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SEM studies in kidney of *Ctenopharyngodonidellus* (Cuvier and Valenciennes) induced by monocrotophos

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ABSTRACT

The histological effects of monocrotophos on the kidney in Ctenopharyngodonidellus (Cuvier and Valenciennes) were determined by SEM. Studies revealed that the kidney of Ctenopharyngodonidellus (Cuvier and Valenciennes) showed degenerative changes in the glomerulus due to pesticide exposure. The damage to the renal tubules increased with increase in exposure period.

Keywords: *Ctenopharyngodonidellus,* Monocrotophos, SEM

INTRODUCTION

Fishes have long been used to monitor the quality of the aquatic environment and fish histopathology is increasingly being used as an indicator of environmental stress [1] [2].Fishes exhibit enormous diversity in their morphology i.e. habit, habitat and they have long been used as a model for monitoring aquatic environment and serve as excellent model for experimental investigations. There are approximately 19,650-21,535 living fish species all over the world, out of which one third are freshwater and two third are marine [3].

Among organic pollutants, pesticides and herbicides have important role in causing water pollution. Their increased use in agriculture leads to the contamination of water table. These deadly chemicals are carried down into ground water as well as surface waters through rain and irrigation, making it unfit for drinking purpose. Thoughmonocrotophos, an organophosphate is banned for control of vegetable pests, but it is still being used widely because it is non-specific systemic insecticide and acaricide which is used to control a wide spectrum of chewing and sucking insects, ticks, spiders and also common mites [4]. It is widely used against cotton pests and on various crops like rice, bajra, cotton, wheat, citrus, sugarcane, sugarbeet, ornamentals, tobacco, potato, soyabeans etc.

As Grass carp, *Ctenopharyngodonidellus* is considered to be good candidate for composite fish culture along with Indian major carps and other Indian exotic fishes. Grass carp is a very hardy fish which can tolerate a wide range of temperatures and is adaptable to the varying environment. Due to its good taste, it fetches good price in the market. It is also introduced in these waterbodies which are heavily infested with macrophytes for the biological control of macrophytes.

The Scanning Electron Microscope is tool which is used to study the surface morphology of the different tissues. The application of SEM to the study of the cell surfaces is limited in the intact tissues because extracellular material may often obscure the details of non-luminal surface [5].

The renal corpuscles of the Lamprey mesonophros were studied by Miyoshi (1978) [6] under the scanning electron microscope and he observed that the lateral walls of the Bowman's capsule are opposed to those of the neighbouring capsules and bulging of the capillaries into capsular space are associated

with mesangial folds of the capsular epithelium. Elger and Hentschel (1981) [7] reported that the structural changes of the rudimentary glomeruli of the carp kept in 15 % salt water differ from those observed in euryhaline fish from sea water. These changes include retraction of the endothelium from the basement membrane, widening of the subendothelial region, folding of thickened basement membrane and epithelial layer when scan under electron microscope.

Scanning electron microscopy of the kidney of dog fish was studied by Brown and Green (1992). They noted that glomeruli were located close to the dorsal margin of the posterior mass of the kidney and towards the lateral edge of the anterior lobes of the kidney of female dog fish. In male dog fish, glomeruli were evenly distributed through the posterior mass of kidney. Sahoo*et al.* (2003) [9] reported the histology and electron microscopy studies of gills and opisthonephros of rohu, after exposure of acute and subacute concentration of Aflatoxin B1 and showed degeneration and necrosis of tubular epithelium and shrunken glomerulus with hyperplastic mesangial cells. With increase in the concentration of the toxicant, the severity of the effects on the glomerulus increased and led to the detachment of glomerulus from Bowman's capsule. There were changes in the bowman's capsule in the elasmobranch as studied by Lacy *et al.* (2005) [10]. These include the Bowman's capsule lined by ciliated cells, thickening of basement membrane and numerous mesangial cells.It can be concluded that pesticides adversely affect the liver, kidney, muscle and other tissues of the fish. Hence, histological studies can be used as an effective tool to determine the health of entire ecosystem. In the present study, an attempt has been made to observe possible histopathological alterations in the kidney of Grass carp, *Ctenopharyngodonidellus*.

MATERIALS AND METHODS

4.1 Procurement of fish

The live specimens of fish, *Ctenopharyngodonidellus* (Cuvier and Valenciennes) were collected from Neelamber Fish Farm, Nanoke village, District Patiala, Punjab. Fishes were acclimatized under laboratory conditions for 15 days in dechlorinated water and the tank was provided with an aerators and filters. The average length and weight of the fishes under investigations varied from 13.97 cm (± 15.5) and 20.75 gm (± 7.65) respectively at the start of experiment. The fishes were fed with fresh *Hydrilla*during the experiment so that fish tissues does not show any changes due to starvation.

