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BIOTOXICITY OF MANGROVES ON FINGERLINGS OF *LIZA MACROLEPIS* (SMITH)

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ABSTRACT

Seeds, flowers, leaves, stem and root bark of seven species of mangroves namely *Acanthus ilicifollus, Acrostichum aureum, Avicennia officinalis, Bruguiera cylindrica, Clerodendrum inerme, Excoecaria agallocha* and *Rhizophora mucronata* were extracted with hot ethanol and water to study the effects on fingerlings of *Liza macrolepis*. The dwarf variety of *A. officinalis* was also collected from Tuticorin for testing its biotoxicity. The ethanol and aqueous extracts did not show any difference in their toxic action as far as lethality is considered. The total free sugar, protein and cholesterol of muscle tissue of the tested fishes indicated that in all cases of lethality by different extracts, there is considerable reduction. The paper chromatography of various ethanolic extracts showed that most of the extracts were containing 4 to 7 different chemical components.

In India extensive area of mangroves are found in Krishna, Godavari and Kalinadi delta, Vembanad lake region, West Bengal, Goa, Bombay, Gulf of Cambay and Andaman and Nicobar islands. The biochemical as well as the chemical composition of the mangrove leaves of Goa and Maharashtra region have been studied by Bhosale *et al.* (1976), Kotmire and Bhosale (1979). Chopra *et al.* (1956, 1965) and Kirtikar and Basu (1975) reported that mangrove plants were used as drugs from olden days in the indigenous medical system. They have reported that the root of *C. inerme* is administered to human poison caused by eating unwholesome fishes. The latex of *E. agallocha* shows abortificient property and is also a fish poison, and the milky juice of it is very acrid and injurious to the eyes which is also poisonous to human beings and is used as adjunct to arrow poison. The bark of *R. mucronata* had been used for haemorrhage, angina, diabetis and it is also containing tannin. The fishes belonging to the families Mugilidae, Channidae, Elopidae, Pomadasyidae, Gerreidae, etc. are usually found and harvested from the mangrove region. The present study describes the effect of biotoxicity of mangrove plants on fish fingerlings of *L. macrolepis*.

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Materials and Methods

Fresh plant materials of seven different mangrove species were collected from Puduvypeen, Vypeen and Narakkal in Kerala State. *A. officinalis* (dwarif variety) was collected from Karappad near Tuticorin in Tamil Nadu. Seeds, flowers, leaves stem and its bark and root bark of each species were brought to the laboratory and their fresh weights were determined. In the case of stem and root, their barks were peeled off and their fresh weight also noted. The moisture content of each plant material were calculated. The dried materials were then coarsely powered in a pulveriser and separately packed for further treatment.

The dried powder was extracted with hot ethanol using wholeglass soxhlet apparatus until the ethanolic extract was colourless. The ethanolic solution thus obtained was distilled using a distllation apparatus on a water bath and finally concentrated and evaporated to dryness on a boiling water bath. The residue was dried in a desiccator over fused calcium chloride till a constant weight was obtained. The percentage weight of ethanol soluble of each plant material was calculated. The dried residue of various plant materials were dissolved in 100 ml of ethanol with stirring and warming over water bath whenever necessary and allquot of the cooled ethanolic solution equivalent to 2 gms of dried plant material pipetted out into a clean dried boiling tubes, evaporated to dryness and dissolved in 10 ml of Phosphate Buffered Saline (PBS) solution. Two gms. of dry powdered material of each part of mangrove species were heated with 10 ml of distilled water in test tubes on a boiling water bath for about 30 minutes, cooled to room temperature and filtered through cotton wool to get the aqueous extract.

