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Histological alterations in the ovarian tissue of air breathing fish *Heteropneustes fossilis* exposed to sublethal concentration of malathion (50% E.C)

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Abstract

The present study deals with the effects of sublethal concentration of malathion on the ovarian tissue of an air breathing freshwater fish *Heteropneustes fossilis*. Such alterations in the ovarian tissue may have an adverse impact on reproductive system and reproduction process. In the present study malathion exposure in sublethal concentration (which is $1/10^{th}$ of the 96h LC_{50} value) resulted in degeneration of oocytes, deformation of oocytes, nuclear and cytoplasmic retraction, adhesion of oocytes, increased interfollicular space and appearance of macrophages.

Key-Words: Pesticides, ovary, malathion, sublethal concentration, *Heteropneustes fossilis*

Introduction

Pesticides are used extensively in agriculture and are one of the major water pollutants. Pesticides eradicates both target and non-target economically important species either indirectly through breaking the biological chains or directly by producing toxic stress and chemical changes. As a result of extensive application of pesticide, large scale mortalities of fish has occurred widely (Srivastava and Srivastava 1994). Fishes are very sensitive to a wide variety of toxicants in water. Various species of fish show uptake and accumulation of contaminants or toxicants such as pesticides (Herger *et al.*, 1995). After accumulation in tissues, pesticides produce many physiological, histological and biochemical changes in the fishes and other freshwater fauna by influencing the activities of different enzymes and metabolites (Nagratnamma and Ramamurthi, 1982).

Histopathological changes are often the result of the integration of a large number of interactive physiological processes. Sub lethal exposure to persistent organic compounds may alter enzymatic activities and potentially cause reproductive effects by reducing fecundity (Patyna *et al.*, 1999). Histopathology provides valuable information concerning changes in the cellular as well as sub cellular structures of an organ or tissue much earlier than the external manifestations (Au, 2004). Malathion is widely used for controlling pest in agricultural field and tea gardens.

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The present study was undertaken to investigate the detailed histological changes induced in the ovary of *Heteropneustes fossilis* exposed to sub lethal concentration of malathion.

Material and Methods

Live specimens of *Heteropneustes fossilis* (10-12 cm in length and 4-6 gm in weight) were collected locally and acclimated for 15 days. The physico-chemical characteristics of water which was used for the experiment were pH 6.4±.04, dissolved oxygen 7.8±0.32mg/l and temperature 28 ± 0.47^0 C. For chronic study 1.07 ppm concentration of malathion was taken which was the $1/10^{th}$ concentration of 96h LC_{50} for malathion. The experiment was continued for 21 days. Ten fishes with replicate were maintained in test solution along with control. After 21 days both the control and pesticide treated fishes were sacrificed for histological study. Ovary was dissected and kept in formaldehyde for 24 h., then dehydrated, embedded in paraffin and sections were cut at 5 µm thickness and stained with Haematoxylin and Eosin. Slides were viewed under Olympus CX41 microscope (X100) and photographs were taken.

Results and Discussion

Ovary of control fish showed normal histological architecture without any pathological lesions. A large number of oocytes were visible in the ovary (Fig.1). Each oocyte contained a homogenous mass of cytoplasm which was deeply stained. Nucleus with nuclei were scattered in the nucleoplasm (Fig 1). In the present study degeneration of oocytes (Fig.2) was observed after malathion treatment. Similar pathological change was reported by Narayanaswamy

and Mohan (2014) in freshwater fish *Glossogobius giuris* after malathion exposure. Pathan *et al* (2012) also reported degenerating oocytes in the ovary of *Rasbora daniconius* when it was treated with paper mill effluent. Deformation of oocytes (Fig3) was found in the present study after malathion treatment. Similar type of alteration also reported by Tantarpale and Rathod (2014) in the cypermethrin treated ovarian tissue of *Channa striatus*. Likewise Maqbool and Ahmed (2013) noticed deformation in oocytes of *Channa punctatus* when it was treated with an organophosphate pesticide –monocrotophos. Nuclear retraction and adhesion of oocytes were found in the present study (Fig 4and Fig 5).These findings are correlated with Deka and Mahanta (2012). They noticed similar pathological alteration in *Heteropneustes fossilis* after malathion exposure. Likewise Dutta and Maxwell (2003) also reported similar observation in diazinon treated ovaries of *Lepomis macrochirus*.