The experiment was carried out by using the organophosphate Hilcron 36SL (Monocrotophos 36SL), manufactured by Hindustan Insecticides Ltd., having 36% W/W of monocrotophos as an active ingredient.

4.2BEHAVIOURAL AND MORPHOLOGICAL CHANGES

The exposed fishes were observed for any behavioural and morphological changes during acute and chronic toxicity tests. They were observed from time to time for colour change, jerky movements, feeding habits, equilibrium etc.

4.3SEM STUDIES - KIDNEY

After completion of exposure periods, fishes were sacrificed and the kidneys were removed for light microscopic investigations. It was washed in 10% saline for 5 minutes so as to make it free from blood.SEM studies were conducted for monocrotophos exposed fish to look at the finer details of the damage incurred on the exposure of the pesticide for different duration.

RESULTS

The use of pesticides has increased drastically over the last few years as these are potent tools in agriculture as well as forestry and these contribute immensely to increase the production of the crops. SEM studies were conducted for both control and monocrotophos exposed fish to look at the finer details of the damage incurred on the exposure of the pesticide for different duration.

In the control group, the kidney showed long, narrow numerous bilobed renal tubules and the kidney surface was all the more smooth (Plate 1, Figs. A and b). Upon further magnification, the kidney showed both the normal glomerulus with indispensed cells called as podocytes. These podocytes are also called as visceral epithelial cells and these form a crucial component of the glomerular filteration barrier contributing size selectivity besides maintaining the filteration surface area (Plate 1, Figs. c and d). Further exposure of the pesticide for 15 days led to the damage of the renal tubules which were looking more or less a mass of debris at certain places (Plate 1, Fig. e) whereas at other places, they were observed to be clumped together (Plate 1, Fig. f). The damage seems to have

increased with pesticide exposure period (Plate 1, Figs. g and h). The renal tubules became rough due to the sloughing of the epithelial layer and became very rough (Plate 1, Fig. e).

