
Static bioassays reveal that the LC{sub 50} 96 hour of dairy effluent for a freshwater fish Oreochromis mossambicus was 50% of the effluent. The fish were reared in different sublethal concentrations (10 and 15%) of the effluent for 30 days. Various biochemical constituent in three tissues (gill, liver, muscle) of the fish were estimated. These concentrations were found to decrease depending on the dose of the effluent.


Male albino rats were divided into five groups and were orally administered cadmium (0.4 mg/kg) and HCH (10 mg/kg) daily for 90 days. After 45 days one group of Cd and HCH was supplemented vitamin E (50 mg/kg) till the end of experiment. The group dosed with HCH + Cd had a significantly higher concentration of HCH in plasma and tissues than the group dosed with HCH alone. The brain content of Cd was significantly increased whereas a marked depletion of copper and iron was observed in the group of Cd + HCH. Vitamin E affords protection against the Cd + HCH induced neuronal toxicity.


A sensitive spectrophotometric method is proposed for the determination of widely used pesticide endosulfan. The method is based on the liberation of sulphur dioxide from endosulfan by adding acid reagent and alcoholic potassium hydroxide. The liberated sulphur dioxide is then passed through potassium iodate solution and the iodine liberated is then reacted with N-chlorosuccinimide and leuco crystal violet. The method has been applied for the determination of endosulfan in water, soil and vegetables.

Study investigates the magnitude of contamination of organochlorine insecticides in vegetables which were brought for sale to the consumers in the local markets of Jaipur city, Rajasthan. Most of the collected samples were found to be contaminated with residues of DDT and its metabolites isomers of HCH heptachlor, heptachlor epoxide and aldrin. Some of the detected insecticides exceeded the limit of tolerance prescribed by WHO/FAO. Seasonal variations of residue levels were also studied.


Among the test systems, *Allium cepa* has been listed as an example of the plants used in screening mutagens. A study was carried out to study the genotoxic effect of untreated and treated paper mill effluents on the somatic cells of *Allium cepa* L. The effluents lowered the mitotic index values.


Paper reports cytogenetic and biochemical effects of untreated and treated paper mill effluents on the somatic cells of *Allium cepa*. The effluents lowered the mitotic index. The effluent significantly lowered the protein, DNA and RNA content.


Freshwater crab *Paratelphusa hydrodromus* were exposed to 0.6 ppm to 5 ppm concentration of the pesticide contamination of the medium by monocrotophos. The results showed gradual increase in oxygen consumption of *P. hydrodromus* in concentration ranging from 0.5 to 0.1 ppm and gradual decrease at higher concentration ranging from 1.0 to 5.0 ppm. The change in oxygen consumption of the crabs could be related to the interference respiratory enzymes.

The effect of five sublethal concentrations of endosulfan were evaluated on serum glucose, serum cholesterol and serum protein of *Heteropneustes fossilis* after 5d, 15d and 30d exposure. Noticeable differences were observed in the blood chemistry of treated fish. Intoxicated fish after 5d exposure showed hyperglycemia and hypercholesterolemia, but insignificant increase was observed in protein content. Prolonged exposure for 15d and 30 d resulted in decrease in all the three parameters.


The development of prawn and fish industry largely depends on steady and adequate supply of seed of desired species. During collection of seed, the collectors have been observed to fall victim to some diseases. To assess the frequency of these diseases, an investigation was carried out in some villages of Sundarbans. The results shows that the poor people of Sundarbans who chose this profession for their livelihood, do not afford to bear the cost of treatment. Therefore, it is high time that welfare programs be launched for the benefit of those down trodden rural populace.


The impact of nickel chloride and lead chloride on amylase activity of freshwater bivalve, *Parreysia cylindrica* was studied. The activity of amylase after acute treatment showed a decrease in both the tested heavy metals. NiCl₂ was more toxic as compared to CdCl₂ affecting amylase activity.


Some aspects of protein metabolism were studied in foot, hepatopancreas and mantle tissues of snail, *Pila globosa* on exposure to lethal concentration for 2 days (336.7 mg/L) and sublethal concentration (67.34 mg/L) of nickel for 1, 5 and 10 days. Total, structural and soluble proteins decreased significantly and to continence, this the levels of amino acids and protease activity increased in all the tissues of snail at all
time points examined. Under lethal and sublethal exposures, the changes in all the parameters were pronounced in hepatopancreas followed by foot and mantle.