Cytoplasmic retraction (Fig 4) was also observed in malathion treated ovary. Deka and Mahanta (2012) found similar type of alteration in malathion treated ovary of *Heteropneustes fossilis*. Dutta and Dalal (2008) also reported cytoplasmic retraction in endosulfan treated ovarian tissues of Bluegill Sunfish.

Increased interfollicular space was seen in malathion treated ovary of *Heteropneustes fossilis* (Fig 5). Increased interfollicular space may be because of degeneration of many oocytes. Marutirao (2013) studied histological changes in the ovary of freshwater fish *Puntius ticto* under dimethoate toxicity and found similar observation. Sharma *et al* (2011) also reported increased interfollicular space in *Heteropneustes fossilis* after the treatment of cadmium chloride. In the present study macrophage (Fig 6) was visible in malathion treated ovaries. Large patches of macrophages were also reported by Dutta and Dalal (2008) in the ovary of Bluegill Sunfish after endosulfan treatment. Macrophages appeared in the exposed tissue to fight against the foreign bodies (Dutta and Dalal 2008).

In the present study alterations like degeneration of oocytes, deformation of oocytes, cytoplasmic and nuclear retraction, adhesion of oocytes etc. were noticed in the ovaries of *Heteropneustes fossilis* exposed to sub lethal concentration of malathion. Such type of alterations may have inhibitory effects on the ovarian development which can lead to reduced fecundity and abnormal offspring. Damage to the ovarian tissue may be due to the direct effects of pesticides on developing oocytes. Such damage may interfere with the enzyme system in metabolism or destroy the function of hormone that control the ovarian growth and leads to decline reproductive activity (Kumar and Ali, 2014).

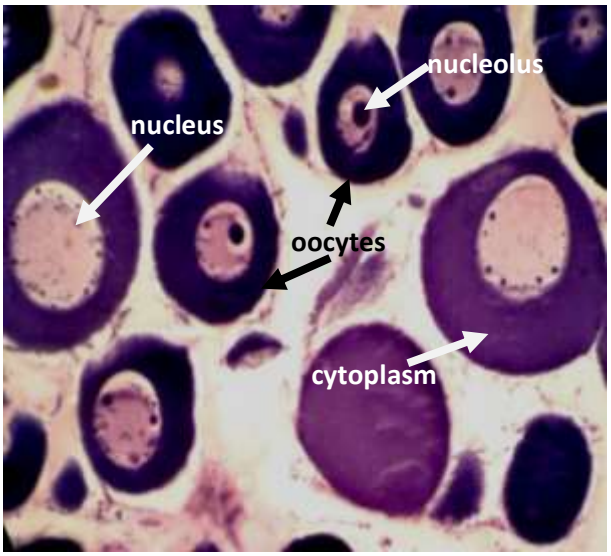

Fig.1: Control ovary showing a number of oocytes, nucleus, nucleolus and cytoplasm (100X)

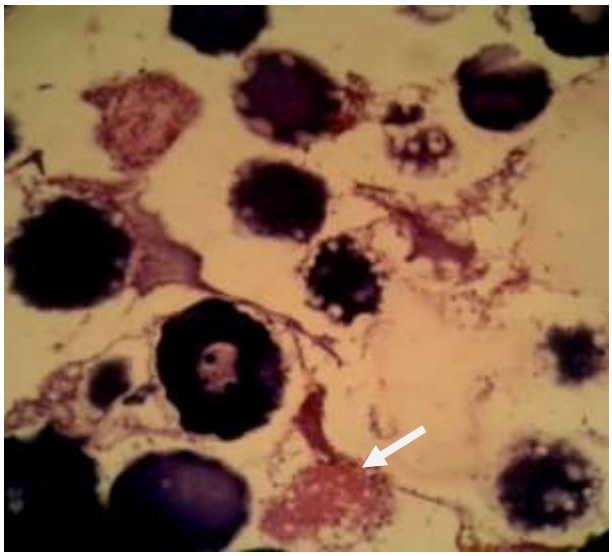

Fig.2: Malathion treated ovary showing degenerating oocytes (100X)

