

## Histopathological Changes in Ovary of Freshwater Prawn, *Macrobrachium Kistnensis* Exposed to TBTCI

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**Abstract:** There is a still concern about the effects of organotin compounds on freshwater organisms especially on their reproductive system. We investigated the toxicity of TBTCI and its effects on ovary of freshwater prawn, *Macrobrachium kistnensis* at different concentrations in present study. After exposure of different concentrations as 0.33 ppm, 0.26 ppm, 0.17 ppm and 0.09 ppm LC50 values for 24 h, 48 h, 72 h and 96 h respectively of tributyltin chloride, the ovaries showed different changes in their architecture. There was a destruction of epithelial layer and evidence of degeneration of oocytes and disorganization of nucleus after treatment of 0.26 ppm of TBTCI. Vacuolization at periphery, degenerating oocytes with disintegrated nuclei and vacuolization and alteration in shape was observed for 0.09 ppm.

**Key words:** TBTCI • Histopathology • Ovary • *Macrobrachium kistnensis*

### INTRODUCTION

Environmental degradation in the modern world increased considerably due to man's excessive intellectual trespassing on delicate environmental limits. Pollution of aquatic ecosystem by chemical used in industry and agriculture is increasing day by day, heavy metals, pesticides, antifouling agents, fertilizers and agricultural drainage from water bodies adversely affects on growth and survival of aquatic animals. Today there is no brook, pond, lake, river or sea environment that is entirely free from pollution, due to the consistent rise in use of toxic chemicals. These chemicals used in industries, horticulture and layer on ships, pipelines or boats reach ultimately the water bodies along with the run off. As a result, the large mortality of aquatic life has been reported due to direct attack of pollutants on aquatic animals, there is imbalance in their physiological activities with respect to respiration, reproduction, excretion and osmoregulation etc. These chemical pollutants directly indirectly enter into the body of aquatic animals and affect on different parts of their body and affect vital physiological mechanism.

Histopathological studies were useful in evaluating the pollution potential of organotins since trace amount of these chemicals which do not bring mortality over a

period were capable to producing considerable organ a damage, [1]. In addition, analysis of histological changes in target organs provides a valuable tool in understanding the role of specific cells and organelles metabolism, [2, 3]. Tributyltin compounds are already being used in variety of paint formulation either alone or as an active agent or in combination with metal ion compounds [4, 5]. Tributyltin compounds are extremely effective and relatively economical as biocides, contributing to rapid uptake of organotin based paints by shipping industry and small boat owners in 1970's. These compound causes variety of effects in aquatic environment, [6]. They interfere and interact with various physiological activities of the organism like reproduction, which is an important biological phenomenon dominating all other physiological processes and are a need to the animal for continuity of their races, [7].

Histopathological effect of pollutants on various tissues of aquatic animals was studied by many workers. Ovary is the reproductive organ when oocyte maturation takes place i.e. vitellogenesis. Machale *et al.* [8] studied on the histopathological changes in the ovary of freshwater crab, *Barytelphusa guerini* exposed to copper sulphate and reported extensive damage to oocyte. Sarojini *et al.* [9] studied the effect of heavy metal pollutant, cadmium chloride on ovarian

histopathology in freshwater crab, *Barytelphusa guerini*. Gyananath [10] reported the histopathological lesion in gonads of freshwater prawn, *Macrobrachium lamerrii* exposed to potassium ferrocynide. Reddy *et al.* [11] observed that the sumithion affects on the ovarian growth of crab, *Oziotelphusa senex senex*. Victor [12] observed structural changes in ovary of freshwater prawn, *Caridina rajadhari* exposed to malathion and DDT.

Tributyltin affects the *Oyster gigas* was first noticed by Alzieu and Heral [13]. Bruno and Ellis [14] observed histopathological changes in different tissues of Atlantic salmon, *Salmo salar L.*, attributed to use of tributyltin antifoulant. Indira [1] worked on histological changes in gills and ovary of prawn, *Caridina rajadhari* exposed to Tributyltin oxide. Bodar *et al.* [15] investigated cytological changes of digestive tract and storage cells in *Daphnia magna* exposed to cadmium and tributyltin. Dode [16] reported morbid changes in ovary and hepatopancreas in freshwater prawn, *Macrobrachium kistnensis* due to impact of organotin mellatoids copper.