Toxicological effects of some biochemical parameters of freshwater fish *Channa punctatus* (Bloch), under the stress of nickel (NiSO$_4$ 6H$_2$O), at various concentrations of 10, 20, 30 and 40 ppm for 30 days were observed. Gradual decrease in the levels of liver protein and liver ascorbic acid due to proteolysis and liver glucose breakdown respectively was observed. There was also gradual decrease in the brain protein level showing significant alterations but the brain ascorbic acid level showed no significant alterations.


Acute toxicity tests of pesticide endosulfan were performed on early stage tadpoles of three anuran species - *Bufo melanostictus*, *Limnonectes limnocharis* and *Microhyla ornata*. Mean LC$_{50}$ values at 24,48,72 and 96 h were 0.057,0.029, 0.022 and 0.020 ppm for *B. melanostictus*; 0.0066, 0.004, 0.0014 and 0.0013 ppm for *L. limnocharis*; and 0.0025, 0.0006, 0.00025 and 0.00016 ppm for *M. ornata* respectively. Several behavioural as well as morphological changes were also observed in all the three species.


Study evaluates the toxicological impact of flyash leachate and zinc chloride on fresh water catfish *Heteropneustes fossilis* and the effect of leachates and zinc chloride concentration on oxygen uptake of fish. The 96 hours LC50 values for zinc chloride and flyash leachate were found to be 15.75mg/l and 550g/l, respectively. The oxygen consumption was significantly reduced as compared to control, leading to respiratory stress.

Some haematological tests were carried out on albino rat, *Rattus norvegicus*. The rats (8.05 g) were exposed to LD₅₀ (24 hr) malathion. Haematological tests like WBC, RBC, Hb%, PCV, MCV, MCH and MCHC were recorded on 24, 48, 72 and 96 hrs post dose. A decrease in RBC, WBC and Hb% observed in 24 hrs exposure and increase in 48 hrs and onward shows gradual decrease.


The effect of cadmium toxicity on some biochemical components in commonly available fresh water species *Labeo rohita*, *Cirrhinus mrigala* and *Cyprinus carpio* were studied. Marked reduction was recorded in the body tissue carbohydrates and residual protein in all the three fish species after 45 days of exposure to cadmium as compared to control which may be due to dysfunction of several physiological and biochemical processes in the body, and it renders the fish incapable of normal growth.


Exposure of albino rats (*Rattus norvegicus*) to different combinations of lead acetate and zinc acetate indicated differential changes in haemoglobin concentration due to heavy metal intoxication. A maximum fall in haemoglobin content was observed in rats exposed to a combination of zinc acetate and lead acetate. It was observed that zinc acetate was more toxic and interfered with heme synthesis to a greater extent as compared to lead acetate.


Experiments were conducted to observe the toxicity of lead nitrate in the fresh water cat fish, *Heteropneustes fossilis* at varying concentration of 2.25 mg/l and 2.85 mg/l. Observation on Total Erythrocyte Concentration (TEC) and Hb% indicate as fall in both parameters reaching upto a maximum 32% in TEC and 34% at the higher concentration of 2.85 mg/l of PbNO₃ at day 21 post treatment.
An air-breathing fresh water fish *Channa punctatus* was exposed chronically to sublethal concentrations of mercuric chloride and the respiratory surface was found to exhibit lesions, lifting of lamellar epithelium and increased number of mucus gland openings. The damage increased with increase in the concentrations. The gill surface was studied using scanning electron microscope.

article deals with the assessment of potential health risks related to certain carcinogens and non-carcinogens (e.g. cadmium, chromium and nickel) present in three environmental media, viz., air, water and food in different Indian states (regions). Appropriate dose-response models have been identified and used for this purpose with the assumptions and input data as per the Indian context. Mean values of ambient air concentration levels of Cd, Cr and Ni have been used to estimate the individual and societal risks of extra cancer in different states of India. The hazard quotients and hazard index representing the non-carcinogenic chronic health effects caused by chromium and cadmium due to their long-term exposure through water and food have also been estimated.

