

SUMMARY

AND

CONCLUDING REMARKS

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A critical analysis on the existing literature shows that most of the work has been carried out to understand the histological structure of gill in normal fish and the histopathological changes brought about there-in by variety of pollutants. However, in most of such work, fishes other than C. Punctatus and pollutants other than malathion and sumithion are used. Similarly, there are few reports on histochemistry of mucosubstances in gills of normal fish, however, comparatively less attention has been paid to histochemical studies of mucosubstances in fishes exposed to some pollutants, particularly to pesticides. Existing literature shows that gills of fishes have been studied separately to understand the histopathological alterations and histochemical changes in mucosubstances, produced by some pollutants. However, no one has studied simultaneously the effect of pesticides on histomorphology and histochemistry of mucosubstances. At present, chloride cells have been reported in number of fishes, however, the presence of chloride cells have been denied by some in fresh water teleosts. The problem of presence or absence of chloride cells and their nature in gill epithelium in teleost fishes is not settled yet. Presently six types of mucous cells have been reported depending upon the nature of mucosubstances secreted by them in fishes from diverse habitat. Therefore, the

present investigation was aimed at histological study of the gill of control C.punctatus, histomorphological alterations brought about due to toxic effects of malathion and sumithion and the distribution of mucosubstances in the histological sites, such as gill epithelial cells and mucous cells of control C.punctatus and qualitative and quantitative changes produced in the mucos<sup>u</sup>stances in the gill epithelial cells and mucous cells of C.punctatus exposed to different concentration of malathion and sumithion. The following is the brief summary of results obtained and conclusions drawn in the present investigations.

1. From the experiment it is evident that with increase in concentration of malathion from 4 ppm to 12 ppm and sumithion from 10 ppm to 30 ppm in test aquaria there is a direct correlation in the physico-Chemical parameters studied. When the concentration of particular pesticide increases there is decrease in the pH and DO values leading to the toxic nature of these pollutants.
2. The studies on the LC 50 values of fish to the malathion and sumithion for 48 hours showed that the values were 7 ppm and 17.5 ppm respectively.
3. The study revealed that death of fishes occurred at lower concentration of malathion than the sumithion, which indicated that malathion is more toxic to

- present fish than the sumithion.
4. The behavioral study on the test fish showed that initially fishes were restless and showed agitation but subsequently sluggishness increases with time and increase in the concentration of the pesticides.
  5. From the histomorphological observation of the gill of C.punctatus it may be seen that the results obtained are matched by what had previously been observed by number of other workers in the species of teleost fishes.
  6. Histopathological alterations produced in the different components of gills are more or less identical to what has been reported previously for other pollutants in other species of fishes.
  7. The histopathological results obtained in the present investigation revealed that malathion produced much notable histopathological effects at all concentrations than the sumithion.
  8. Both the pesticides produce some common histopathological changes in the gill e.g. lifting of epithelium from the gill lamellae and interlamellar regions, swelling of secondary gill lamellae, enlargement of tip of the primary gill lamellae, dilation of blood sinuses of secondary gill lamellae. However, some of the gill lesions are characteristic of individual pesticide.
  9. As regards the histochemical characteristics it has

- been possible to show that the epithelial cells appears to consists of only neutral mucosubstances while the M1-mucous cells consists of neutral mucosubstances and M2-mucous cells consists of sulfomucins.
10. When the fishes are exposed to malathion and sumithion increased production of mucosubstances occure with increase in concentration of both the pesticides in both gill epithelial cells and mucous cells. However, at extreme concentration of both the pesticides the mucosubstance secretion decreases in both epithelial cells and mucous cells.
  11. When fishes are exposed to particular pesticides the mucus secretion by epithelial cells qualitatively altered from neutral to neutral and sulfo or neutral and sialo or neutral, sulfo and sialo under malathion exposure and from neutral to neutral and <sup>and neutral to neutral, sulfo and sialomucins,</sup> sulfomucins under sumithion exposure. However, there is no qualitative change in the mucus secretion by mucus cells under exposure of both the pesticides.
  12. Quantitatively the secretion of mucus by epithelial cells and mucous cells is more under malathion stress than the sumithion.
  13. Chloride cells/Acidophils have been observed in the present fish. The number of these cells have been found decreased with increase in concentration of both the pesticides.

14. Three types of mucous cells have been identified in the present investigation namely M1-mucous cells secreting neutral mucins, M2-mucous cells producing sulfomucins, and M3-mucous cells elaborating mixture of neutral and sulfomucins.

### CONCLUDING REMARKS

The aims and objectives of the present investigations were to study the LC 50 values of C.punctatus for malathion and sumithion, to compare the behaviour in control fish and fishes in test aquaria, to study the histology of the gill and histopathological lesions produced in the gills due to malathion and sumithion, to study histochemically the identification of mucosubstances in gill epithelial cells and mucous cells in control fish and fishes exposed to malathion and sumithion and to compare the results obtained in the present investigation and the existing literature. It is hoped that the aims and objectives of the present investigation have satisfactorily been achieved.

The author is fully aware of the short commings during the tenure of the present investigation. The author had to depend mainly on light microscopic observations, for minute and detailed histological and histopathological observations electron microscopic study is essential. Similarly, the author had to depend mainly

on the histochemical techniques which give the exact location of the mucosubstances in the given histological site but this information do not provide information on the exact quantity of the various mucosubstances in mathematical terms. The approximate staining intensities by visual estimation such as trace, poor, weak, moderate and intense may indicate roughly the relative amounts of mucosubstances in the given histological site of the gill of fish. The use of recent techniques such as autoradiography, immunohistochemical techniques and electron microscopy would have provided some additional information and confirm the results obtained in the present investigation with histochemical techniques. The results obtained in the present investigation will be published in due course of time.