A Case Study:

ENVIRONMENTAL DETORIATION THROUGH ORGANOCHLORINE PESTICIDE RESIDUES IN AQUATIC BIODIVERSITY OF GOMATI RIVER IN DISTRICT JAUNPUR (INDIA)

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SUMMARY

Gomati is located in Jaunpur district, which is very famous for aquatic biodiversity in U.P. Aquatic biodiversity in this river is depleting rapidly due to human development, anthropogenic stress, pollutants, and habitat degradation affecting the water quality. The accumulation of organochlorine pesticides like DDT, BHC in Fresh water aquatic ecosystem is well documented. Several pesticides are being used in India both in agriculture and public health sectors. Although the use of pesticides have resulted increased food production and other benefits, it has raised concerns potential adverse effects on the environment and human health. The greatest potential for unintended adverse effect of pesticides is through contamination of the hydrologic systems, which supports aquatic life and related food chains and is used for drinking water, irrigation, recreation and many more purposes. The persistence of the organochlorines in aquatic ecosystem has special significance as they are picked up by aquatic organisms like plankton and in the process pesticide residues enter in the food chain. In view to conserve the Aquatic biodiversity of Uttar Pradesh, it is necessary to determine the level of contamination in stream and aquatic biota, since these are important in the food web of terrestrial organisms, with some aquatic biota, such as fish, being consumed by people and wildlife. In the present communication a systematic survey was carried out in Gomati at Jaunpur.

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The organochlorine pesticides are lipophilic, extremely toxic and non biodegradable. It is reported that DDT and Endosulfan at concentration of 16 ppb and 1ppb respectively, are toxic to fresh water fish (Brown, 1979).In river streams there is also possibility of pesticide contamination through non-point source pollution and agricultural runoff during wet season the other possibility is deposition of pesticides originating from plains during snow melting and interference of various physicochemical processes. The resent reports indicate contamination of United States river streams from atmospheric deposition and erosion of soil contaminated from past use. The pathways by which the pesticides are transported from the application areas to other parts of the environment with reference to stream are given in Fig. 1. Incidence of fish kill due to insecticides had occurred in different streams (Young and Nicholson, 1951). However, in India report on occurrence and distribution of organochlorine pesticide in aquatic environment is very rare and no systematic investigation was done on the pesticide in stream environment is very rare and no systematic investigation was done on pesticide residues in the streams and rivers of Uttar Pradesh.

MATERIALS AND METHODS

The water samples were collected from different sampling sites of river Gomati at Jaunpur during November, December, 2006. Samples were collected from different segments of river Gomati. Water samples (n = 6) were collected from the sides and midstream. The details of the sampling locations and the details of the water quality parameters of the river stream given in Fig. 1 and Table 1, respectively. Fishes (n = 12) were collected using cast net and gill net and preserved in crushed ice till analysis. The sample processing, extraction, cleanup and gas chromatography was done by the pesticide laboratory of Industrial Toxicology Research Center (ITRC) Lucknow, Uttar Pradesh, India as per standard methods (Singh *et al*. 1987). Physico-chemical parameters of the water were analysed as per standard methods (APHA, 2000).

RESULTS AND DISCUSSION

The result of the physicochemical parameters of Gomti indicates that the mean value of all the parameters were on the higher side except chloride, COD and BOD in Gomati. Highly significant differences ($p < 0.001$) were recorded for conductivity and hardness. The other

parameters were significant ($p > 0.05$) variation was observed includes turbidity, total solids, total dissolved solids, pH, total nitrogen, calcium and magnesium.

Table 1 : Mean values of physico-chemical parameters of river Gomati

Sr. No.	Parameter	Mean Value
1	Turbidity (mg/l)	1.62 ± 0.08
2	Conductivity (µ mhos/cm)	92.75 ± 3.18
3	Total solid (mg/l)	98.0 ± 14.14
4	Total Dissolved Solid (mg/l)	75.5 ± 12.02
5	Total Suspended solids	22.5 ± 2.12
6	pH	7.95 ± 2.21
7	Total alkalinity (mg/l)	53 ± 12.71
8	Hardness (mg/l)	37.5 ± 0.70
9	Calcium (mg/l)	31.0 ± 0.00
10	Magnesium (mg/l)	6.5 ± 0.70
11	Chloride (mg/l)	3.5 ± 1.41
12	Fluoride (mg/l)	0.91 ± 0.12
13	BOD (mg/l)	3.57 ± 0.95
14	COD (mg/l)	7.65 ± 0.21
15	Sulphate (mg/l)	2.0 ± 2.80
16	Total nitrogen (mg/l)	4.16 ± 1.02

In the present investigation, γ–BHC, total BHC and total DDT were detected in all water and fish samples (Table 2) collected from Gomati, where as endosulfan was detected only in two water sample collected from Gomati. The concentration of γ–BHC, total BHC and total DDT in different sampling sites ranged from 0.010 to 0.023 µg/1, 0.012 to 0.026 µg/1 and 0.019 to 0.025 µg/1, respectively.

The pesticide analysis of the fish samples of endangered *Chitala chitala*., (n = 6) and *Ompok pabda* (n = 6) indicated presence of γ–BHC (0.001 – 0.003 µg/g) total BHC (0.001 – 0.0006 µg/g) and the total DDT (0.013 – 0.055µg/g, respectively. The mean values recorded were 0.002 ± 0.001µg/g for total DDT. No endosulfan residues were detected in fish samples of Gomati river. The maximum concentration of total DDT recorded in fish collected in sampling site D. (0.013 to 0.046µg/g). This indicates higher persistency of pesticides in Gomati water which detoriate the aquatic wealth of the Gomati river.

