Uttar Pradesh J. Zool. 8(1) : 18-26, 1988

ENDOSULFAN INDUCED ALTERATIONS IN THE GONAD OF TWO FRESHWATER MUSSELS IN DIFFERENT SEASONS

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Endosulfan caused more or less similar type of effects on both, male and female gonads of *Lamellidens corrianus* and *L. marginalis* in monsoon and winter, but the severity of effect was more in summer. Comparatively, it was observed that the female follicles of *L. corrianus* and male follicles of *L. marginalis* were more affected in all the seasons.

INTRODUCTION

It is widely recognised that growth and reproduction in aquatic animals are affected due to contamination of toxicants in aquatic media. Pesticides are shown to be hazardous to the aquatic species (Popova, 1970; Holden, 1972; Akarte *et al.*, 1986). Eisler (1970) reported latent effects of insecticides on number of egg cases deposition in gastropods and stimulatory effects on fecundity and survival of clams and gastropods. Pesticides have been shown to affect at cellular and subcellular level by destroying the tissues of animals (Eller, 1971; Anees, 1976; Kling, 1981). The lamellibranch molluscs are broadcast fertilizers and gonad form an important body components. Considering the pesticide impact on growth and reproduction, here we report the pesticide induced histopathogical alterations in the gonad of two freshwater lamellibranch molluscs from Godavari river at Paithan near Aurangabad.

MATERIAL AND METHODS

The freshwater bivalves, *Lamellidens corrianus* (70-75 mm) and *L. marginalis* (60-65 mm), were collected from Godavari river at Paithan near city Auragabad (45 km away). Tho bivalves were brought to the laboratory and cleaned to remove fauling algal biomass and mud.They were then stocked in aerated reservoir water for 24 h. Ten bivalves of each species were grouped separately and held in experimental aquaria of 5 l water containing appropriate test concentrations of commercial grade pesticide. Endosulfan 35 EC, for 96 h. For each experiment a control group of each species was also run. In different seasons