Very few literatures were available on the impact of Tributyltin chloride compounds on histopathological aspects such as ovary in crustacean. Hence the present investigation was under taken to find out histopathological changes in ovaries in freshwater prawn, *Macrobrachium kistnensis* exposed to TBTCI.

## MATERIALS AND METHODS

The fresh water prawns *Macrobrachium kistnensis* were collected from Kham river near Aurangabad, Maharashtra. The prawns were maintained in plastic trough containing aerated tap water. They were acclimatized for a week in laboratory condition. The water was changed every 24 h. Prawns were fed with green algae at alternative days. 1ppm stock solution of TBTCI was prepared in acetone Laughlin *et al.* [17]. Matured healthy female prawns were selected for experiment. For each experiment 20 animals of approximately similar size ( $2.5 \pm 1$ cm in length) were exposed to 0.33, 0.26, 0.17 and 0.09 ppm LC50 values of TBTCI at 24 h, 48 h, 72 h and 96 h respectively. Simultaneously group of 20 female prawns were also set up for the experimental control period in non-contaminated medium. Tissue such as ovary were dissected out from control and experimental prawns and then fixed in Bouins fluid. Respective tissues were processed for microtechnique routine procedure for histopathological examination.



Fig. 1: (100x). Transverse section of the ovary of control prawn, *Macrobrachium kistnensis* showing vitellogenic oocytes (VO), Previtellogenic oocytes (PVO), Yolk Vesicles (YV), Germative oocytes (OG)

## RESULTS

**Control Ovary:** In result the ovary of freshwater prawn, *Macrobrachium kistnensis* (Fig. 1) was covered with an outer epithelial membrane followed by connective tissue and inner germinative epithelium. In early stage of development of germinative zone of proliferation is distinguished by the presence of compact mass of oogonial cell, which undergo meiotic division and give rise to primary oocytes. Previtellogenic oocytes were covered by a thin rim of ooplasm. The matured oocyte or vitellogenic oocytes were filled with yolk globule. The nutritive cells were present in close vicinity of the oocyte and supply the nutritive material to the developing oocytes. The degenerating ova are surrounded by the nutritive phagocytes.

**Experimental Study:** After exposure of different concentrations of TBTCI as 0.33 ppm, 0.26 ppm, 0.17 ppm and 0.09 ppm LC50 values for 24 h, 48 h, 72 h and 96 h respectively of tributyltin chloride, the ovaries showed different changes in their structural design. There was a destruction of epithelial layer and evidence of degeneration of oocyte and disorganization of nucleus (Fig. 2) after treatment of 0.26 ppm of TBTCI has been found. Vacuolization at periphery, rupturing of follicular epithelium, maximum number of degenerating oocyte with disintegrated nuclei and vacuolization and alteration in shape was observed for of 0.09 ppm (Fig. 3).

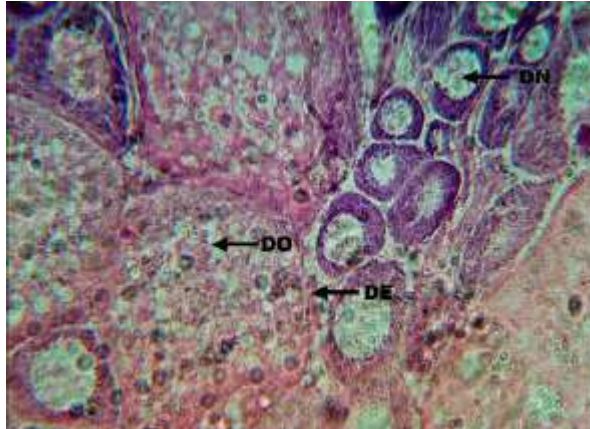


Fig. 2: (400x) After exposure lethal concentration at 0.26 ppm (LC<sub>50</sub> of 48 hrs) of TBTCI showing degeneration of oocytes (DO) and Destruction of epithelial layer (DE)

