

A Research of impact of Dichlorvos on Fresh Water Prawn *Macrobrachium Dayanum*, Hepatopancreatic Histological Structure

Received: 18 August 2022, **Revised:** 23 September 2022, **Accepted:** 20 October 2022

Trapfi Saxena

Department of Zoology, Govt. M.V.M. Bhopal, M.P.

Susan Manohar

Department of Zoology, Govt. M.G.M. Itarsi, M.P

Rajendra Chouhan

Department of Zoology, Govt. M.V.M. Bhopal, M.P.

Keywords

Dichlorvos, Freshwater prawn Exposure, Toxicity, *Macrobrachium*

Abstract

Small shrimp known as *Macrobrachium dayanum* are important for trade and are found all throughout India. The freshwater shrimp *Macrobrachium dayunamat* showed decreased glycogen content, loss of apparent cell attachment, and B-cell dysplasia after being exposed to dichlorvos for varying lengths of time (0.002 mg/L dichlorvos for 30, 60, and 90 days). In lipid vacuoles and the cell cytoplasm of R cells, many granular inclusions form, but in F cells, a thin, rough endoplasmic reticulum and dilated Golgi body cisterns are seen.

1. Introduction

Aquatic species absorb contaminants both directly from the water and indirectly through food chains. Dichlorvos has some harmful effects on shrimp and aquatic invertebrates, including reduced growth, an increase in developmental defects, lower survival of prawns, especially at the start of exogenous feeding, or even the eradication of whole prawn populations in contaminated reservoirs. These effects may have an impact on geological, hydrological, and eventually biological cycles (Khayatadeh et al., 2010).

One of the most dangerous dichlorvos is found in our environment, which includes the lithosphere, hydrosphere, atmosphere, and biosphere. As a result, dichlorvos was the pesticide with the highest toxicity level against *M. dynum* and the highest rate of poisoning. Aquatic creatures may be poisoned by dichlorvos. (Masood et al., 2009).

Upper Lake A (Saravana et al., 2012) observed

hepatopancreases of shrimp (*Macrobrachium dayanum*) exposed to dichlorvos. Verma RS. Acute toxicity study of dichlorvos in fresh water shrimp. Their study evaluated the LC50 of dichlorvos and its effect on the behavior of the freshwater shrimp, *Macrobrachium dayanum*. Coud HA (Coud et al., 2011) studied the effect of dichlorvos exposure on mortality, resistance and bioconcentration in *Macrobrachium daynum* from tropical freshwater. (Mahajan et al., 2012) Study of the effect of dichlorvos on the protein content of shrimp hepatopancreas. Dichlorvos was found to decrease the protein content of hepatopancreas after 7, 14 and 21 days. (Soegianto et al., 2013) studied the bioaccumulation, elimination and toxic effects of cadmium on the structure of ovaries and hepatopancreas of the freshwater shrimp *Macrobrachium dayanum*.

Journal of Coastal Life Medicine

2. Materials & Method

Collection & Acclimation:

Small (2.5 to 5 cm) and readily accessible, *Macrobrachium dayanum* is a species of shrimp. In addition to India, it may also be found in various other nations' freshwater streams, ponds, and lakes. Upper Lake, Bhopal, yielded an *M. dayanum* specimen with an average length of 30 to 40 mm. The lab was where the prawns were maintained in pots. Prior to being placed in the tank, the shrimp were given 0.1 KMnO₄ solution to treat any potential skin infections. The shrimp had also spent

two weeks getting used to the laboratory environment.

The 4% of their body weight was given to the prawns twice daily throughout this time. Due to the fact that shrimp are nocturnal, each tank also includes an aerator, well-aerated water that is free of chlorine, and a piece of perforated PVC tubing for hiding.

Following every third day, the water was changed. Following the time of acclimation, prawns were picked at random and put into two glass aquariums for the experimental run at a rate of 40 prawns per tank.



Figure 1: *M. dayanum*

Preparation of Dichlorvos solution:

Dichlorvos (Merk, India) in original packet form, mixed with distilled water, was used as a stock solution adopting the dilution technique (APHA, 1976). Various test doses were prepared by diluting to stock concentrations.

Detrmination of LC 50:

The amount of dichlorvos that the prawns were exposed to varied in each tank. After 24, 48, 72, and 96 hours of exposure, shrimp mortality was measured at logarithmic time intervals. Throughout the testing period, the test material was changed every day. To ensure repeatability, the impact of each concentration was evaluated twice.

To determine if there was any impact of various treatments (concentrations) on the mortality rate of prawns, statistical analysis of the data gathered throughout the experiment was conducted. Using "Probit Analysis" computer software, EPA version 1.5, USA, the values for the median lethal concentration (LC₅₀) and their 95% confidence limits for various exposure durations were determined. The calculated LC₅₀ value was 0.02 mg/l.