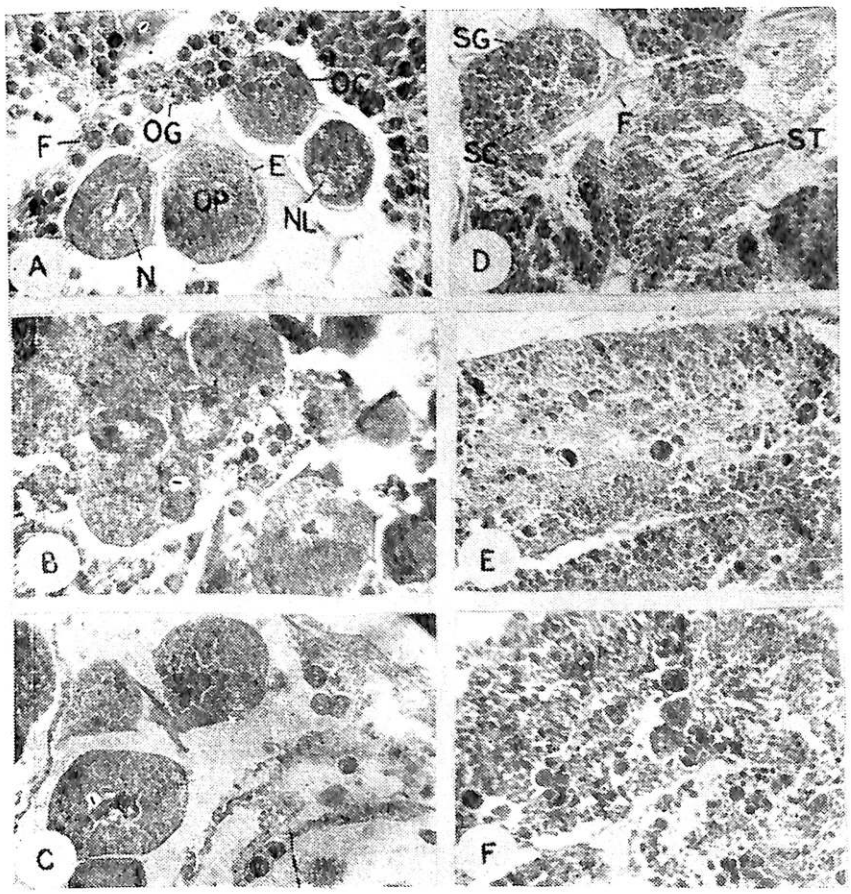

Fig. 1. Sections of gonad showing different stages in male and female follicles of *Lamellidens corrianus* in different seasons × 400.

A to C, Female follicles; D to F, Male follicles; A and D, Summer; B and E, Monsoon; C and F, Winter.

F, Follicle; OG, Oogonia; E, Egg cell; OP, Ooplasm; N, Nucleus; NL, Nucleolus; OC, Oocyte; SG, Spermatogonia; SC, Spermatocyte; ST, Spermatids.

the bivalves were freshly collected and treated in similar way. The bivalves *L. corrianus* were exposed to predetermined LC_0 (0.004, 0.02 and 0.024 ppm) and LC_{50} (0.017, 0.04 and 0.044 ppm) values, whereas *L. marginalis* to predetermined LC_0 (0.002, 0.016 and 0.022 ppm) and LC_{50} (0.006, 0.036 0.04 ppm) values of endosulfan during summer, monsoon and winter seasons respectively for 96 h. The procedure for the acute toxicity tests is described earlier (Mane & Muley, 1984).

After 96 h acute toxicities of both the pesticides, gonads of both the bivalves form control, LC_0 and LC_{50} groups were removed and fixed in Bouins fluid for 48 h in different seasons. The tissues were then dehydrated in