Live fingerlings of 100 numbers of *L. macrolepis* having average length of 45 mm and weight 0.75 gm. respectively were collected, kept alive in brackishwater having salinity 5 ppt and acclimatised for 13 days with sufficient aeration and light. The ethanolic and aqueous extracts of each part of mangroves species were separately used for toxicity experiments (Bakus, 1974). Anthrone reagent method for total free sugar, Folin-ciocalteu method for protein (Lowry *et al.*, 1951) and Henly's method for cholesterol were followed for biochemical analysis of experimental fishes. Paper chromatographic technique was used to determine the number of chemical compounds present in the ethanolic extract of each part. Five different solvent systems n-Butanol : Acetic acid: Water = 14:4:50; 4:1:1; and 4:1:5; n-Butanol : Water : Ethanol = 5:4:1 and Benzene : Methanol : Water = 4:4:1 (Zweig and Whitaker, 1971) were used.

Results and Discussion

The moisture content and physical nature of mangrove species have showed variation among the parts of each species (Table 1). The colour of ethanol extract is suggestive of their

Among the 7 species of mangroves tested for toxicity, all parts of *R. mucronata*, *E. agallocha* and flowers of *C. inerme*, stem bark of *B. cylindrica* are found to be toxic to fishes whereas other parts of *C. inerme* and *B. cylindrica* did not show lethality. This may be due to the presence of toxic component only in certain parts. Chopra *et al.* (1956, 1965) and Kirthikar and Basu (1975) also reported the toxic action of mangroves and found that *C. inerme* and *R. mucronata* contain tannin and the latex of *E. agallocha* showed toxic effect to fishes. Any part of other species such as *A. ilicifolius*, *A. aureum*, *A. officinalis* did not show any lethal effect to the treated fishes. The dwarf variety of *A. officinalis* collected from Karapad also did not show any lethality to fishes. This indicates that there is no regional difference in their toxic action. The ethanol and water extracts of mangrove species have not shown any difference in their action as far as lethality is

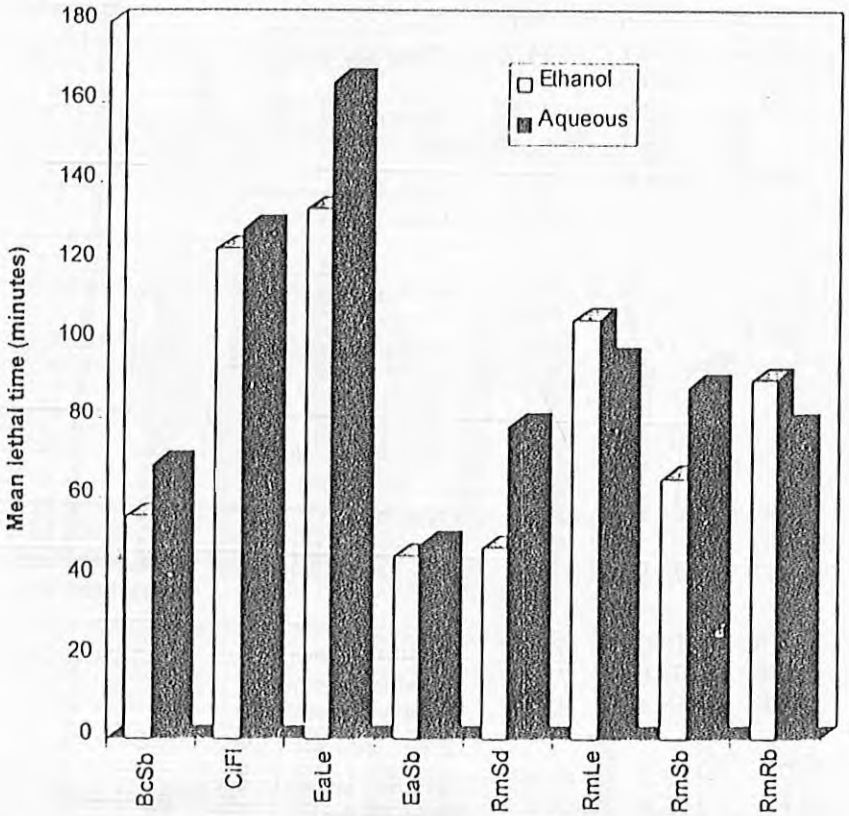

Fig. 1. Time taken for lethality of *L. macrolepis* in different extracts of mangroves
BcSb- *B. cylindrica Stem bark*; CiFl- *C. inerme* Flower; EaLe- *E. agallocha* Leaves; EaSb- *E. agallocha Stem bark*; RmSd- *R. mucronata* Seeds; RmLe- *R. mucronata* Leaves; RmSb- *R. mucronata Stem bark*; RmRb- *R. mucronata* Root bark