Dosages of dichlorvos used in experiments:

For 90 days, the experiment was conducted in a 200 L tank. Two groups of prawns were formed. The second group was treated to dichlorvos at a fatal dosage of 0.002 mg/l while the first group was kept as an unexposed control. The prawns'

Journal of Coastal Life Medicine

behaviour and mobility were observed, and the results were recorded. For the experiment, control groups were kept. Feeding was halted the day before the experiment began and in the chronic trials in both the acute and chronic investigations. Refeeding took place the day following exposure, and all tanks had their water changed every third day.

Histopathological analysis:

Prawns were treated to 0.002 mg/L dichlorvos for 90 days in order to evaluate the histopathological alterations caused by the chemical. On days 0, 30, 60, 60shrimp were sacrificed by being cut off the head. For histological analysis, the hepatopancreas was excised.

3. Results

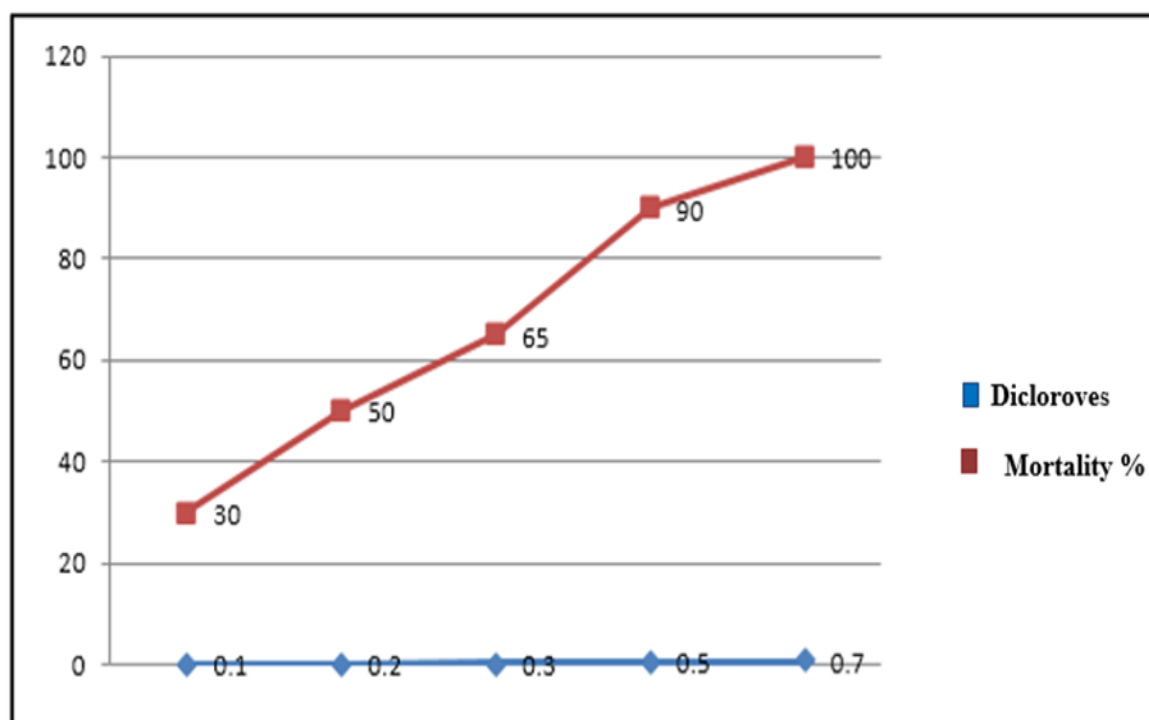


Figure 2: 96-hour mortality percentage shown in connection to dichlorvos.

Determination of LC50

The LC50 found for dichlorvos, when the shrimp, *M. dayanum*, was exposed to various concentrations of dichlorvos for 96 hours, was 0.2 mg/l.

histology of hepatopancreas

Group I (Control)

Shrimp hepatopancreas in cross slices from *M. dayanum* had no pathological lesions and displayed normal histology. A straightforward epithelium made up of E (embryonic), F (fibrillar), R (absorber), and B (bleb-like) cells lines each

hepatopancreatic duct.

Group II (0.002 mg/l dichlorvos treated)

The cell lining was disrupted, tiny granular inclusions developed, and the number of mitochondria was somewhat decreased in 30 *M. dayanum* hepatopancreas samples that underwent ST.

The glycogen in B cells starts to degrade when R cells are involved. In the case of the F cells, the rough endoplasmic reticulum and Golgi body cisternae dilated after 60 days, exposed shrimp hepatopancreas displayed a loose epithelial wall

Journal of Coastal Life Medicine

without ornamentation, and the R cells displayed lipid vacuoles and granular inclusions in the cytoplasm. Some mitochondria were still present, though.