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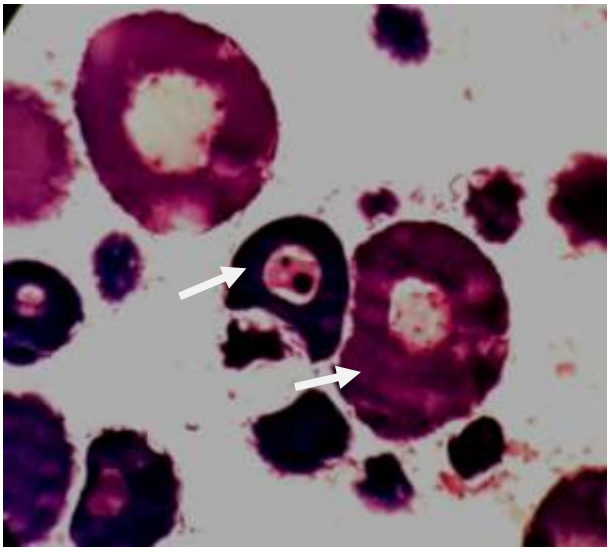

Fig.3: Malathion treated ovary showing deformation of oocytes (100X)

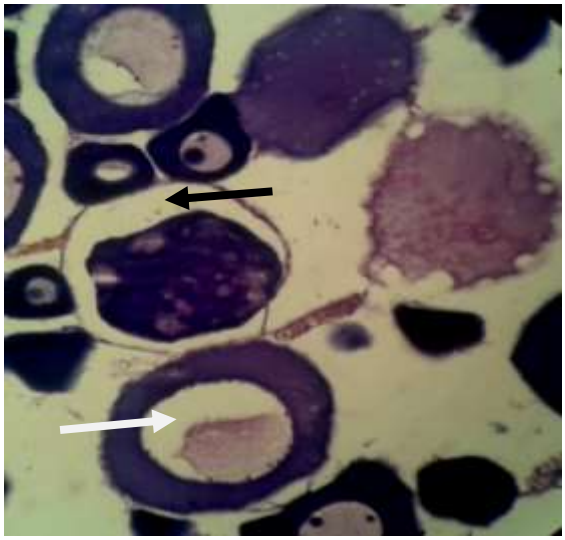

Fig.4: Malathion treated ovary showing nuclear retraction (white arrow) and cytoplasmic retraction (black arrow) (100X)

Fig.5: Malathion treated ovary showing adhesion of oocytes (black arrow) and increased interfollicular space (white arrow) (100X)

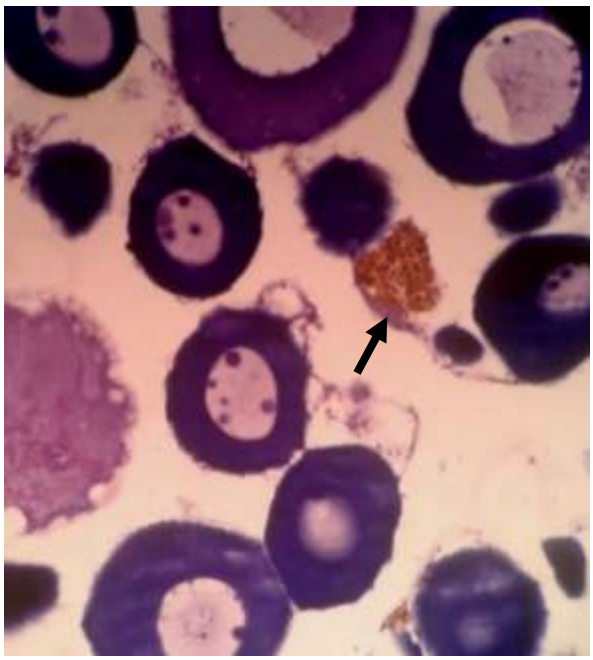

Fig.6: Malathion treated ovary showing appearance of macrophage (100X)

Conclusion

The presence of pollutants in water can trigger series of events which directly or indirectly affect aquatic life. The possible impacts are on growth, metabolic and physiological processes. From the present study it is observed that sub lethal concentration of malathion exposure to *Heteropneustes fossilis* induced several pathological alterations in the ovary as compared to normal. So we can conclude that very low concentration of the pesticides can affect the physiology of fish, which in turn may affect the yielding of the fishes. On the other hand exposure to pesticides for 21 days was sufficient to cause pathological changes in the ovary like degeneration of oocytes, deformation of oocytes, nuclear retraction etc. If it persists for a long period of time the alterations may be transferred to developing eggs and may affect the total reproductive system and process. Disruption of reproductive function will affect the successful breeding in fishes and also threaten the existence of the fishes. Fishes are integral part of the ecosystem, economically important and rich source of protein for the human population.