Acute arsenic poisonings commonly result from suicidal or accidental ingestion. The brain is rich in unsaturated lipids, and lipid peroxidation is known to produce cellular damage in the toxicity of environmental pollutants and heavy metals. This investigation demonstrates the amount the Thiobarbituric Acid Reactive Substances formed, an indicator of lipid peroxidation, in different regions of the brain, in the liver and in the kidney of the rats.

Neurotoxic effect of BHC, the organochlorine pesticide in *Heteropneustes fossilis* has been studied exposing at the dose concentration of 1 ppm, 5 ppm and 10 ppm in lab aquarium for 96 hours over a period of one year. The results showed the behavioural
abnormalities in different exposure concentrations. Severe behavioural abnormalities were recorded at high dose concentration of pesticides with higher accumulation of pesticide residues in brain tissue.


*Spongilla lacustris* were exposed to lethal concentrations of pesticides, rogar and endosulfan for one month period. Metabolites like carbohydrates, protein and enzymes like those that peroxidase and carbonic anhydrase were estimated in the experimental and control animals. The results show depletion of carbohydrates while protein elevated as the days progressed. Similarly an enzyme activity found to be decreased in exposed *Spongilla lacustris*.


Fenvalerate induced alterations in the activities of acid and alkaline phosphatases were quantified in the catfish *Heteropneustes fossilis*. The fish, exposed to different graded concentrations of fenvalerate for 30 d, elucidated an elevation in the activity of acid phosphatase, and inhibition in the activity of alkaline phosphatase in muscle, liver and kidney.


Static bioassay tests for acute toxicity of five heavy metals to the shrimp *Penaeus monodon* in brackishwater medium (salinity 15 ± 1.0 ppt) were conducted. The 96 h LC$_{50}$ values of metals such as Cr, Zn, Cu, Cd and Hg were found to be 4.20, 1.50, 1.20, 0.15 and 0.03 ppm respectively for shrimp of size group 33-46 mm. Except mercury, the concentration of other heavy metals were below detection level of the instrument used. Based on the LC$_{50}$ values and derived safe concentrations, the inflow sea water appeared to be safe at present levels of mercury at 0.0003 ppm.

Green mussels *Perna viridis* (shell length 80-90 mm) from Bhatye creek, Ratnagiri in summer were exposed to ZnCl₂ of 0.2 ppm and 0.4 ppm (1/10⁶ LC₀ and LC₅₀) for 7 days, 7 days laboratory depuration and 7 days field depuration. The glycogen content in 0.2 ppm and 0.4 ppm exposed (7 days) showed increased level in gill, hepatopancreas and adductor muscles while 7 days laboratory depurated 0.2 ppm group of animal showed increase in gill, hepatopancreas adductor muscles and 0.4 ppm group of animal in adductor muscles, gill, hepatopancreas, siphon.


The fingerlings of *Labeo rohita* were exposed to sub-lethal concentration / doses of copper, cadmium, zinc and aflatoxin for different duration. The effects of these substances were observed in the form of chromosomal abnormalities developed during the test period. The abnormalities were reported to be 5-8% when the fingerlings were exposed for duration of eight days. Exposure of more than eight days at the given dose of the pollutants caused complete mortality of the stock.


Inhalation toxicity was assessed by exposing rats of 376 ± 1.76 ppm trichloroethylene (TCE) for 28 days and 90 days in a dynamically operated all glass whole body inhalation chamber. The lysosomal rupture resulting in increased activity of acid phosphatase (ACP) and alkaline phosphatase (ALP) along with reduced glutathione content and increased total sulphhydryl contents in lungs confirmed pulmonary damage by TCE and or biotransformed products of TCE.


Many species of cyanobacteria (blue-green algae) produce secondary metabolites with potent biotoxic or cytotoxic properties. The mass growth of cyanobacteria which develop in fresh, brackish and marine water commonly contain potent toxins. Cyanobacterial toxins or cyanotoxins are responsible for or implicated in animal poisoning, human gastroenteritis, dermal contact irritations and primary liver cancer in humans. Article discusses cyanobacterial toxins and their implications on human health.