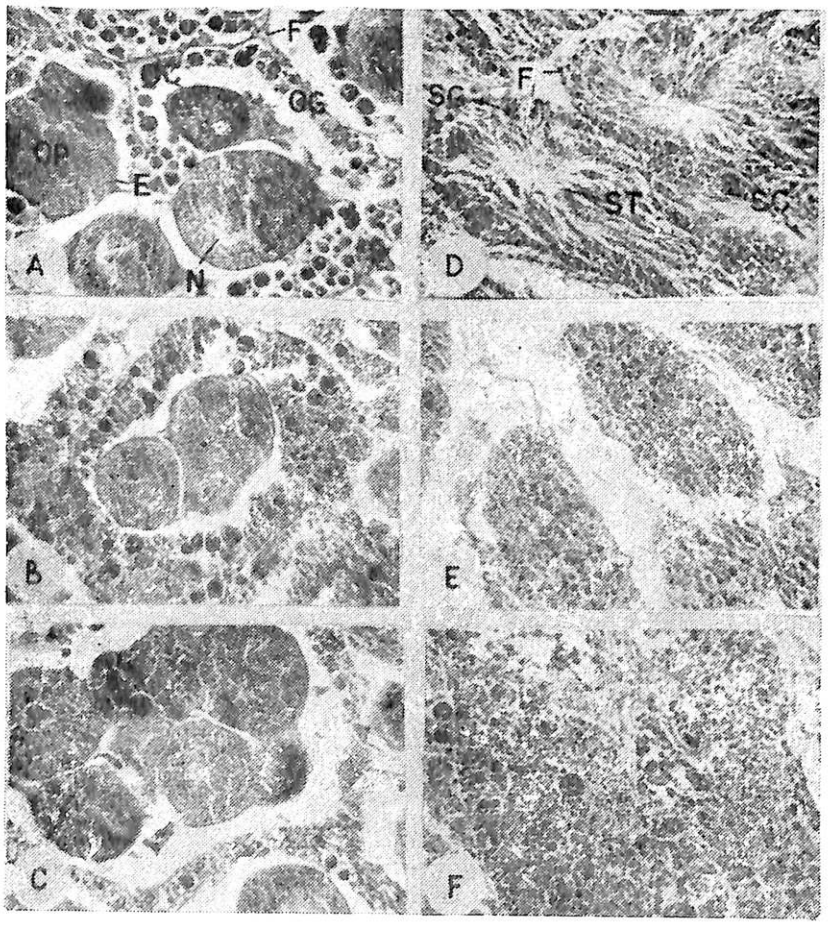

Fig. 2. Sections of gonad showing different stages in male and female follicles of *Lamellidens marginalis* in different seasons × 400.

A to C, Female follicles; D to F, Male follicles; A and D, Summer; B and E, Monsoon; C and F, Winter.

ethyl alcohol, cleared in xylol and embeded in tissue mat (at 58-60°C). They were sectioned at 6-7μ. The sections were stained with Delafield's hematoxylin-eosin stain. Histopathological changes were observed under research microscope.

RESULTS

Condition of gonad in different seasons

Control : Both the species of bivalves, *L. corrianus* and *L. marginalis*, showed developmental condition of gonad in summer. The female follicles showed follicle wall with prominent germ cells and vitellogenic oocytes of different sizes. Many free mature eggs possessed dense cytoplasm and distinct

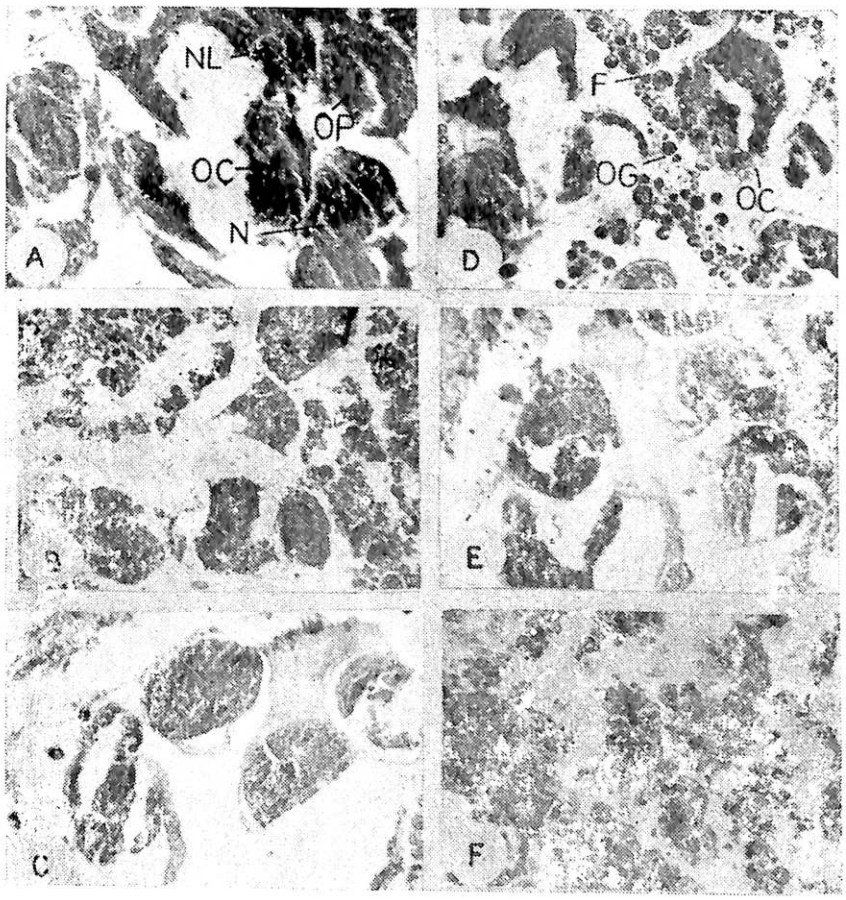

Fig. 3. Effect of endosulfan on female gonad of *Lamellidens corrianus* In different seasons ×400
A to C, LC_0 group; D to F, LC_{50} group; A and D, Summer; B and E, Monsoon; C and F, Winter.