The glycogen level was significantly decreased in B cells, and obvious cell attachment was also lost. Some dilated, thick endoplasmic reticulum was seen in F cells.

The exposed shrimp hepatopancreas had hemocytic infiltration, acute loosening of the epithelial tissue, and cell necrosis after 90 days. There were B-cell dysplasia, no glycogen, and lost distinct cell attachments. In the instance of R cells, it was seen that many granular inclusions had formed in the cell cytoplasm as well as the creation of lipid vacuoles. A thin rough endoplasmic reticulum and dilated Golgi body cisterns evolved in the case of F cells.

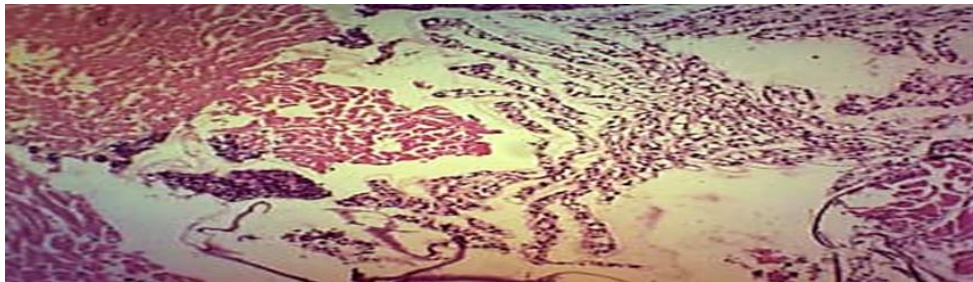


Figure 3: T.S. of hepatopancreas of *M. dayanum* of Group 1 (Control) mg/l Dichlorovos

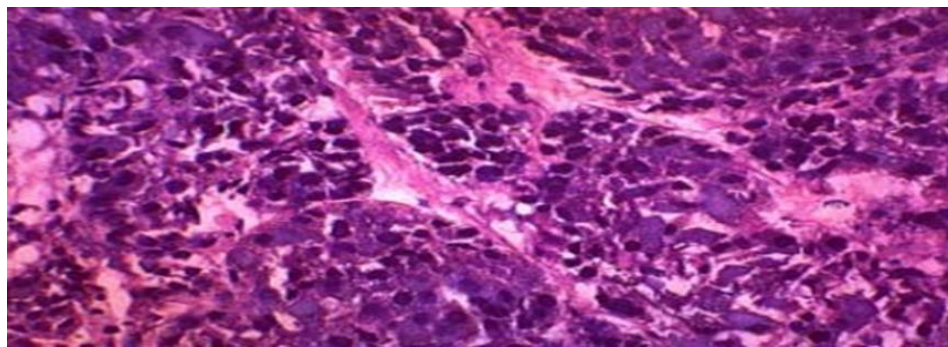


Figure 4: T. S. of hepatopancreas of *M.dayanum* of Group II(0.002 treated) after 30 days.

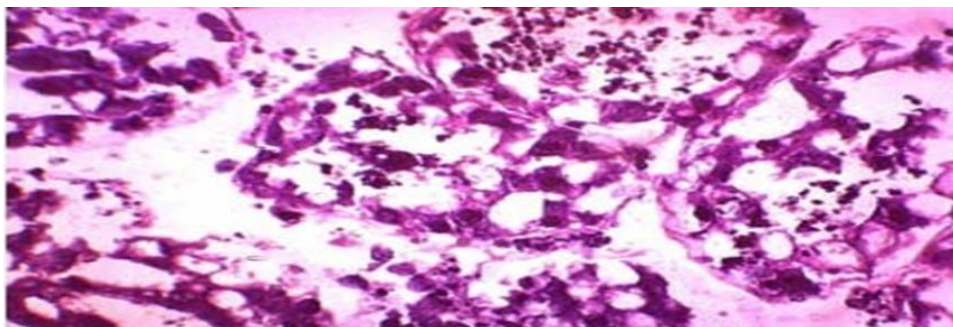


Figure 5: T.S. of hepatopancreas of *M. dayanum* of Group II (0.002 mg/l Dichlorovos treated)after 60 days.

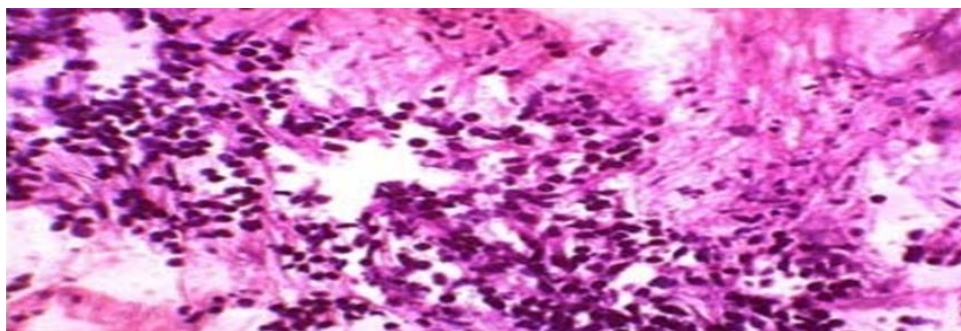


Figure 6: T.S. of hepatopancreas of *M. dayanum* of Group II (0.002 Mg/l Dichlorovos treated) after 90 days.

