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Bioaccumulation of Pesticides on Some Organs of Freshwater Catfish *Mystus vittatus*

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Large scale application of pesticides to agricultural and forest areas may contribute to the presence of toxic substances in the environment. These chemicals may find their way into the water reservoirs, streams, and rivers, thus producing an adverse impact on the aquatic biota including fishes. Continuous accumulation of these pesticides may bring about several changes in fish resulting into pathological conditions (Hazarika and Das, 1998). It can also alter the normal activity of fish by changing their physiology (Rao et.al. 1990).

The persistence and low water solubility of many pesticides contribute to their concentration in fish tissues and leads to biological magnifications. Residue analysis helps us in understanding the action and effect of these pesticides on aquatic life. Bioaccumulation of organochlorine pesticides was reported by several researchers (Mathiesen, et. al. 1982; Srivastava, et. al. 1990; Verma, 1990; Sharma, 1994;). But the studies related to the accumulation of organophosphate and carbamate pesticides are scanty. Thus the present investigation was undertaken to estimate the amount of pesticides accumulated in some organs of the freshwater fish *Mystus vittatus*.

MATERIALS AND METHODS

The freshwater teleost fish *Mystus vittatus* belonging to order Siluriformes and family Bagridae was procured from the local sources and acclimatized for 14 days in the laboratory glass aquaria. After acclimatization, the fish of size 5 to 8 cm. and weight of 15 to 25g were divided into two groups of twenty each. Group 1 served as control and group II was exposed to two synthetic organic pesticides

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viz. metasystox, an organophosphate, and carbaryl, a carbamate, separately for 30 days. The selected concentrations for these pesticides were 4 ppm and 7 ppm for metasystox and carbaryl respectively. After the treatment the fish were dissected and the tissues – muscles, blood, gill, liver and kidney were taken out and weighed for further investigations. For the quantitative analysis of metasystox, colorimetric method of Sreeramulu (1985) and for carbaryl, method described by Zweig (1963) was used. Recovery of analytes from fortified samples was 95-98%. The standard error was calculated by using the formula given by Snedecor (1961).

RESULTS AND DISCUSSION

The results of the present investigation are given in the Table I. From the obtained result it is found that the accumulation of metasystox was more as compared to carbaryl. Pesticide residues were found more in muscles and less in kidney, while in blood and liver the residues were present in between these two extremes. In control fish none of these pesticides were found. The gills tested for these pesticides were found with the amount of residues next to the amount found in the muscles. The general trend in the residue levels is found to be muscle > gill > blood > liver > kidney in both the cases.

Table 1.Pesticide accumulation in different tissues of *Mystus vittatus*.

Tissue	Control	Metasystox	Carbaryl
Muscle	ND	4.35 ± 0.013	3.78 ± 0.012
Gill	ND	3.62 ± 0.048	2.85 ± 0.041
Blood	ND	2.18 ± 0.034	1.55 ± 0.054
Liver	ND	1.28 ± 0.027	1.05 ± 0.035
Kidney	ND	0.95 ± 0.032	0.76 ± 0.023

Amount expressed in ppm. Values are mean $\pm$ S.E. (5 observations)
ND = Not Detected.

Maximum accumulation of metasystox and carbaryl in the muscles and gills may be due to their direct exposure to these pesticides. Moreover, most of the xenobiotics are taken into the body by passive diffusion through semipermeable membranes such as the general body surface, gill, lining of the mouth and gastrointestinal tract. Fish gills are especially vulnerable to foreign chemicals because their design maximizes diffusion. In vivo uptake of pesticides viz. metasystox, chlordane and sevin by the gills of freshwater fish *Labeo rohita* and *Saccobranchus fossilis* has been observed by Bansal (1979).

Lesser accumulation of biocides in kidney and liver than muscles, gills and blood is possibly due to the fact that the kidney eliminates chemicals during the course of excretion, either by glomerular filtration or by diffusion or by secretary process in the kidney tubules. Most xenobiotics dissolved in the blood are small enough to be removed by glomerular filtration. Xenobiotics and their metabolites are usually excreted more effectively by liver or kidney. Metabolites formed in the liver are transported to the gall bladder where they are discharged with bile and are eventually eliminated with the faces. A significant portion is likely to be reabsorbed in the intestine and returned to the blood. Further, the liver is capable of conjugating many organic chemicals that are bound to plasma proteins and are thus unavailable for excretion. These conjugates are secreted into the bile. Similar pattern of aldrin and methyl parathion degradation has also been reported by Verma and Gupta (1976) in *Colisa fasciatus* and *Notopterus notopterus*. Observations of other workers like Subbaih, et. al. (1985), Gong and Bhargava (1989), Verma, et. al. (1990) and Sharma (1994) also support the present findings.

It was further observed that accumulation of metasystox is more in quantity as compared to carbaryl. Bansal (1979) pointed out that the organophosphate residues accumulated in aquatic biota as a result of their low degradable nature as compared to the carbamate residues which is less stable and more degradable. Present findings also support this possibility of the quantitative difference between metasystox and carbaryl in the organs of fish *Mystus vittatus*.

Although the present study was restricted to metasystox and carbaryl, it serves as a representative index to understand the toxicity of pesticides on functional system of fish in polluted environments.

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