nucleus located in centre having prominent nucleolus. The staining to these different parts in female follicles. was distinct (Figs. 1 & 2A) The male follicles showed development of spermatogonia, spermatocytes and few spermatids arranged in array. All these components were distinctly stained (Figs. 1 & 2D). In monsoon, both the species of bivalves showed mostly mature condition of gonad. The female follicles in *L. corrianus* showed many vitellogenic oocytes with prominent nucleolus. Few mature eggs were also seen in the lumen of the follicle. Few developing oocytes and germ cells were prominently seen along the follicle wall. Similar condition of female follicles was observed in *L. marginalis*. The only difference form *L. corrianus* was few vitellogenic oocytes and more mature eggs (Figs. 1 & 2B). The male follicles showed many spermatogonia. Few spermatocytes and spermatids in *L. corrianus*, whereas in *L. marginalis* the spermatocytes were more then spermatids All these components

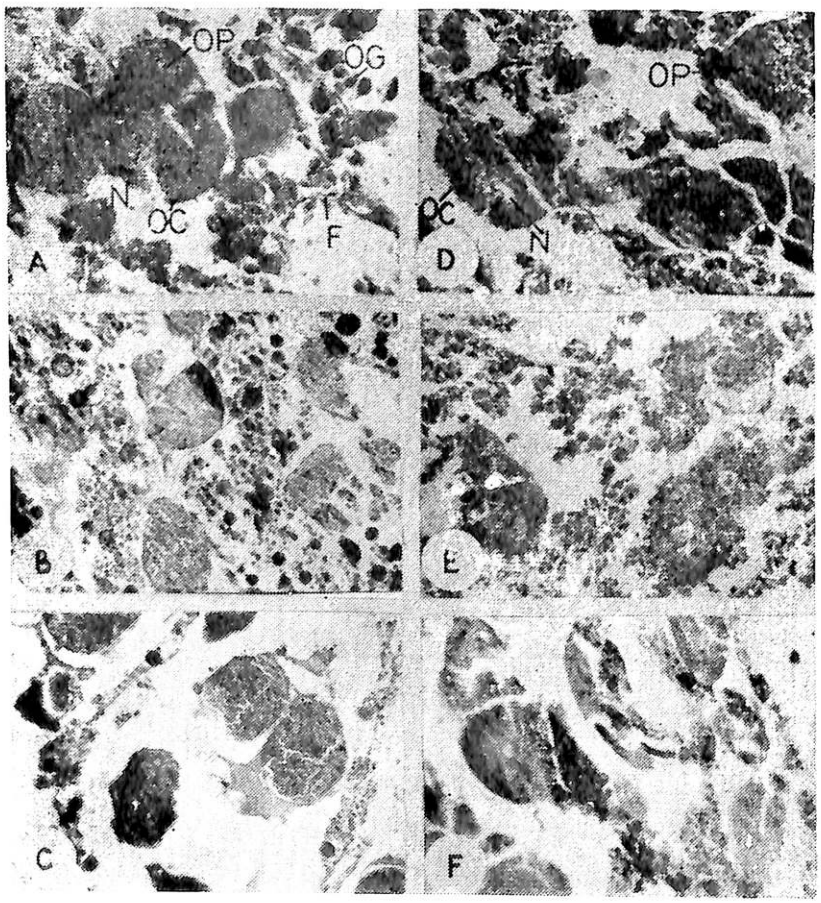

Fig 4 Effect of endosulfan on female gonad of *Lamellidens marginalis* in different seasons × 400.
A to C, LC_{-} group; D to F, LC_{50} group; A and D, Summer; B and E Monsoon; C and F, Winter.

distinctly appeared in an array (Figs. 1 & 2E). In winter, both the species of bivalves showed few relict gametes in the female follicles containing very few mature eggs with distinct nucleus and nucleolus. Very few mature eggs showed distinct nucleus and nucleolus. Very few vitellogenic oocytes and germ cells appeared along the follicle wall. These components were distinctly stained (Figs. 1 & 2C). The male follicles showed few spermatogonia, many spermatocytes and spermatids in both *L. corrianus* and *L. marginalis* (Figs. 1 & 2F).