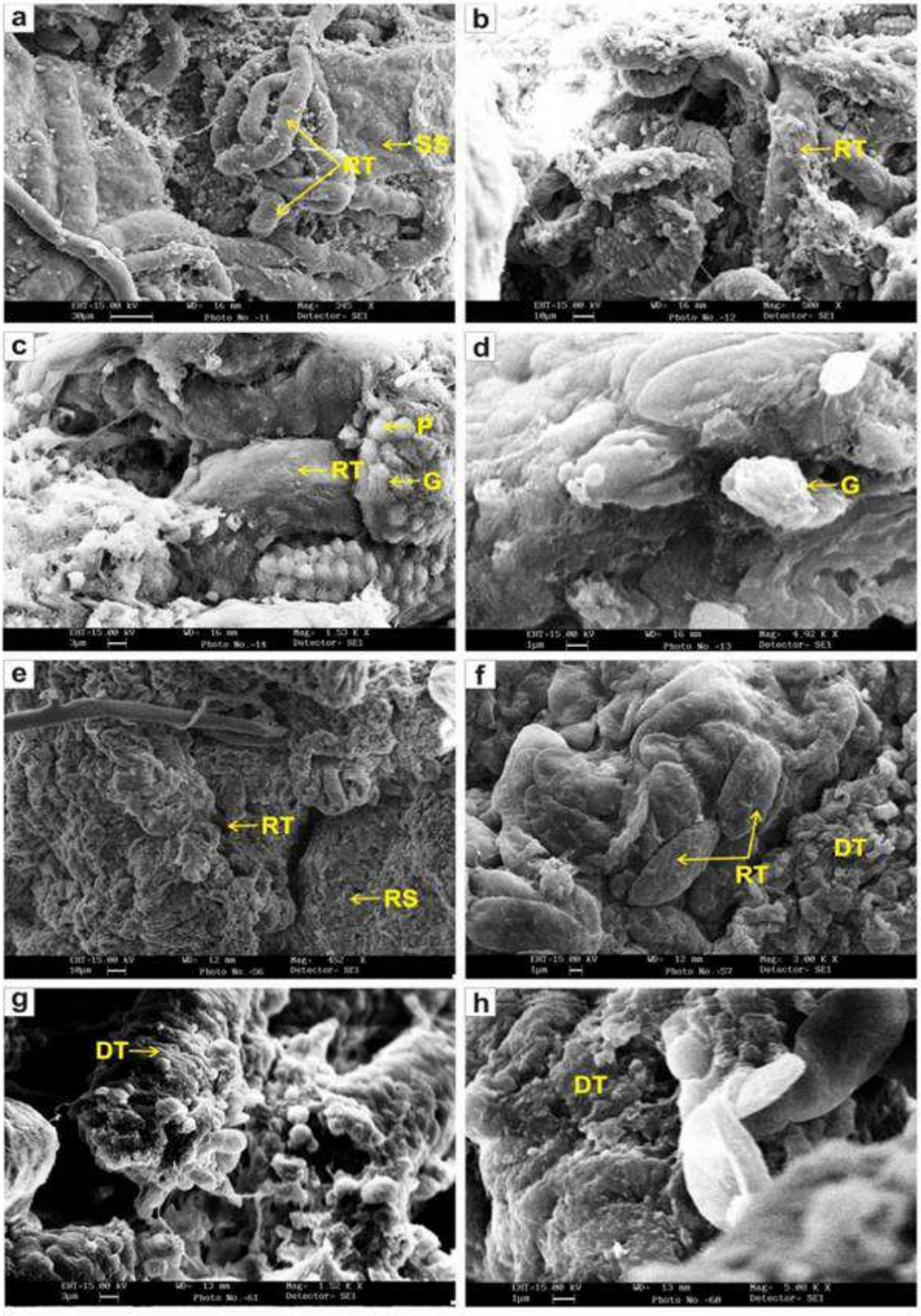

Plate 1 (a-h): Scanning electron micrographs of kidney sections of *Ctenopharyngodonidellus* (Cuvier and Valenciennes) of control and monocrotophos treated fish. Control: a-d; Treated (15 days): e-h

Abbreviations: *DT – Damaged Tubule, G – Glomerulus, P – Podocytes, RS – Rough Surface, RT – Renal Tubule, SS – Smooth Surface*

Upon 30th day, after pesticide treatment, the damage to the renal tubules were more apparent. The renal tubules appeared to be grossly damaged at many places (Plate 2, Fig .a) whereas at other places, there were clear breakages in the renal tubules (Plate 2, Figs. b and c). The glomeruli were also damaged at many places (Plate 2, Fig. d). As

expected, the damage further increased upon exposure of the fish to the toxicant for 45 days, resulting in apparent damage to the tubules and glomerulus (Plate 2, Figs. e, f, g, h).

DISCUSSION

The results of present TEM study on the ultrastructural changes observed in the kidney of fish exposed to monocrotophos have been correlated with the previous findings of various workers in various toxicological studies conducted with other toxicants and it has been found that the monocrotophos also induces degenerative changes as induced by other toxicants.