Table 1. : Moisture content of mangrove species and its physical nature of extracts

Name and parts of mangrove species	Fresh wt. (gm)	Dry wt. (gm)	Moisture content (%)	Colour of ethanolic extract	Forming nature during final evaporation
A. ilicifolius					
Seeds	116.5	31.5	73.0	Greenish brown	-
Flowers	477.5	112.1	74.7	Greenish brown	-
Leaves	610.2	215.5	64.7	Dark brown	-
Stem	187.9	52.3	72.2	Dark green	-
A. aureum					
Leaves	797.4	307.8	61.4	Dark green	-
Stem	227.3	90.8	60.0	Light green	-
A. officinalis					
Flowers	286.7	125.0	60.3	Dark green	-
Leaves	305.5	121.3	60.8	Greenish red	-
Stem	125.4	72.1	42.5	Greenish brown	-
A. officinalis (dwarf)					
Leaves	575.0	441.2	76.7	Greenish black	-
B. cylindrica					
Seeds	133.6	55.5	58.5	Dark brown	Foams at the end
Leaves	433.7	131.7	69.6	Greenish black	Foams at the end
Stem bark	165.1	75.5	54.3	Dark reddish brown	Foams at the end
C. inerme					
Flowers	28.8	10.0	65.2	Greenish brown	-
Leaves	372.5	105.0	71.8	Brownish green	-
Stem	63.8	46.3	27.4	Greenish brown	-
E. agallocha					
Leaves	360.8	123.3	65.8	Greenish brown	Foams at the end
Stem bark	257.6	105.9	58.9	Greenish red	Foams at the end
R. mucronata					
Seeds	366.1	157.6	57.0	Raddish brown	Foams at the end
Leaves	507.5	130.1	74.4	Dark green	Foams at the end
Stem bark	175.0	100.0	42.9	Reddish brown	Foams at the end
Root bark	100.0	95.0	5.0	Reddish brown	Foams at the end

contents. Thus the dark reddish brown extracts of seeds and stem bark of *B. cylindrica* and *R. mucronata* indicate the presence of tannin. The greenish (light and dark) colour is suggestive of the presence of chlorophyll. Similarly the foaming nature of extract of all parts of *B. cylindrica*, *E. agallocha*, *R. mucronata* at the end of distillation is attributed to the presence of saponin.