The physicochemical analysis of the water samples collected from the river streams of Gomati. The values

Fig. 1 : Study Area – Sampling sites of Gomati river at Jaunpur.

Table 2 : Mean values of Organochlorine pesticide in water (µg/1) and fish (µg/g) samples of river Gomati

Sr. No.	Parameter Water Sample	Sampling Sites A	B	C	D	E	F
1	γ–BHC	0.013	0.010	0.014	0.023	0.021	0.014
2	Total BHC	0.015	0.012	0.014	0.026	0.022	0.014
3	Total DDT	0.033	0.021	0.019	0.025	0.021	0.019
4	Endosulfhan	ND	ND	0.001	0.001	ND	ND
Fish samples							
1	γ –BHC	0.001	0.002	0.001	0.002	0.002	0.001
2	Total BHC	0.001	0.004	0.014	0.004	0.003	0.014
3	Total DDT	0.0042	0.013	0.019	0.046	0.004	0.019

Note : Tot – BHC = Sum of isomers of BHC;
Tot – DDT = Sum of pp – DDT; op – DD, pp – DDD; ND – Not detected

for total suspended solids, total alkalinity, chloride, fluoride, BOD, COD, sulphate and total nitrogen were not significantly differed.

The physico-chemical parameters showed significant variation in turbidity, conductivity, total solids, and total dissolved solid, total alkalinity, hardness, magnesium, calcium, and sulphate. This variation may be due to interference of various physical/ chemical processes, source of origin of river, type of river basin, catchment's type, and other unknown factors. This was also reflected in the results of pesticide analysis in river Gomati.

The wealth of information on pesticides in bed sediment and aquatic biota in the scientific literature has provided a national perspective on Organochlorine pesticides in United states rivers (Nowell *et al.*, 1999 and Majewski and Capel,1995). The review of literature indicates that no studies have been done earlier in Indian streams. However a considerable works on the

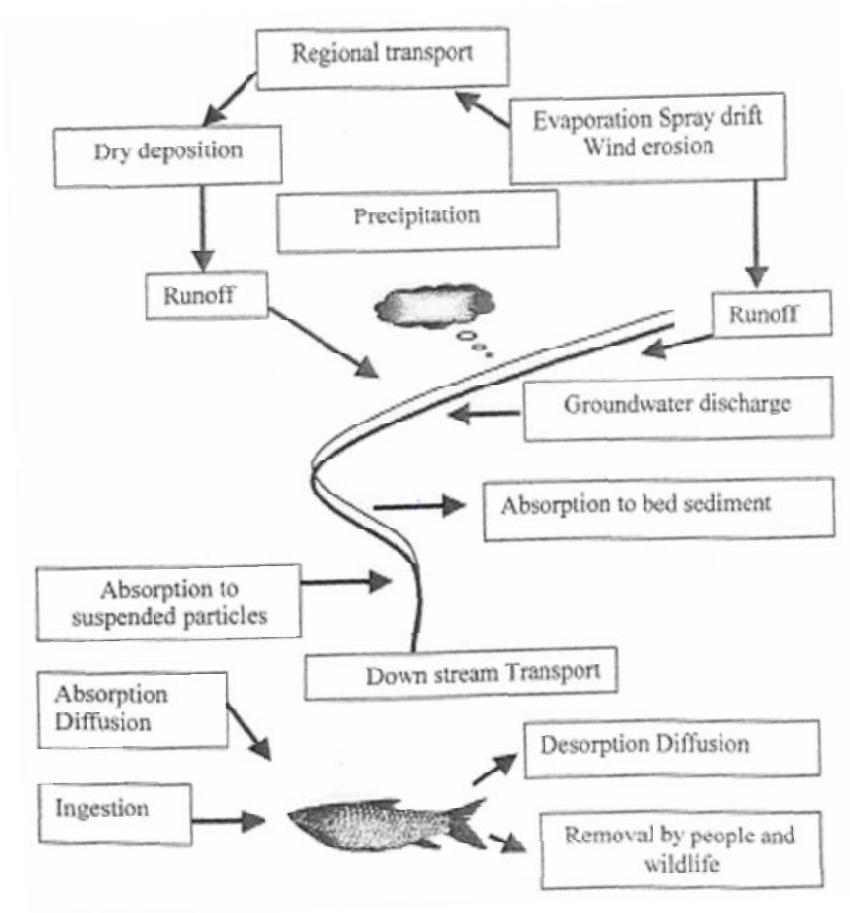

Fig. 2 : Pathways of pesticides in streams (Modified from Majewski and Capel, 1995)

occurrence of pesticide accumulation in Ganga waters had been done earlier by several investigators (Nayak *et al.*,1995 and Kannan,1995).The result of recent studies of the United States Geological Survey (USGS) programmes showed detection of a large number of organochlorine pesticides in the stream sediment and aquatic biota in which forty four percent of the pesticides in stream sediment, and 64 percent were detected in aquatic biota, even though their agricultural uses in the United States were discontinued during the 1970 s (Nowell *et al.*, 1999). This reflects the hydrophobicity and persistence of these compounds in fresh water ecosystem.

These findings emerged from the present study will provide baseline information for making effective conservation programmees in the fresh water habitats of endangered fishes. The present observation suggests a need for more studies of organochlorine pesticide occurrence in the Gomati river where fishes are getting endangered. Also, researchers should look for currently used pesticides with the potential to accumulate in sediment and aquatic biota, and toxic and long-term effects of pesticide mixtures on people and wildlife. Studies are also required to investigate the mechanisms and pathways of pesticide contamination in freshwater fishes, particularly in U.P. These studies are also helpful for more and more fish production, which generate employment and food for local community by the sustainable utilization of fresh water fishes and improve the public awareness about rehabilitation at fishery resources and also save our detoriated natural water resources.

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