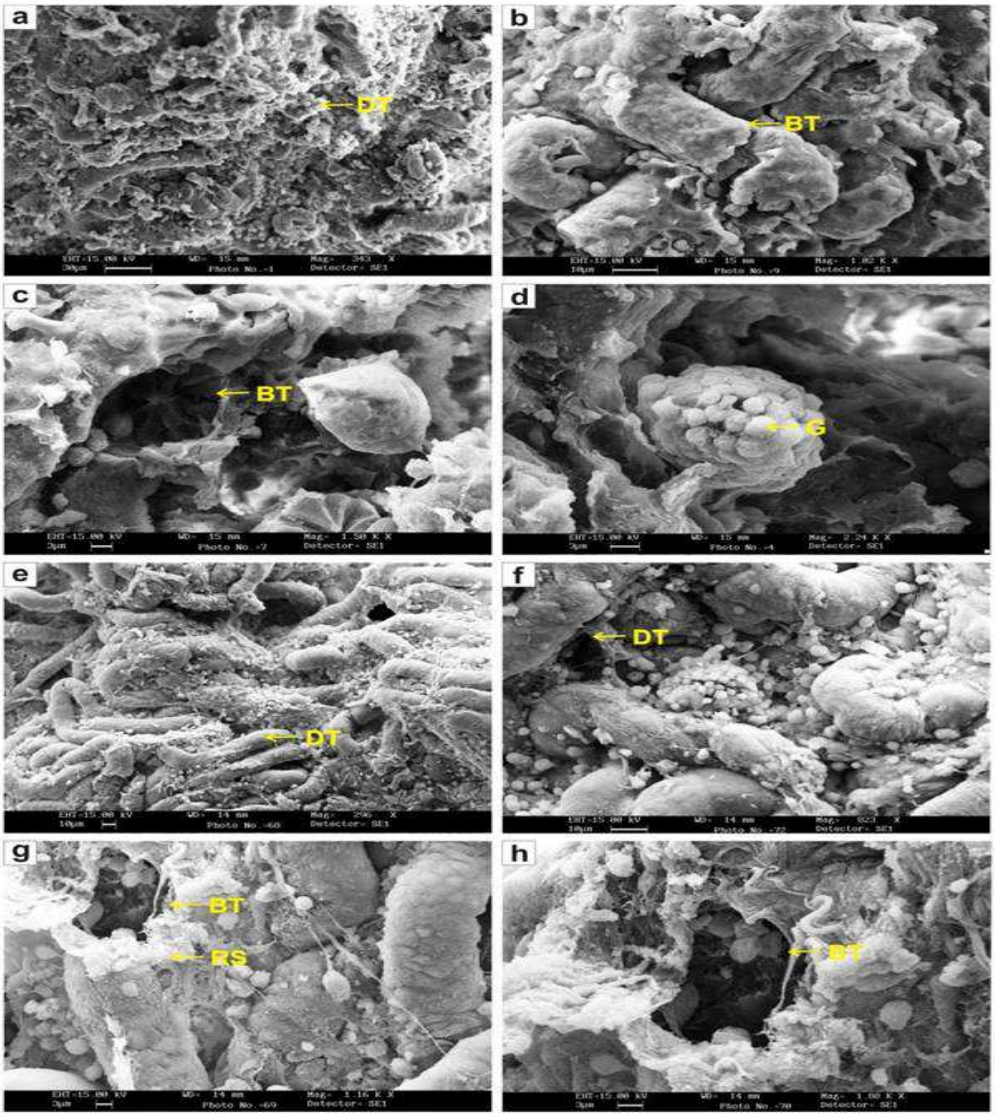

Plate 2 (a-h): Scanning electron micrographs of kidney sections of Ctenopharyngodonidellus (Cuvier and Valenciennes) of control and monocrotophos treated fish. Treated (30 days): a-d; Treated 45 days): e-h
Abbreviations: *BT – Breakage of Tubule, DT – Damaged Tubule, G – Glomerulus, RS – Rough Surface*

Elger and Hentschel (1981) [7] observed alterations in the fish kidney of a freshwater teleost, Carassiusauratusgibelio adapted to saline water which included retraction of the endothelium from the basement membrane and dislocation of the silt diaphgrams. Kaedtisuke*et al.* (1989) [11] showed the distortion in the shape of the glomerulus after treatment with malathion and trimethylphosphorodithionate. Similarily, Srivastava *et al.* (1990) [12] reported damage of the glomerulus after treatment with chloropyrifos and monocrotophos.

So, SEM study showed that upon exposure to the toxicant, there was change in the kidney of the fish which impairs the normal functioning of the kidney.

CONCLUSION

It can be concluded that the various organs of freshwater fishes have been subjected to toxicological investigations time and again and valuable information available from such studies can help in rationalizing the use of these pesticides to minimise their harmful effects. The use of these harmful pesticides can affect fish population in future and may cause serious health issues.

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REFERENCES

[1] SJTeh, SMAdams, DEHinton,*Aquat Toxicol,***1997,**37, 51-70.
[2] GDStentiford, MLongshaw, BPLyons, G Jones, MGreen,SWFeist,*Mar Environ Res,***2003,**55, 137-159.
[3] DMCohen,*Proc Calif Acad Sci,* **1970,**38, 341-345.
[4]NBurkhard, JDrabek,*Rev Environ Contam Toxicol,***1994,** 139, 1-2.
[5] APEvan, WG Dail, DDammrose, CPalmer, *Anat Rec,***1976,** 185(4), 433-445.
[6] M Miyoshi,*Cell Tiss Res,***1978,** 187(1), 105-113.
[7] M Elger, H Hentschel, *Cell Tiss Res,***1981,**220(1), 73-85.
[8] JA Brown, C Green, *Cell Tiss Res,* **1992,**269(2), 299-304.
[9] PK Sahoo, SC Mukherjee, AK Jain, A Mukherjee, *Asian Fisheries Sci*, **2003,**16, 257-268.
[10] ER Lacy, M Castellucci, E Reale, *Anat Rec,* **1987,**218(3), 294-305.
[11] S Keadtisuke, W Dheranetra, TR Fukoto, *Toxicol Lett,* **1989,**47(1), 53-59.
[12] SK Srivastava, PR Tiwari, AK Srivastav, *Bull Environ Contam Toxicol,* **1990,**45(5), 748-751.