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References

1. Au D.W.T. (2004). The application of histo-cytopathological biomarkers in marine pollution monitoring: a review. *Mar. Pollut. Bull*. 48 (9-10): 817-834.
2. Deka S. and Mahanta R. (2012). A study on the effect of organophosphorus pesticide Malathion on Hepato-Renal and Reproductive organs of *Heteropneustes fossilis* (Bloch).*The Science Probe*. 1 (1): 1-13.
3. Dutta H.M. and Dalal R. (2008). The effect of Endosulfan on the ovary of Bluegill Sunfish: A histopathological study (*Lepomis macrochirus*). *Int. J. Environ. Res*. 215-224.
4. Dutta H.M. and Maxwell L.B. (2003). Histological examination of sublethal effects of Diazinon on ovary of bluegill, *Lepomis macrochirus*. *Environ Pollut*. 121(1) : 95-102.
5. Herger W., Jung S.J. and Peter H. (1995). Acute and prolonged toxicity to aquatic organisms of new and existing chemicals and pesticides. *Chemosphere*. 31 (2): 2707-2726.
6. Kumar M.S.A and Ali A.J. (2014). Histopathological changes in the ovaries and muscle tissues of freshwater fairy shrimp *Streptocephalus dichotomus* (Baird, 1860) exposed to Malathion and Glyphosate. *International Journal of Bioassays*. 3 (9): 3229-3232.
7. Maqbool A. and Ahmed I. (2013). Effects of pesticide Monocrotophos(organophosphate) on the gonadal development of female freshwater murrel, *Channa punctatus* (Bloch). *International Journal of Recent Scientific Research*, 4(10): 1454-1458.
8. Marutirao G.R. (2013).Histopathological changes in the ovary of freshwater fish *Puntius ticto* (Ham) under Dimethoate toxicity.*The Bioscan*. 8 (3): 989-992.
9. Nagratnamma and Ramamurthi R. (1982). Metabolic depression in the freshwater teleost *Cyprinus carpio* exposed to an organophosphate pesticide. *Curr.Sci*. 51 (13): 668-669.
10. Narayanaswamy S.Y. and Mohan M.R. (2014). Histopathological studies on hypophysis and ovary of freshwater fish *Glossogobius giuris* (Hamilton).*World Journal of Pharmacy and Pharmaceutical Sciences*, 3(8) 841-862.
11. Pathan T.S., Thate P.B, Shinde, S..E. and Sonawane, D.L. (2012). Histopathological impact of paper mill effluent in the ovary of a fresh water fish, *Rasbora daniconius*. *Journal of Fisheries and Aquaculture*. 3(1): 29-32.
12. Patyna P.J., Davi R.A., Parkerton T.F., Brown R.P., Cooper K.R. (1999). A proposed multigeneration protocol for Japanese medaka *(Oryzias latipes)* to evaluate effects of endocrine disruptors. *Sci. Total Environ.* 233: 211-220.
13. Sharma S., Manhor S., Qureshi T.A., Kaur P. and Dar B.A. (2011). Histological studies on cadmium chloride exposed air breathing fish *Heeropneustes fossilis* (Bloch) with special reference to ovaries. *International Journal of Environmental Sciences*, 2 (2): 411-416.
14. Srivastava A.K. and Srivastava A.K. (1994). Effect of chlordecone on the gonads of freshwater catfish, *Heteropneustes fossilis*. *Bull. Environ. Contam. Toxicol*. 53**:** 186-191.
15. Tantarpale V.T and Rathod S.H. (2014). Effect of Cypermethrin on the ovary of freshwater fish *Channa striatus* . *Indian J. L. Sci.*, 3(2): 87-89

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