Effect of Endosulfan 35 EC

In summer, compared to control, LC_0 groups of *L. corrianus* and *L. marginalis* showed considerable damage to the gonad. The follicle walls ruptured at places with shrinkage of germ cells along the wall. In female follicles, detarioration of ooplasmic material nucleus and nucleoli was observed in mature eggs.Chromatin material was not intensively stained.The germ cells and vitellogenic oocytes lost the shape and detached from follicle wall (Figs. 3 & 4A). Male follicles were disrupted at places and thereby the growing gametes got damaged. The clumping of spermatocytes at places took place. The spermatids lost the continuity in developent and got detached. The spermatogonia also got clumped at places and lost the continuity in developmental sequence (Figs. 5 & 6A).

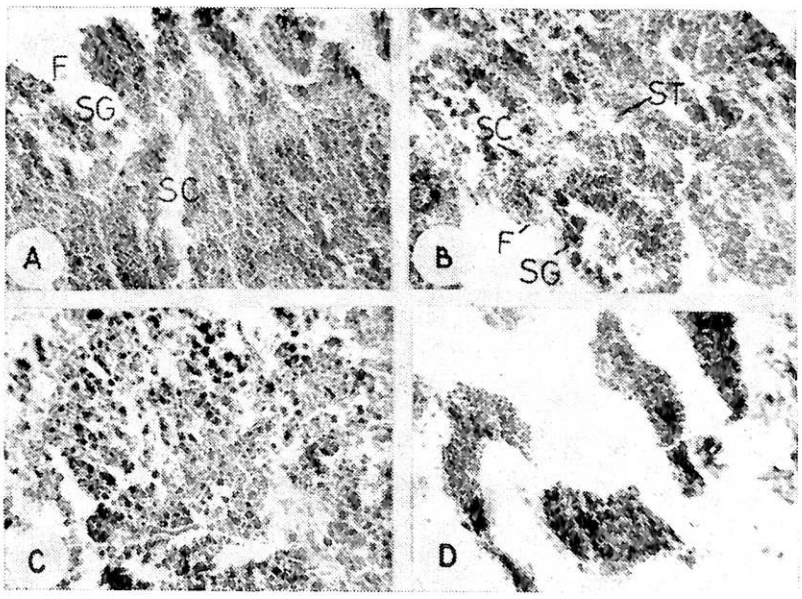

Fig. 5. Effect of endosulfan on male gonad of *Lamellidens corrianus* in different seasons × 400. A and B, LC_0 and LC_{50} groups in summer; C, similar effects in monsoon; D, similar effects in winter.
S, Sperms.

In LC_{50} group, though the effect was similar it was more pronounced than LC_0 group in both female and male follicles (Figs. 3, 4D, 5B & 6C).

More or less similar type of effects were observed on both the female and male follicles of *L. corrianus* and *L. marginalis* in monsoon and winter but the severity of effect of pesticide on *L. corrianus* and *L. marginalis* it was observed that the female follicles of *L. corrianus* and the male follicles of *L. marginalis* were more affected in all the seasons

DISCUSSION

The pesticides could affect the histology of the aquatic organisms; the detarioration of tissue and damage at cellular and subcellular levels Cope (1966) reported that the herbicide at sublethal levels to blue gills caused generative lesions in liver and testis while dichobenil caused fusion of gill lamellae. He also noted the lesion in gills, liver and kidney tissue caused by a number of other pesticides. Mathur (1969) observed the vacuolation of liver cells, degeneration of cytoplasm, localised necrosis and hypertrophy of hepatic cells in the liver of *Ophiocephalus punctatus* exposed to aldrin. Amminikutty & Rege (1977) reported that acute exposure of endosulfan caused vacuolation in the hepatic cells in

