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Effects of cartriz on ovarian histopathology of *Channa punctatus* (Bloch).

Renu Pathak, D.N. Sadhu* and Md. Noor Alam
Fish Research Laboratory, Department of Zoology, Vinoba Bhave University, Hazaribag – 825301, Jharkhand, India.

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Abstract: Indiscriminate use of pesticides including cartriz for getting better result in agriculture, has ultimately affected the aquatic biota in general and fishes in particular. The present investigation is aimed to study the adverse effects in the histological make up and gonado somatic index(GSI) of a fresh water fish, *Channa punctatus* (Bloch) exposed to sublethal concentration of carbamate pesticide, cartriz for different ovarian cycle. The pesticide produced deleterious changes in the ovarian structure and also caused significant changes in GSI, revealing its toxic nature. Parallelly a central set of experiment was kept for observation without any pesticide. Hence it is suggested to use cartriz within prescribed level, to save the environment.

Key words: cartriz; ovary; GSI; *Channa punctatus*.

Introduction

Modern civilization and recent trends in agricultural practices to meet the demand of the excess food for growing human population has led to the use of various agro- chemicals extensively indiscriminately and injudiciously to boost the crop production. These chemicals on the other hand, find their ways directly or indirectly in to the nearby water bodies and change the water quality, causing ecological imbalance, creating noticeable disaster in the ecosystem, damage the vital organs of the aquatic biota in general and fishes in particular and ultimately reduce the overall prospect of the fish yields from the aquatic sources. (Pawar *et al*; 2007; Alam, 2009; Alam and Sadhu, 2010; Sendedge *et al.,* 2011; Vijaya Lakshmi and Alam, 2013; Prasad and Kumar, 2013 and Alam and Vijaya Lakshmi, 2015). Very little information about the impact of cartriz on *Channa punctatus* has been given in Jharkhand. In the present study, effect of a carbamate pesticide, cartriz on the ovarian histopathology of an air-breathing fish, *channa punctatus* (Bloch) has been observed.

Materials and Methods

Live specimens of *Channa punctatus* were collected from local freshwater non-polluted ponds and brought to the laboratory. They were washed with 0.1% KMnO4 solution to avoid dermal infection and were allowed acclimatization to the laboratory condition for a period of 15 days. The fishes were fed with live fish food.

To study the toxic effects of the pesticide, cartriz (cartap hydrocholoride) on the ovarian stages of the test fish two glass aquaria of 30 litre capacity were taken and marked as "A" and "B". The aquarium "A" served as control where as in the aquarium "B" the test fishes were subjected to exposure of pre- determined LC50/96hr (1.675 mg/litre) concentration of the pesticide cartriz. For the determination of gonado somatic index(GSI) monthly data of the total body weight and eight of the ovary of both control and treated fish were taken for one year and GSI was calculated by the following formula:-

$$GSI = \frac{Weight\ of\ ovary}{Total\ weight of\ the\ body} x\ 100$$

For histopathological study, the ovaries of both control and treated fish were taken out, cut in to small pieces and fixed in aqueous Bouin's fixative. Paraffin sections (5-7µ thick) were prepared and stained in haematoxylin – eosin to make the histological observations.

Results and Discussion

Histologically the ovary of *Channa punctatus* consists of an outer thin peritoneum below which is the ovarian wall composed of an outer tunica albuginea and inner germinal epithelium, consisting of single layer of cuboidal cells. It loses its connection from the tunica albugenia at several places and projects into the ovocoel as ovigerous lamellae. The lamellae are the seat of development of new oogonia. The ovary contains oocytes at its several stages of development (Fig. 1 and 2).

***Corresponding Author:**
D.N. Sadhu
Fish Research Laboratory,
Department of Zoology, Vinoba Bhave University,
Hazaribag-825301, Jharkhand, India.
E-mail: dns_hzb@yahoo.com

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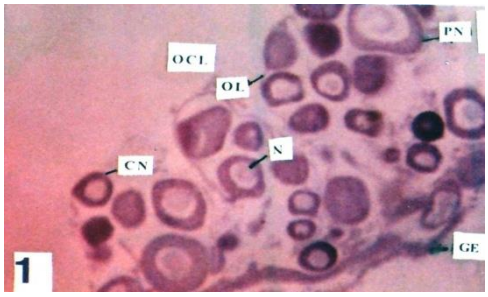
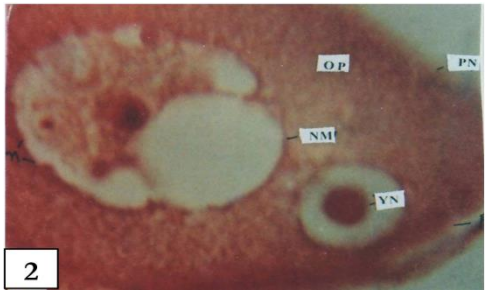




Figs. 1-2: T.S. of Ovary of control fish, *Channa punctatus* showing normal histological structure.