Adults swiss mice were administered 5% solution of textile industry wastewater orally for 25 days and haematological parameters like RBC, WBC, Hb, and PCV were studied. Red cell indices like MCV, MCH and MCHC were calculated. Results indicate significant reduction in RBC, Hb and PCV levels. It is inferred that toxic effluents cause metabolic alteration in erythrocytes and reduce their Hb carrying capacity.


The metal levels in hairs in polluted and unpolluted environments provide an insight into potential bioaccumulation, mobility within the ecosystem and response relationship. Monitoring the metal bioaccumulation in organisms need a strict analysis of quality control samples. Inter laboratory analysis add to the reliability and validity of data in biomonitoring of trace/toxic metals. Paper gives details of the observations made in respects to these aspects in the analysis of human hair made in a metal exposure assessment study.


Investigations were undertaken to monitor the health status of farm labourers engaged in field sprays of MIPC 50 WP (Hexamicin, Mipcin), a carbamate insecticide on cotton crop, as per the protocol approval by the Central Insecticide Board. The spray personnel (mixers, loaders and sprayers) with protective clothing did not reveal any alteration in clinical, hematological and blood bio-chemical profile during exposure and post exposure periods. The spray personnel without protective clothing showed only a marginal reduction in their blood cholinesterase activity during the exposure period.


The determination of LC$_{50}$ to Labeo rohita for 72 hours in treated and untreated sago effluent confirm that 35% and 3% was LC$_{50}$ for treated and untreated sago effluent
respectively. *Labeo rohita* reared in 15% treated sago effluent recorded maximum conversion rate of 18.80 mg/g/day and conversion efficiency of 37.61%.


Studies on respiratory metabolism of fish *Oreochromis mossambicus* (Peters) exposed to different concentrations (5, 10, 20 and 40%) of pulp and paper mill effluent were done for a period of 15 days and there was a marked decrease in oxygen consumption rate from control. Difference in oxygen consumption rate of the fish in different concentration was significant ($F=63.1$, $P<0.001$) whereas the difference between the days was insignificant ($F=2.75$).


The acute toxicity of butachlor, malathion and carbofuran to the earthworm *Drawida willsi* was determined. The 96-h LC$_{50}$ values for juvenile, immature and adult earthworms were calculated following Finney’s probit method. The LC$_{50}$ values for all the age groups ranged from 7.72 to 10.22 mg/kg for butachlor, 12.38 to 16.22 mg/kg for carbofuran and 15.07 to 18.81 mg/kg for malathion. The LC$_{50}$ value of *D. willsi* determined for three pesticides were much higher than their respective recommended agricultural doses.


The histopathological and histochemical examinations of the gills of *Channa marulius* under CuSO$_4$ and ZnSO$_4$ indicate damaging effect. However, the changes observed were found similar and indistinguishable and followed the same course of development in both pollutants. The changes observed in the structure of the gills of the fish seem to cause by irritation and absorption of the pollutants.

The toxic impact of biocide chlorine (NaoCl) on the tissue histology of an euryhaline teleost fish *Oreochromis mossambicus* revealed marked abnormalities. The liver cells showed degeneration and blood cells occlusion/stasis. The kidney tissue revealed tubular dilation, cloudy swelling of cells and necrosis. The gills demonstrated mucous elaboration, epithelial lifting and interlamellar cell debris formation. The above change in turn may result in tissue hypoxia and the consequent metabolic changes.


Significant alterations in the ionic composition of blood were recorded in *Oreochromis mossambicus* exposed to sub-lethal and lethal concentrations of endosulfan. Dysfunction of osmoregulatory processes was manifested by the increased levels of serum sodium, potassium and chloride and decreased levels of phosphate and bicarbonate. This calls for careful application of pesticides in plant protection operations to ensure proper protection of fishery resources.


The acute toxicity of selected heavy metals to a freshwater *T. tubifex* Muller was determined in very soft, soft, hard and very hard (12, 45, 170 and 300 mg CaCO₃ L⁻¹ total hardness, respectively) water. Percentage mortality of *T. tubifex* as influenced by heavy metals was studied in water of variable hardness. Water hardness had a significant effect on heavy metals toxicity. The results indicate that Cu, Cd, Hg and Zn induced autonomy of the caudal region and mucus production. It is concluded that water hardness parameters should be considered in establishing appropriate water quality criteria and standards for the protection of aquatic fauna and flora, and ultimately human health.