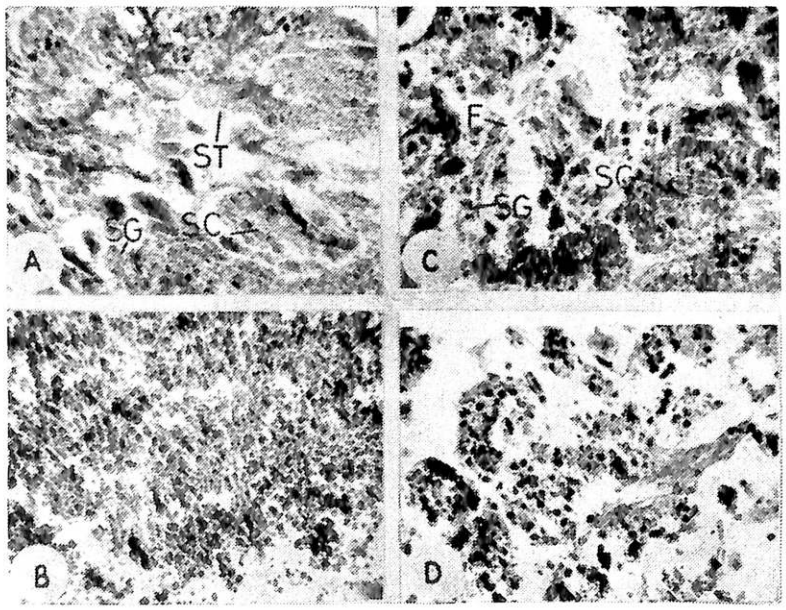

Fig 6. Effect of endosulfan on male gonad of *Lamellidens marginalis* in different seasons × 400. A and B, LC_0 group; C and D, LC_{50} group; A and C, Summer; B and D, Monsoon and winter(similar effects).

Gymnocorymbus ternetzi characterised by swollen hepatic cells with coarse cytoplasm. Little evidences are in existance on the invertebrate histopathology due to pesticide toxicity. Aiken & Byard (1972) have observed degenerative changes and cellular damage in hepatopancreas of lobster, *Homarus americanus* when exposed to yellow phosphorous Bodkhe (1982) also observed the swelling of digestive gland cells and degeneration of gonadal product of the freshwater crab, *Barytelphusa cunicularis* when exposed to sublethal and lethal concentration of carbamate, sevimol. Nagabhushanam *et al.* (1983) found that acute exposure of malathion (48 h LC_{50} = 0.3548 ppm); dimecron (1.025 ppm) and monocrotophos (4.467 ppm) caused pronounced changes in the gonad of a freshwater prawn, *Macrobrachium lamerrii.* The authors further showed that malathion causes degeneration of the oocytes with vacuolisation within the ooplasm, while the dimecron caused shrinkage and disruption of oocytes and follicle cells surrounding the ova and monocrotophos caused degeneration of oocytes.

In the present study the control group showed developing sex products in gonad during summer (May), maturation of sex products in monsoon (September) and partially spent gonads with relict gametes and redevelopment were found during winter in both the species of bivalves. Endosulfan caused severe damage to both the species in summer. Endosulfan caused more damage to female follicles of *L. corrianus* and the male follicles of *L. marginalis.* The overall effect on both the species during different seasons was more at LC_{50} group than LC_0. The penetration of pesticide deep into the gonad affect the free mature gametes in the lumen of the follicles and appeared to stop the growth of the germ cells and development of the sex cells. This affects the reproductive process in bivalve molluscs.

ACKNOWLEDGEMENTS

This work is supported by the Department of Science and Technology, New Delhi through a research project given to UHM. The authors are thankful to the authorities for financial assistance.

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