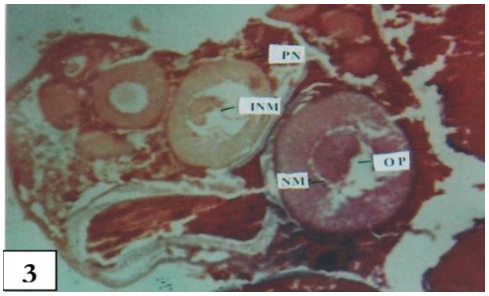
In the present study the pesticide cartriz produced deleterious changes of various magnitudes in the ovarian structure and its functional status in the exposed fish. Though the GSI was calculated for the entire ovarian cycle, the histological effects were studied mostly in spawning period. The effects were more pronounced in the longer exposure (30 days) than in the shorter exposure duration. A gradual shrinkage of oocytes was noticed along with reduction in the total weight of the ovary. In the initial period of intoxication, the immature oocytes were small and the atretic follicles were present very few in number. When exposed chronically for longer duration, further damage of the ovarian histology was observed Tunica albugenia was irregular, immature oocytes were small sized but without spherical shaped nucleus. The ovigerous lamellae were ruptured. The number of atretic follicles was increased. Yolk vesicles showed greater damage and many broken follicles were seen (Table 1; Fig. 3, 4, 5 and 6).

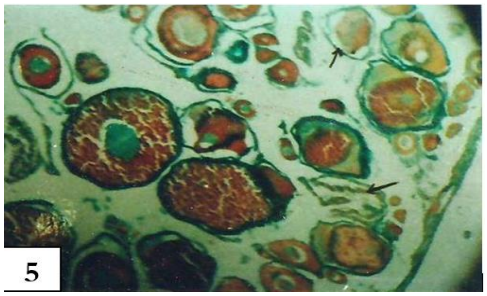
Table 1: Histopathological effect of Cartriz on ovary of *Channa punctatus* (Bloch)

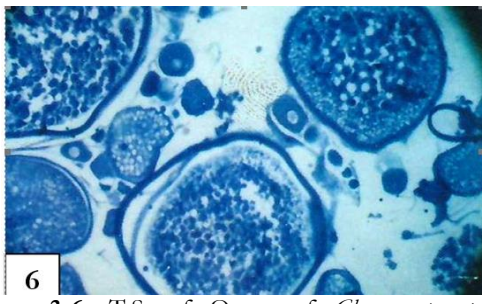
S.No	Tissue	Normal/ Control	Experiment Duration of exposure to *Channa punctatus*		
			7 Days	15 Days	30 Days
1	Peritoneum	Thin membrane, intact	Intact	Slightly damaged.	Further damaged (broken at many places).
2	Tunica albuginea	Made up of connective tissue, blood vessels	Normal	Irregular in shape	Blood vessels were dilated
3	Germinal epithelium	Inner most layer of ovary, projecting as ovigerous lamella on which oocytes are present in different stages of development	Ovigerous lamella was slightly damaged	Further damaged	Ovigerous lamella also ruptured at many places
4	Oogonium	Small epithelial structure with single nucleus and nucleolus, clear cytoplasm	Normal oogonium present evenly, small spherical with nucleus and cytoplasm	Oogenium aggregated at places	Reduce in numbers and small sized.
5	Immature Oocytes	Spherical structure with cytoplasm, large nucleus containing 5 to 10 nuclei	Small spherical with nucleus and many nuclei	Small but lost spherical shape nucleus and nuclei visible	Oocytes showed variation in size and reduction in numbers.
6	Maturing Oocytes	Increased in size, large round structure with a large number of yolk vesicles along with the periphery of oocytes. Oocytes posses vitelline membrane in zona radiate	Increased in size, large round with nucleus in many nuclei	Present in few number	Reduction in size and numbers
7	Mature Oocytes	Large, round few with yolk in Ooplasm and outer covering of theca.	Interfollicular spaces were Present.	Lost their shape and size.	Wall of oocytes showed greater damage and interfollicular Spaces were increased
8	Atretic Oocytes	Present in very few numbers.	Very few in numbers.	Increased.	Increased.

Table 2: Monthly variation in Gonado-somatic index (GSI) in *Channa punctatus* (Bloch) exposed to sub-lethal concentration of cartriz.