Attempt has been made to study the physiological and biochemical responses and to evaluate the bioaccumulation potential of moss *Sphagnum* to environmental lead. Supply of 0.1 to 100 mM lead acetate caused a loss in chlorophyll and nitrogen content of moss and in nitrate reductase activity in the moss, although the peroxidase activity was increased. Partial recovery in the above parameters was recorded upon
simultaneous treatment with glutathione. Results also indicate that treatment with glutathione increased the bioaccumulation potential by lowering the lead toxicity.


Routine static tests were conducted for determining the median lethal tolerance limit of paddy field crab, Paratelphusa hydrodromus exposed to copper, arsenic and HCH at different time intervals of 24, 48, 72 and 96 hours. The LC_{50} values for copper came to be 28.00, 22.00, 18.00 and 15.70 ppm; arsenic 136.00, 128.00, 121.00 and 114.00 ppm and HCH 10.00, 8.80, 7.00 and 6.00 ppm, respectively. The safe concentration, application factor and safe application rate were calculated for Copper: 5.56, 1.59 and 3.26 ppm, Arsenic: 38.53, 11.40 and 76.00 and HCH: 4.07, 0.06 and 1.28 ppm.


Glucose content in the brain of Heteropneustes fossilis, exposed to sub-lethal concentration of carbaryl (0.04 ppm) for a period of one month has been studied. The brain showed significant decrease in glucose content from first week of treatment onwards. The amount of glucose decreased from -67.3%, to and -80.8% for a period of 30 days.


The effect of lead on the behaviour of tilapia (Oreochromis mossambicus) exhibited alteration in their behavioural patterns. The majority of fish exposed to lead remained in the upper layer of the water column, whereas the untreated fish positioned themselves either in the middle or the bottom of the water body. Feeding activity of the fish decreased on exposure to lead. The majority of the individuals exhibited difficulty in locating and handling the food materials.

The use of pyrethroids and pesticides have now diverse application extending from crop protection to personal protection. The comparatively greater margin of safety and low incidence of side effects makes them attractive and add to their value. The review is an effort to characterize their health risk in human exposure situations. It suggests a watch on introduction of chemical variants of pyrethroids and clinicotoxicological vigilance should be maintained.


Toxicity of zinc has been evaluated in *Channa punctatus* (Bloch), after exposing the fish to sublethal concentrations of ZnSO₄ (10 mg/L, 15 mg/L and 25 mg/L) for 15 days. Biochemical changes in the liver and muscle were noted after 8, 10 and 15 day autopsy intervals. Significant depletion was recorded in liver glycogen, total proteins and cholesterol levels and similar results were obtained for muscle glycogen and proteins. These changes were time and dose dependent.


Phthalates, used as plasticisers, and dioxins, released during recycling plastics, cause health hazards including cancer. The plastic menace can be solved by using eco-friendly biodegradable plastic - the polyhydroxyalkanoates (PHAs), which are storage compounds synthesized by over 50 genera of bacteria. Biopol is a biodegradable plastic [poly (3-hydroxybutyric acid-co-3-hydroxyvaleric acid)] manufactured using *Ralstonia eutropha*.


DDT, HCH, their isomers and metabolities were analyzed in samples of soil and rice plants collected from ten different villages of a well-known Basmati rice growing area in Dehradun. Residues of both pesticides were found in all samples of soil and different parts of rice plants except for a few grain samples. Maximum residue was observed in husk and minimum in grains. The average concentration of DDT in soil ranged from 0.013 to 0.238 ppm. The average concentration of DDT in rice grain varied from 0.002 to 0.040 ppm. The average concentration of HCH in soil ranged from 0.122 to 0.638 ppm. The average HCH concentration in rice grain ranged between 0.013 and 0.113 ppm.
0301-219. Tilak KS, Veeraiah K, Jhansi Lakshmi S (Dept Zoo, Nagarjuna Univ, Nagarjunanagar 522510). **Studies of some biochemical changes in the tissues of Catla catla (Hamilton), Labeo rohita (Hamilton) and Cirrhinus mrigala (Hamilton) exposed to NH$_3$-N, NO$_2$-N and NO$_3$-N. J Environ Bio, 23(4)(2002), 377-381 [15 Ref].**

