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Man has made great strides towards industrial development and civilization which has without doubt improved the living conditions and comforts of human life. Human activity and consequent developments have brought the spectra of an overwhelming degradation of all facets of the natural environment, physical, chemical, biological and social.

With increasing human population in the world every year, the problem of producing more food annually is apparent. Food security depends on productivity in agriculture and pesticides are integrated components of the same. Pest control is an important aspect of green revolution to increase the crop yield but these toxic chemicals designed to kill pests have damaging influence on the non-target aquatic organisms. The indiscriminate and extensive use of pesticides to protect crops poses threat to humans and surrounding environment. These pesticides are posing great threat to aquatic fauna which constitute one of the major sources of protein rich food for mankind.

There are more than 1000 different agrochemicals, which are being manufactured and used for agriculture as well as public health purposes. Pesticide consumption in India has increased from 2353 MT in 1955 to 40,672 MT in 2005 for technical grade chemical pesticides. In March, 2005, 186 technical grade pesticides were registered in the country for use under section 9(3) of Insecticides Act, 1968. (Directorate of Plant Protection and Quarantine, Govt. of India). Indian pesticide industry has achieved the status of second largest basic pesticide manufacturer in Asia after Japan. Interestingly, India’s consumption of pesticides per hectare is low (0.5 kg/ha) when compared with world averages like those of Korea (6.60 kg/ha) and Japan (12.0 kg/ha). According to the pesticide industry statistics, India spends only $3/ha on pesticides compared to $24/ha spent by the Philippines, $255/ha by South Korea and $633/ha by Japan.
However, the contamination of food products in the country is alarming. About 20% of Indian food products contain pesticide residues above tolerance level compared to only 2% globally. This is primarily due to their non-judicious use in certain areas/states, lack of awareness and inadequate information dissemination amongst the farming community.

Pesticide usage for cultivation of food crops amongst different states of India indicates a mixed pattern. The per hectare pesticide usage is highest in Punjab (923 g/ha) as compared to other agriculturally advanced states like Haryana (843 g/ha), Andhra Pradesh (548 g/ha), Tamil Nadu (410 g/ha), Karnataka (216 g/ha) and Gujarat (47 g/ha).

Pesticide toxicity in aquatic environment is mainly depending upon the water quality, concentration gradient and species specific. These pesticides affect general metabolism of the aquatic organisms including rate of oxygen consumption, biochemical manipulations, histopathological changes in the reproductive organs and other gastrointestinal organs, alter nervous system and affect the behavior of the animals. The literature reveals that organophosphate and organochlorine pesticide poisoning is increasing concern for the management of aquatic resources from Indian waters. Therefore, in the present investigation two pesticides have been selected viz, dichlorovos (76% EC) an organophosphate and dicofol (18% EC) an organochlorine insecticide for conducting experimentation. Major literature is available on the aquatic toxicity of the fishes and other vertebrates as far as toxicological studies are concern, whereas very little information is available as far as freshwater lamellibranches mollusc is concern. Therefore, in the present study the freshwater bivalves, Parreysia cylindrica has been selected for the present investigation, which is an ideal experimental animal and distributed from inland waters from Maharashtra state.
Reasons for selection of ascorbic acid:

Ascorbic acid is an antioxidant vitamin. It helps to prevent oxidation of water soluble molecules that can create free radicals. Ascorbic acid also indirectly protects the fat soluble vitamins from oxidants. It acts as a detoxifier and reduces the side effects of drugs and also reduces the toxicity of pollutants. It plays vital role as an antioxidant that serves protective function against oxidative damage in tissues. In animals during stressed condition ascorbic acid level is altered which indicates protective role of ascorbic acid in detoxification. Antioxidant property of ascorbic acid helps to prevent free radical formation from water soluble molecules, which may causes cellular injuries and diseases.

It is confirmed that the free radical scavenging property of L-ascorbate is responsible for reducing damages. So that, for the detoxification of pesticides from animal body ascorbic acid can be ideally useful. Vitamin-C has been shown to play an important role in the process of hydroxylation, oxygenation and oxidation of corticosteroids. The role of ascorbic acid in disease and tissue repair is also well known.

The role of ascorbic acid as an anti-oxidant in detoxification of pesticides was observed independently as well as in combination with pesticides.

Reasons for selection of Parreysia cylindrica as an experimental model:

Molluscs are the soft bodied aquatic animals. About 1, 12,000 species of the molluscs are known to mankind. These bivalves are the source of food for human beings in various parts of the world such as China, Japan, Malaya, Europe and America. These are also having economical importance as these are used in the production of toys, ornaments, utility articles, lime, cement, paint, etc. These are also most successfully used for the pearl production. Oysters have been drawn the
attention of zoologists for pearl culture. The artificial pearl culture techniques have been developed at National Institute of Oceanography, Goa and Central Marine Fisheries Institute, Cochin in India. The shells of Cypraea (cowrie) were used as money as well as ornaments.

The vulnerability of aquatic species to chemical pollution depends on pollutant properties, pollutant concentrations entering ecosystems and capacity of ecosystems to resist increases in concentrations of pollutants. Bivalve molluscs are considered to be useful indicator organisms for assessing environmental pollution levels. This is because of number of factors including ease of collection, widespread distribution, relatively sedentary habits, suitable size and often ecological and economic importance. Pesticides can enter bivalve molluscs by two main routes; through the large exposed areas of gills and mantle, and through filter feeding activity.

For the present research work, Parreysia cylindrica was selected as an experimental model because the body wall, gill, gonad, digestive glands and mantle of this animal are soft through which substance diffuses easily as compared to thicker skin. This animal is filter feeder, because all above-mentioned organs always bath in toxicant contaminated water, large surface of the body is exposed to water at particular strength, so that there is no problem of feeding or injecting the doses and the effect will be prominent at low doses. The animals are easily available in large number and are easy to rear in the laboratory.

