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HOLOTHURIAN TOXIN AS A POISON TO ERADICATE UNDESIRABLE ORGANISMS FROM FISH FARMS

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ABSTRACT

Eradication of predators and undesirable organisms from fish ponds and farms is an important operation in any culture practice. Hitherto various chemicals and extracts from plants are being used for this purpose. For the first time, a toxin extracted from the holothurian, *Holothuria atra* (Jaeger) was tried with success. When used in limited water volume eradication was thorough and complete. Not only fishes but other organisms such as molluscs, crustaceans and polychaetes were found to be affected by the toxin. Experiments conducted in a rock pool at Port Blair (Andamans) and in a tidal pool at Mandapam camp are discussed in detail.

INTRODUCTION

PREDATORS and undesirable organisms pose a serious problem in culture operations. Several methods are in vogue to remove them before stocking the ponds on farms. The simplest method is to net them out. Unfortunately by this method the weeding is not complete. Several kinds of chemicals are used in ponds and farms for controlling undesirable fishes. The control chemicals can be grouped as plant derivatives, chlorinated hydrocarbons and organophosphates. Of all the chemicals chlorinated hydrocarbons are most toxic to fishes (Jhingran, 1975). Shirgur (1975) has listed several poisons of plant origin, the chief being Derris powder which is extensively used to weed out fishes and other organisms. Smith (1947) and Frey (1951) have stated that holothurian toxin is used in some places for fishing.

In this paper the results of the experiments conducted in a rock pool at Port Blair (Andamans) and in a tidal pool at Mandapam Camp are presented.

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Some holothurians have a toxin known as holothurin in their bodies. The defensive mechanisms of toxins of some tropical holothurians have been discussed by Bakus (1968). The holothurians release the toxin when disturbed and this serves as defensive mechanism for the otherwise softbodied defenceless animals. Holothurin is a saponin (steroid glycosid) found in four of the five orders of the class Holothuroidea. It may be highly concentrated in the body wall, viscera, Cuvierian tubules. The concentration of holothurin varies according to the seasons. Holothurin appears to have a direct effect on muscle contraction. It has also a nerve blocking effect similar to that of cocaine and physostigmine in laboratory animals. Holothurin is considerably stronger than the most powerful haemolytic reagent saponin and probably enters fishes through gills. It is stated

that fresh water fishes are more resistant to holothurin than are marine fishes probably because gills of the latter are less permeable (Bakus, 1974a). Bakus (1974b) has proposed a hypothesis that toxicity in tropical holothurians probably evolved in part as a chemical defense mechanism against predation by fishes. Bakus and Green (1974) have also discussed the geographic pattern of toxicity of sponges and holothurians.

Holothuria atra is one of the most common holothurians in the Indian region. It is abundant both at Andamans and on the South East coast of India around Mandapam. It is numerically abundant when compared to other species of holothurians. This species which does not find any use in *Beche-de-mer* in India can be used for the extraction of toxin to weed out fishes.

Extraction of Toxin

Extraction of toxin from holothurians is relatively simple affair. When *Holothuria atra* is handled the toxin is released as a burgandy coloured liquid from the body wall. For every hundred holothurians one bucket full of sea water is used for the extraction of the toxin. The holothurians are taken one by one and gently rubbed all over the body with hand inside water. About 200 CC of toxin is extracted from hundred holothurians. The holothurian is in no way affected by the extraction of the toxin this way. The holothurians used in the experiments at two places ranged in length from 110 to 300 mm. The toxin from 100 holothurians will make one bucket full of sea water red in colour and the extraction takes about an hour. After extracting the toxin the holothurians are kept in a corner of the pond in which the toxin has been poured. In this way the holothurians are kept alive and can be used again since they regenerate the toxin again. Also small quantities of the toxin continue to be discharged from those which were handled for toxin extraction. While no irritation or pain is felt when the toxin is handled with bare hands it was observed that continuous handling of toxin for three or four days make the outer skin of the palm peel off at some places.

Experiments

The experiments conducted in rock pools at Port Blair is first described. During low tide big rock pools are exposed. One such rock pool was selected near the Government College at Port Blair. The area of the rock pool was 16 square metres, with the depth of water at 0.75 metres. The toxin extracted in the manner described above and poured into the rock pool. One hour after the release of the toxin small fishes like *Ambassis urotaenis* were found to move to the edge of the rock pool. In this state they can easily be removed by hand net. At the same time some big fishes like *Pseudopristipoma nigra* were found to swim weakly at the surface of the water. Two hours later many of them were found to be dead, the bigger ones being more susceptible. Four hours later all most all fishes including crabs, molluscs and polychaete worms were found to be dead. It was found that some large mullets at the bottom of the rock pool were not affected till the tide came up again. However at Mandapam Camp when the toxin was used in a tidal pool all the mullets which were small in size were also affected and died. This experiment was repeated several times in the same rock pool and the fishes collected on one particular occasion are listed below. The figures in the parenthesis indicate the number of fish collected under each species.

Ambassis urotaenia Bleeker (132 Nos.)

Pseudopristipoma nigra (Cuvier) (4 Nos.)

Acanthurus gahm (Forskal) (3 Nos.)

Callyodon dussumieri (Valenciennes) (2 Nos.)

Tetrodon spp. (2 Nos.)

Cheiloprion labiatus (Day) (2 Nos.)

Daya jerdoni (Day) (2 Nos.)

Chaetodontops collaris (Bloch) (1 No.)

Siganus javus (Linnaeus) (1 Nos.)

Siganus vermicularis (Valenciennes) (4 Nos.)

At Mandapam Camp a small tidal pool near the fish farm was selected for the purpose of testing the toxin. The area of the tidal pool was more or less same as that of the rock pool at Andamans. Toxin extracted from 100 holothurians was poured into the tidal pool at 10 A.M. Two hours later when the tidal pool was visited it was seething with life with hundreds of fish coming to the surface and performing gyrating movements. The holothurians for the experiment were collected from Mandapam Camp and were more or less of the same size as those used at Port Blair. Several fish were also found at the edge of the pool as noticed at Port Blair and four *Tilapia mossambica* were found dead. Six hours after the release of the toxin there was no sign of life in the pool. All fishes were found dead and settled to the bottom. More than 75% of the dead fish were retrived from the pool the same evening by hand picking and the rest which were floating next day were collected by hand net. The weeding was thorough and complete. In the tidal pool where the toxin was tested only *Tilapia mossambica*, *Mugil waigiensis* and *Liza macrolepis* were found. Exactly 910 *Tilapaia mossambica* weighing a little over 5 kg and ranging in length from 45 to 93 mm and 29 mullets weighing 90 g and ranging in length from 41-49 mm were collected from the tidal pool.

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