay. For fish toxicity, *Chanos* (average size 96.5 mm and average weight 6 g) and *Tilapia* fingerlings (average size 40 mm and average weight 0.9 g), were used. In the case of holothurians, the washings obtained, by cleaning the animal with sea water, was tested for biotoxicity for fish namely *Chanos, Tilapia* and cuttle fish (*Sepia* sp., average size 10 mm).

In the case of bioassays for toxicity on mice, 1 ml solution of the ethanolic extract residue dissolved in 10 ml of distilled water was injected intra-peritoneally into white (albino) mice of average weight 20 g. Hemolytic activity was studied with rabbit blood erythrocytes in phosphate-buffered saline at pH7 at 37°C using colorimetry. In all cases of bioassays, controls and blanks were maintained simultaneously with each experiment.

The results showed that all the parts of *Holothuria atra H. spinifera* and *Behadschia marmorata* exhibited a high degree of toxicity to fish fingerlings and mice and also destructive action on erythrocyte cells. The cuverian tubules of *B. marmorata* seemed to be highly toxic to *Chanos* and *Tilapia* fingerlings. These also showed strongest action on erythrocyte cells.

All organs of *H. atra* and *B. marmorata* were highly lethal and toxic to *Chanos* fingerlings while those of *H. scabra* and *H. spinifera* were less toxic. It was found that the toxin from the echinoderms *Actinocumis typicus, Pentoceraster regulus, Tropiometra carinata* and *Astropecten indicus* were only mildly toxic and were not lethal whereas *Goniodiscaster scaber* and *Stomopneustes variolaris* did not contain any substance toxic to *Chanos.* The action of the echinoderm extract on *Tilapia* fingerlings was more or less the same as for *Chanos.* Here also *H. atra*, and *B. marmorta* were highly toxic and *H. scabra* and *H. spinfera* were less toxic. The only change noticed was that for all other species of echinoderms tested, *Tilapia* continued to show normal behaviour. This may be due to the fact that *Tilapia* is more sturdy and resistant to changes in environments (except temperature) than is *Chanos.*

It was found that the toxins were water soluble from the fact that the aqueous washings showed similar toxicity to fishes. An interesting feature noted was that whereas the alcoholic extract of *A. typicus* did not show any lethality to *Chanos*, its aqueous washings showed clearly that this echinoderm contains water soluble and alcohol insoluble toxin which is concentrated in the body wall. Another interesting phenomenon noticed was that even the non-toxic and weakly toxic echinoderms (to *Chanos* and *Tilapia* fingerlings) were toxic and lethal to *Sepia* fingerlings except the star fish *Stomopneustes variolaris. Sepia*, thus seemed to be the most sensitive of all test fishes used.

The mice bioassay, showed that only two species of echinoderms, viz. *H.atra* and *B.marmorata* were toxic and lethal to mice.

All the echinoderms exhibited hemolytic activity thereby giving the true index of toxicity as the action is on the primary cellular level. The gradation of toxicity is brought out clearly by this assay. The gradation from strongest to weakest toxic species is *H. atra* (body wall and viscera), *B. marmorata* (body wall and cuverian tubules), *H. spinifera* (body wall and viscera), *H. scabra* (body wall), *P. regulus*, (body wall), *A. typicus* (body wall), *A. indicus, H. scabra* (viscera), *P. regulus* (viscera), *S. variolaris* (viscera), *G. scaber, T. carinata* and *A. typicus* (viscera).

Further detailed chemical investigations aimed at isolation and characterisation of the bio-active compounds present in these species are in progress.

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