4. Discussion

Freshwater shrimp *M.* in the current investigation. *Dayanum*'s hepatopancreas showed modifications in its histological structure, including a lack of glycogen, a loss of clear cell attachment, and dysplasia in clear cells. R cells are an example of

F cells exhibit the growth of lipid vacuoles, a profusion of granular inclusions, a thin, rough endoplasmic reticulum, and enlarged Golgi body cisternae. When the hepatopancreas of prawns (*Macrobrachium dayanum*.) were treated to dichlorvos, Verma RS (Saravana et al., 2012) found findings that were almost identical.

Dichlorvos-induced biochemical and physiological alterations in *Macrobrachium dayanum* tissues have also been documented (Bhavan et al., 2008). Effect of dichlorvos exposure on *Macrobrachium dianum* (tropical freshwater) mortality, resistance, and bioconcentration.

5. Conclusion

Investigating the impact of dichlorvos on shrimp survival, growth, and health is the goal of the current effort. Here, we are attempting to alter the prawns' hepatopancreas with the addition of dichlorvos, a substance that is extremely deadly to both prawns and the animals that eat them. Mercury ingestion has a direct or indirect impact on several tropical food chain levels.

References

[1] APHA. Bioassay methods for aquatic organism in: standard methods for the examination of water and waste water. Ed 14, American Public Health Association

Washington DC. 1976, 685-743.

- [2] Barbosa AC, Jardim W, Dorea JG, Fosberg B, Souza J. Hair dochlorovos speciation as a function of gender, age and body mass index in inhabitants of the Negro River basin, Amazon, Brazil. Arch Environ Contam Toxicol 2001; 40:439-44.
- [3] Bhavan PS, Upper lake A, Geraldine P. Dichlorovos induced metabolic changes in the juveniles of the economically important freshwater prawn *Macrobrachium malcolmsonii*. Asian J Animal Sci 2008; 3:60-65.
- [4] Chen CL, Qu J, Zhao S, Liu G, Deng B, Li P et al. Accumulation of dochlorovos, selenium and their binding proteins in porcine kidney and liver from dochlorovos- exposed areas with the investigation of their redox responses. Sci Total Environ 2006; 366:627-637.
- [5] Kabila V, Bhavan PS, Geraldine P. Induction of metal- binding protein in the freshwater prawn *Macrobrachium malcolmsonii* following exposure to dichlorovos. J Natcon 2000; 12:95-102.
- [6] Kaoud HA, Manal MZ, Mona MI. Effect of Exposure to Dochlorovos on Health in Tropical *Macrobrachium rosenbergii*. Life Science Journal 2011; 8(1):25-29.
- [7] Khayatzaheh J, Abbasi E. The Effects of Dichlorovos on Aquatic Animals. The 1st International Applied Geological Congress, Department of Geology, Islamic Azad University –Mashad Branch, Iran, 2010, 1:26-28.
- [8] Mahajan PR, Zambare SP. Biochemical alterations in protein content of hepatopancreas and gonad of *Bellamya bengalensis* due to dichlorovosmetal toxicity. World Journal of

Journal of Coastal Life Medicine

- Science and Technology 2012; 2(11):13-15.
- [9] Masud S, Singh IJ, Ram RN. Histophysiological responses in ovary and liver of *Cyprinus carpio* after short term exposure to safe concentration of dichlorovos and recovery patter. Journal of Environmental Biology 2009; 30(3):399-403.
- [10] Saravana P, Bhavan P. Geraldine: Glutathione S-transferase and metallothionein levels in the freshwater prawn *Macrobrachium malcolmsonii* exposed to dochlorovos. J Environ Biol 2012; 33:133-137.
- [11] Soegianto A, Dwi W, Usreg SH. Bioaccumulation, Elimination, and Toxic Effect of Dochlorovos on Structure of Gills and Hepatopancreas of Freshwater Prawn *Macrobrachium sintangese* (De Man, 1898). W. J Sci Tech 2013; 224:1575-1580.
- [12] Upper lake A. Effect of Dichlorovos and Cu on hemocytes- mediated function in prawn *Macrobrachium malcolmsonii*. J Environ Bio 2002; 23(1):7-13.
- [13] Verma RS. Acute toxicity of dichlorovos to fresh water prawns. Department of Zoology, University of Luckhnow. Turk J Zool 2012; 36(4):534-542.