Months	Normal Medium			Treated Medium		
	Av. wt. of the body in (g)	Av. wt. of the ovary in (g)	Av.GSI value	Av. wt. of the body in (g)	Av. wt. of the ovary in (g)	Av.GSI value
Jan	41.5 +/- 0.15	0.65 +/- 0.18	1.56	41.5 +/- 0.15	0.65 +/- 0.25	1.46
Feb	41.8 +/-0.20	0.70 +/- 0.15	1.67	41.2 +/- 0.20	0.65 +/- 0.15	1.57
March	42.2 +/-0.25	0.75 +/- 0.20	1.77	41.5 +/- 0.15	0.71 +/- 0.20	1.71
April	42.5 +/-0.10	0.80 +/- 0.30	1.88	41.8 +/- 0.40	0.75 +/- 0.10	1.79
May	44.2 +/-0.35	0.95 +/- 0.25	2.14	42.3 +/- 0.25	0.85 +/- 0.30	2.009
June	45.6 +/-0.30	1.80 +/- 0.10	3.94	43.2 +/- 0.20	1.10 +/- 0.25	2.54
July	46.1 +/-0.25	2.5 +/- 0.18	5.42	43.6 +/- 0.30	1.35 +/- 0.16	3.096
August	46.3 +/-0.35	2.1 +/- 0.30	4.53	43.8 +/- 0.35	1.20 +/- 0.18	2.739
Sept.	48.8 +/-0.25	1.60 +/- 0.35	3.73	41.6 +/- 0.18	0.95 +/- 0.32	2.28
Oct.	41.6 +/-0.40	0.90 +/- 0.28	2.16	40.1 +/- 0.28	0.80 +/- 0.27	1.99
Nov.	41.3 +/-0.50	0.82 +/- 0.35	1.98	40.0 +/- 0.10	0.70 +/- 0.34	1.75
Dec.	40.2 +/-0.20	0.60 +/- 0.15	1.49	38.8 +/- 0.34	0.55 +/- 0.20	1.417







Figs. 3-6: T.S. of Ovary of *Channa punctatus* showing histological damages under cartriz exposure.

Abbreviation

OCL= Ovocoel
OL= Ovigerous Lamellae
CN= Chromatin Nucleus
NM= Nuclear Membrane
YN= Yolk Nucleus
OP= Ooplasm
MO= Mature Oocyte
AO= Atretic Oocyte

Similar results have also been obtained by Pawar *et al.,* (2007), Prasad and Kumar (2013) while working on *Macrones bleekeri* and *Mystus vittatus* respectively. Information given by some other research workers like Pawar *et al.,* (2006), Alam and Sadhu (2010), Velmurugan (2012), Farooq *et al.* (2012) and Vijaya Lakshmi and Alam (2013) on degenerative changes in the vital organs in fishes due to pesticidal action are on also record and the present findings are in agreement with those of other workers. The chronic effect of the pesticide, cartriz was also observed on the ovarian cycle of the test fish.

The test fish, *Channa punctatus* (Bloch) has four ovarian phases as mentioned below:

S.N.	Ovarian phase	Duration (in months)
1.	Resting Phase	October - December
2.	Preparatory Phase	January - March
3.	Pre-spawning Phase	April - June
4.	Spawning Phase	July - September

Monthly average value of gonado somatic index(GSI) of both normal and cartriz treated fish, *Channa punctatus* as summarily given in table -2 reveals that there was a wide variation in gonado somatic index(GSI) of the fish exposed to the agro – chemical as compared to the normal. The GSI of the control fish during resting phase was found to be in the range of 1.49 – 2.16 where as in cartriz treated fish the value ranged from 1.47 – 1.99, exhibiting toxic impact of the pesticide on ovarian development. The ovary in this phase was faint brown colour. In the maturing phase there was a gradual increase in the weight of the ovary and the whole body and an increase in GSI in both control and treated fish was recorded (GSI: Control = 1.56 – 1.77; treated = 1.46 – 1.71).

By the end of the pre - spawning period i.e in June there was enormous increase in the length, size and weight of the ovaries with dull yellow color and more or less turgid appearance due to presence of several mature eggs. The GSI in the normal fish was in the range of 1.88 – 3.94 whereas in the treated fish it ranged from 1.79 – 2.54, showing degenerative changes.

During spawning period, the GSI value reached maximum the month of July (GSI: Control = 3.73 – 5.42; treated = 2.28 – 3.09). During post – spawning period the ovaries became loose and all parameters i.e. body weight, weight ovary and Gonado somatic index value of both control and treated fish decreased, thus showing overall effect of the pesticide on the reproductive potential of the fish.

Decrease in gonado somatic index(GSI) due to pesticide effect has also been observed by Verma and Nath (2002), Prasad and Mamta Rani (2002), Prasad et al. (2006), Alam, (2009), Verma and Chand (2014), and Singh *et al.,* (2014). In the present investigation, the possible reason behind the decrease in GSI may be due to less secretion of endogenous gonadotropins caused due to the action of the ingredients of the pesticide. Probably the steroid hormone needed for the maintenance

of normal ovarian activity is not synthesized as the pesticide cartriz interferes with the steroid metabolism in the exposed fish. It also alters gonadotropin production, disturbing the ovarian development which is reflected in the histopathological changes of the ovary and hindrance in all physiological processes of the fish body, ultimately affecting fish yield. Hence, it is suggested that indiscriminate use of pesticides or insecticides should be discouraged so as to save the aquatic biota in general and fishes in particular.

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