For the present investigation four chapters are structured, which deals with different aspects as mentioned below:

i) Toxicity evaluation
ii) Biochemical studies
iii) Histopathological studies
iv) Neurosecretion
The first chapter on “Toxicity evaluation” includes a brief account of the literature of work based on the toxicology. The impact of dicofol (organochlorine) & dichlorovos (organophosphate) on biological systems has been pointed out. The toxicity tests are useful -
- To provide suitable environment for aquatic life.
- To find out relative toxicity of different pesticides to test species.
- To determine the favorable and unfavorable concentrations of pesticides in environment to the organism.
- To determine the dose for the study of the effect of chronic exposure to the aquatic organism.
- To determine the safe concentration of toxicant to the organism.

The toxicity tests thus throw light on the sensitivity of the organism to the respective pesticide based on the duration of exposure. Ten bivalves in each group were exposed to several concentrations of dicofol (organochlorine) & dichlorovos (organophosphate) and the mortality in each group was observed after every 24 hours. Then there started a journey of statistical calculation of probit analysis by Finney’s method (1971). The LC$_{10}$ and LC$_{50}$ values and regression equations calculated by this analysis for dicofol (organochlorine) & dichlorovos (organophosphate) are presented in tables for Parreysia cylindrica. For sake of simplicity, the cumulative values of LC$_{10}$ and LC$_{50}$ of dicofol (organochlorine) & dichlorovos (organophosphate) to Parreysia cylindrica and respective regression equations are summarized in table. Dicofol was found to be more toxic as compared to dichlorovos. The results are followed by the discussion, which is supported by the cited literature.

The second chapter deals with the “Biochemical Studies” of total proteins, ascorbic acid, DNA, and RNA content from various soft
body of control and experimental bivalves at various periods of exposure to pesticides.

In the present study effect of chronic dose of pesticides dicofol (0.04023 ppm, \(LC_{50/10}\) of 96 hours), and dichlorovos (0.09376 ppm, \(LC_{50/10}\) of 96 hours), with and without ascorbic acid and its subsequent recovery in normal water and in presence of L-ascorbic acid are studied with respect to biochemical changes in soft body tissues like gills, gonad, mantle, foot, digestive gland and whole soft body tissues. Various soft body tissues from experimental and control groups of bivalves at various periods of exposures were removed and dried at 80 °C in the oven till the constant weight of dry tissues were obtained. From each powder proteins were estimated by Lowry’s method (Lowry et al., 1951) by using Bovine Serum Albumin (BSA) for standard. The diphenylamine method of Burton (1956) was followed to determine tissue DNA content while the amount of RNA contents was measured following Orcinol method of Volkin and Cohn (1954), and Ascorbic acid was estimated by the method of Roe J.H. (1967) using the hydrazine reagent.

The results are given in the tables with percent change over control and the results of test of significance. It was observed that after chronic exposure of dicofol and dichlorovos, there was a significant decrease in protein, ascorbic acid, DNA and RNA content in various tissues of experimental bivalves as compared to those of control bivalves. The protein, ascorbic acid, DNA and RNA content was less decreased in pesticides with ascorbic acid exposed bivalves as compared to those exposed to pesticides alone. The bivalves showed fast recovery of tissue protein, ascorbic acid, DNA and RNA in presence of 50mg/l ascorbic acid than those allowed curing naturally. The results are discussed by comparing them with literature and probable role of ascorbic acid.
The third chapter deals with the “Histopathological Studies” of digestive gland (hepatopancreas) and ovary of *P. cylindrica*. In the present study effect of chronic dose of pesticides dicofoi 0.04023 ppm (LC$_{50/10}$ of 96 hours), and dichlorovos 0.09376 ppm (LC$_{50/10}$ of 96 hours), with and without ascorbic acid and its subsequent recovery in presence of L-ascorbic acid are studied with respect to histopathology of digestive glands and ovary. It was observed that the structure of digestive glands and ovary was badly affected by pesticides in proportion to the period of exposure. The histological alterations in the structure of these tissues by pesticides were minimum in presence of L- ascorbic acid.

The bivalves pre-exposed to pesticides showed fast recovery with respect to histomorphological structures of digestive gland and ovary in presence of L- ascorbic acid as compared to those, which recovered naturally. The photo plates of histomorphological changes are presented in this chapter. The results are discussed with the citation of literature and the references supporting the work are cited at the end. The probable role of ascorbic acid is mentioned.

The fourth chapter deals with “Neurosecretion”. In the present study effect of chronic dose of pesticides dicofoi 0.04023 ppm (LC$_{50/10}$ of 96 hours), and dichlorovos 0.09376 ppm (LC$_{50/10}$ of 96 hours), with and without ascorbic acid and its subsequent recovery in presence of L- ascorbic acid are studied with respect to histopathology of neurosecretory cells of cerebral ganglion.

It was observed that the structure of neurosecretory cells of cerebral ganglion was badly affected by pesticides in proportion to the period of exposure. The histological alterations in the structure of neurosecretory cells by pesticides were less in presence of L-ascorbic acid. The bivalves pre-exposed to pesticides showed fast recovery with respect to histopathological structures of neurosecretory cells in presence of L- ascorbic acid.
of L-ascorbic acid as compared to those, which recovered naturally. Thus it indicates the protective and curative properties of ascorbic acid against the pesticide damage. The photo plates of histopathological alterations in neurosecretory cells are presented in this chapter. The results are discussed with the citation of literature and the references supporting the work are cited at the end.