

Pollutants and their effect on fisheries

During the last three decades, use of modern synthetic pesticides has increased about 40 folds in agricultural sector for enhancing the yield of crops. These chemicals affect almost all system of environment. Specially the aquatic ecosystem, they reach the water bodies through run off, fishes being one the most affected organism. These residues enter in non targeted animals via food chain threatening the ecological balance and biodiversity of the nature. Long term exposure of pesticides induces physiological disturbances, behavioural dysfunction, histopathological damages, haematological alterations, biochemical changes, immune suppression, hormone disruption, reproductive abnormalities and cancer.

Fishes serve as important bio indicators for aquatic contamination to access the changes caused by human activities effectively and reliable monitoring bio system to recognize and predict hazardous effects of pollutants. Since fishes are rich source of proteins and lipids, their health is very important for human beings.

After Green revolution during sixties in India pesticides were used widely in fields to control a wide variety of pests such as fungi, rodents, herbs, molluscs, nematodes, plant growth regulators and others. Three major types of chemicals used are herbicides to control weeds, insecticides for insect control and fungicides for mycotic or fungal control.

The major chemicals used are organophosphates, carbamates, organochlorides

pyrethroids, triazole, neocotenoids.

Use of pesticides in India → India is the second largest manufacturer of pesticides in Asia after China and ranks twelfth globally. India ~~uses~~ ^{uses} 40% of the world's different chemical pesticides, in terms of consumption according to WHO.

Effects of pesticides on fishes - Acute toxicity caused by the pesticides showed a significant correlation between dose and mortality. Increased concentration of toxic chemicals, present in water, resulted in more intake or entry of toxic chemicals in body of the animals, depending on several factors such as rate of penetration, nature of slope, variability and onaxional effects of active chemicals. The effect on fishes are as follows -

- 1) Behavioural changes - Fishes are directly affected by bioaccumulation of different pesticides (Rao and Pillala). Pesticides ~~and~~ induce different types of toxicity in fish, lead changes in fish behaviour, such as sluggishness and alteration in their swimming ability making them susceptible of preying. reduce their ability to feed, maintain their survival and ultimately lead to mortality. Interruption in the schooling behaviour of fish such as dangling, erratic and irregular movements ~~and~~ and disturbed swimming due to inhibition of activity of acetylcholine esterase in clarias batrachus and cr

Exposure of propiconazole and mancozeb.

Calla lutea shows increased movements of operula rapid jerk movement equilibrium loss, body color alterations, hypoexcitability in *Labeo rohita* darkening and erratic movements imbalance in swimming etc due to pesticides. Accumulation of pesticides and in tissue and blood of fishes is a common observation.

Bio chemical and Physiological changes -

Secondary metabolites of pesticides induce severe biochemical and enzymatic changes in aquatic organisms. These metabolites react with oxygen present in water and reduce oxygen present in consumption to fish species. When exposed to different pesticides, Dimethyl Parathion disturbs the oxygen consumption in *Labeo rohita* (Bhargava et al 1984) DDT induces disturbance in *Lepidoccephalichthys thermalis* (Gurusamy and Ramodoss, 2000) it induces toxic effects and reduces oxygen consumption.

Biochemical effects on various molecules are as follows -

1) Glycogen - The amount of Toxicants reaching the liver of fish can deplete the glycogen as liver is an detoxificative organ the fall in glycogen content in body tissues of fish indicates its rapid utilization by the respective tissue because of toxic stress of the pesticide

2) Enzymes - Several enzymatic Pathways alterations are also induced by pesticides

4

Pollution in organisms. Succinate dehydrogenase and ATPase activities were depleted in brain, liver and kidney (Das and Mukherjee) various chemicals and pesticides increases the ammonia levels in the blood and lead to ammonia auto-intoxication

3) Blood - Hematological parameters of fishes are also effected by pollution in water it decreases the no of haemoglobin percentage and total erythrocytes, studies shows that pollutants causes carcinogenesis, teratogenesis, clastogenesis and mutation

DNA - At molecular level, the pesticides have an ill effect on genes and DNA levels. The micronucleus test is ~~an~~ one of the most applicable. Technique to identify genomic alteration in environmental animals. Different fish cell types were considered for MNi analysis such as gill fin, kidney and hepatic cells and peripheral erythrocytes. The branchial epithelium acts as a primary indicator for water borne contaminants it shows high sensitivity for the cytogenetic effects induced by environmental contaminants.

Cytoplogical effects includes - modification in enzyme activity, cell death, imbalance in enzyme production, obstruction of normal excretory route, increased cell membrane permeability, change in transaminases, liver damage, change in glycogen and blood glucose level is a general response of fish to acute pollutants. This also effects the protein synthesis in the cells of fishes.

Therefore extensive use of pesticides should be avoided near water bodies and at sustainable application of the pesticides should be done to improve the crop yield.

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