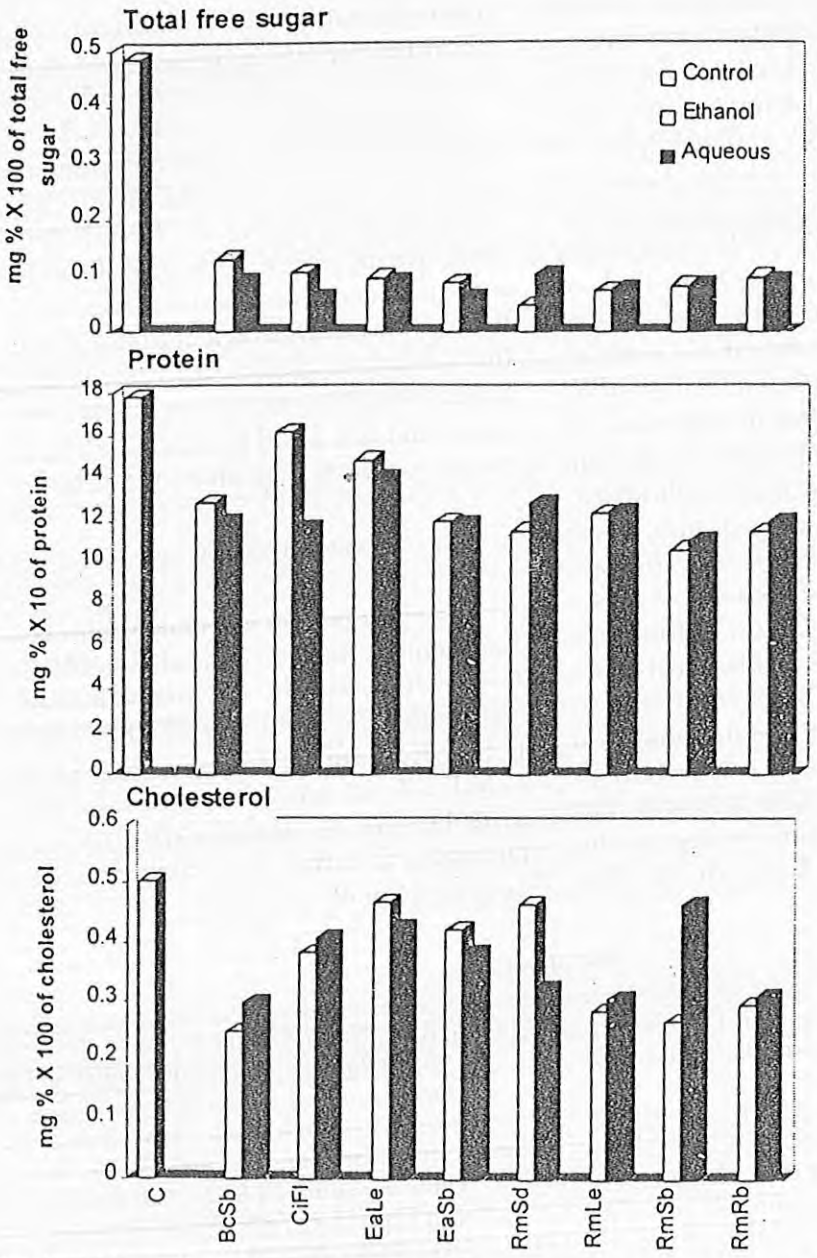

Fig. 2. Biochemical analysis of muscle tissue of *L. macrolepis* in treatments of different mangrove extracts

C- Control; BcSb- *B. cylindrica* Stem bark; CiFl- *C. inerme* Flower; EaLe- *E. agallocha* Leaves; EaSb- *E. agallocha* Stem bark; RmSd- *R. mucronata* Seeds; RmLe- *R. mucronata Leaves*; RmSb- *R. mucronata* Stem bark; RmRb- *R. mucronata* Root bark

considered. Highest toxicity was found by the extract of stem bark of *E. agallocha*. In general ethanol extracts have more toxic action to fishes than the corresponding aqueous extracts (Fig. 1). This may be due to either more solubility of toxic substances in ethanol than in aqueous extracts or there may be an additional toxic compounds soluble in ethanol and insoluble in water. The decreasing order of intensity of toxicity of ethanolic extract to the fishes is stem bark of *E. agallocha*; seeds of *R. mucronata*; stem bark of *B. cylindrica*; stem bark, root bark of *R. mucronata*; flower of *C. inerme*; leaves of *E. agallocha* and leaves of *R. mucronata* whereas in the case of aqueous extracts this order is as stem bark of *E. agallocha* and *B. cylindrica*; seed, root bark, stem bark and leaves of *R. mucronata*; flowers of *C. inerme* and leaves of *E. agallocha*.

Considerable reduction of total free sugar, protein and cholesterol were noticed in treated fishes compared to control and among these the reduction of total free sugar was relatively high (Fig. 2). Thus the study indicates that lethality observed may be due to the considerable reduction in the biochemical content of fishes. The paper chromatographic study revealed that various extracts contained 4 to 7 different chemical components. Among the five different solvent systems maximum number of components were obtained in the solvent system n-Butanol : Acetic acid : Water = 14:4:50.

Further work is necessary to determine the toxic chemical components present in the mangrove plants regarding their chemical nature, lethal concentration, their role and fate in mangrove ecosystem and the associated fishery. However, it is clear that some of the mangrove species are toxic to the fishes inhabiting mangrove ecosystem where the dried and decayed matter of mangrove parts may affect the fishery.

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