Biochemical changes, total proteins, glycogen, aspartate and alanine (AAT and ALAT) amino transferases were studied with exposure of sublethal concentrations of NH$_3$-N, NO$_2$-N and NO$_3$-N to the freshwater fish *Catla catla* (Hamilton), *Labeo rohita* (Hamilton) and *Cirrhinus mrigala* (Hamilton). Depletion in the food reserves and enzyme activity was observed in all the three fish species exposed to those toxicants. Hence, the concentrations of NH$_3$, NO$_2$ and NO$_3$ in water need to be monitored in water quality in aquaculture practices.


Fenvalerate, a synthetic pyrethroid was tested in the fish *Ctenopharyngodon idellus* (Velenciennes) to determine LC$_{50}$ values for 24, 48, 72 and 96 h by employing static and continuous flow through system (C.F.). The static LC50 values are 10% higher to C.F. values. The fish were exposed to sublethal concentration of 1/10 of 24 h of LC$_{50}$ (3.45 mg/l) for 8 days. During the period of exposure, decreased levels of glycogen and proteins were observed. The percentage of degree varies in different tissues and is between 40 and 60%.


Fenvalerate is used extensively and is most effective pyrethroid. The technical isomer is a mixture of four optical isomers 2 S, a S, 2R and a S. The 2S isomers are more toxic than 2R. The toxic action of the toxicant depends on metabolism and mode of action in aquatic organism. Hence to study it static and continuous flow through tests were conducted to determine LC$_{50}$ values to the freshwater fish. The possible mechanism of toxic action is presented.

0301-222. Trivedi SP, Kumar Manoj, Banerjee Indrani (Environ Toxico Lab, Dept Zoo, Univ Lucknow, Lucknow 226007). **Linear alkyl benzene sulphonate (LAS) induced xenobiotic anomalies in the activity of LDH and SDH in the muscles of fresh water teleost, Heteropneustes fossilis (Bloch). J Ecophysio Occupl Hlth, 2(3&4)(2002) 205-214 [34 Ref].**
Short-term static bioassays were conducted for 24, 48, 72 & 96 hr durations by exposing an air breathing food fish *Heteropneustes fossilis* to three different fractional concentrations of LC values of LAS. Significant changes in the activities of lactate dehydrogenase (LDH) and succinate dehydrogenase (SDH) in the muscles of *H. fossilis* were recorded under different sets of xenobiotic exposures of neutralized form of LAS. The findings are thus quite alarming and confirm the hazardous nature of syndet/detergent pollutants.


Paper studies the diseases caused by hazardous waste from the textile industries and analyze, the major diseases suffered by people staying around a textile industry. Since, the very concept of the diseases to which a person staying in the neighbourhood of a textile industry is a vague concept and further one may suffer from one or more diseases in different degree. Paper uses fuzzy analysis in general and fuzzy associative memories in particular to study this problem and gives the conclusion of the study.

0301-224. Verma Yeshvandra, Rana SVS (Toxico Lab, Dept Zoo, Ch Charan Singh Univ, Meerut 250004). **Biological monitoring of exposure to toluene in Indian shoe makers.** *J Ecophysio Occupl Hlth*, **2**(1&2)(2002), 127-134 [29 Ref].

Indian shoe industry poses a serious health risk to shoe makers. This observation was made while studying the urinary hippuric acid in subjects exposed to glue for different periods. Urinary hippuric acid increased with increase in period of exposure to toluene. A comparative study amongst smokers, alcoholics and non-vegetarian subjects was also made. It is concluded that smoking and alcohol consumption enhance excretion of hippuric acid.


Organochlorine and carbamate pesticides (endosulfan and carbaryl) are found toxic to brackish water Oligochaete *Pontodrilus bermudensis* at different seawater concentrations. Both the pesticides are highly toxic in low salinity concentrations (25%). Endosulfan exerted more influence than carbaryl on the worm. Behavioural and symtomatical changes in the worm are more pronounced in endosulfan exposed worms. The results showed that the toxicity of both the pesticides as synergistic at low concentrations of sea water.