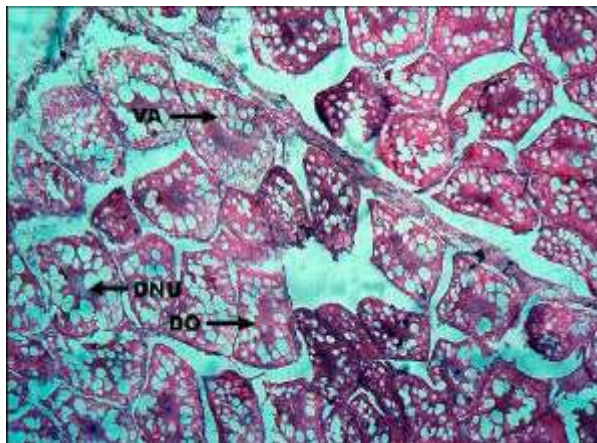


Fig. 3: (400x) After exposure lethal concentration at 0.09 ppm (LC<sub>50</sub> of 96 hrs) of TBTCI showing Disintegrated nuclei (DNU), Vacuolization and alteration in nuclei (VA) and Degenerating oocytes (DO)

## DISCUSSION

Chemical pollution in aquatic ecosystems, especially river systems, is a major environmental concern. Not only does this type of pollution cause a decrease in water quality, but subsequently affects all living organisms in the system Van Dyk [18]. In the present investigation the freshwater prawn, *Macrobrachium kistnensis* was exposed to different concentration of TBTCI.

There was a destruction of epithelial layer and evidence of degeneration of oocyte and disorganization of nucleus (Fig. 2) after treatment of 0.26 ppm of TBTCI.

Vacuolization at periphery, rupturing of follicular epithelium was observed after exposure. There was maximum number of degenerating oocyte with disintegrated nuclei and vacuolization and alteration in shape was observed for of 0.09 ppm (Fig. 3).

In summary, ovaries in *Macrobrachium kistnensis* exhibited epithelial layer destruction, degeneration of oocytes, increased phagocytic cells, vacuolization appearance in cytoplasm and nucleoplasm. TBTCI induced significant alteration in the ovary of the prawn, *Macrobrachium kistnensis*. As increased in exposure leads to increase in damage to the ovary. This damage observed in the ovary might be due to the direct effects of TBTCI on developing oocytes intervening the enzyme system in metabolism or destroying structure the function of hormone that controlling the ovarian growth [19].

Similar histopathological changes were reported in different aquatic organisms exposed to different pollutants by many researchers. Indira [1] noticed shrinkage in ooplasm, vacuolization and necrosis of nucleus and nucleolus, degeneration of tissues, disintegration of nucleus and nucleolus, fragmented cytoplasm disintegration of connective tissue and reduction in cytoplasmic material in ovary of freshwater prawn, *Caridina rajadhari* when exposed to Tributyltin oxide Sarojini *et al.* [20] reported the zinc sulphate adversely affects of on ovarian development of crab, *Barytelphusa guerini*. They investigated zinc sulphate toxicity and in their finding observed ruptured oocyte membrane and vacuolization of peripheral oocytes and disturbances to the supporting connective tissue. For longer exposure of 15 days they observed vacuolization of oocytes, striation of cytoplasm and occurrence of vacuoles. Similar results were reported by various authors [21-24].

## CONCLUSION

In conclusion, present study substantiate earlier findings that in prawn, *Macrobrachium kistnensis* when exposed to lethal concentrations of TBTCI, ovaries showed structural damage. A perusal of data available for aquatic animal exposed to different toxic pollutants, histopathologically study showed that there is a damage observed in the ovary might be due to the direct effects of TBTCI on developing oocytes intervening the enzyme system in metabolism under stress conditions. Therefore the use of TBTCI in various industries should be control.

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