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Toxicity of Carbofuran Technical 75DB to the Fertilization of Eggs of Catfish, *Heteropneustes fossilis* (Bloch)

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Catfishes, particularly the air-breathing species, are attracting attention of the pisciculturists in India owing to their high production potential from paddy fields and stagnant shallow ponds (Dehadrai and Mukhopadhyay 1979). With the increased use of pesticides in agriculture, it has become important to know about the toxic effect of pesticides on such non-target organisms as these catfishes. Enough reports regarding the toxic effects of pesticides related to the survival of fish of different size and age groups are available but information concerning the effects of pesticides on fertilization of eggs and their embryonic development is scanty (Olson and Marking 1973; Kaur and Toor 1977; Ghosh and Dutta 1985).

Heteropneustes fossilis (Bloch), an expensive, nutritious catfish, grows in shallow ditches, beels and marshes including the paddy fields where they breed during monsoon. Since carbofuran is applied at the time of monsoon in the paddy, it is relevant to see the effect of this pesticide on the developmental stages of a non-target organism like fishes. Therefore, this communication deals with the effect of carbofuran pesticide on the fertilization of eggs of H. fossilis (Bl.).

MATERIALS AND METHODS

Human chorionic gonadotropin (HCG) was obtained from Sigma Chemical Co., St. Louis, Missouri, USA. Carbofuran 75DB (75%) was a gift from Rallis (India) Ltd. All solvents and reagents used were of analytical grade.

Healthy gravid female and mature male fish, H.fossilis

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were collected from the local market and acclimatized to laboratory conditions for 7 d in glass aquaria containing sufficient tap water (pH 7.6) at 25°C. Fish were fed with tubifex ad libitum.

Breeding was done following the method of Sarkar et al. (1979). Gravid females were injected 100 I.U. HCG (prepared in 0.6% sodium chloride solution) per 100 g body weight intraperitoneally. About 15 hr after HCG injection the ripe eggs were squeezed directly into petridishes. The testes were dissected out from mature males and squeezed rapidly in tap water containing 0.08 ml acetone/L (in case of control) or in different doses of carbofuran solution (0.5 mg/L, 1 mg/L and 2 mg/L). Carbofuran was dissolved in the mixture of acetone and water (4:1) and diluted to various concentrations with tap water. The sperm suspension was mixed with the eggs very quickly by swirling by hand and kept for 5 min. Then the fertilized eggs were washed to remove the sperm suspension and the same concentration of carbofuran solution or tap water (in case of control) was added. The eggs were allowed to develop at 25±1°C temperature for measuring embryonic development. The rate of fertilization was counted under microscope (48 X magnification). The initial cleavages in control and treated eggs were recorded and statistically analysed by using Student's 't'-test.

RESULTS AND DISCUSSION

Low concentrations of pesticides, which are toxic to fish eggs and fry, frequently occur in polluted waters. The LC_{50} dose of carbofuran for adult Heteropneustes fossilis (Bl.) for a period of 96-hr exposure was determined 4.2 mg/L by plotting log concentration against probit kill value (Chatterjee and Ghosh 1992). The effect of sublethal doses 0.5 mg/L, 1 mg/L and 2 mg/L of same pesticide on the fertilization of eggs is presented in Figs. 1-2. Moreover, the pesticide with all the doses caused abnormal embryonic development such as unequal cell division during initial cleavage, detachment of cells and degeneration of cells (Fig. 2). Obviously, further development was arrested and hatchability reduced.

Inhibition in fertilization of eggs of the same fish has also been observed in presence of sublethal doses of an organophosphate pesticide malathion (Ghosh and Dutta 1985). Survival of developing eggs and percentage of hatchings of the eggs of carp (Cyprinus carpio communis Linn.) decreased with increasing concentrations of different pesticides. Using 1 mg/L malathion 84.5% eggs were hatched while hatching was

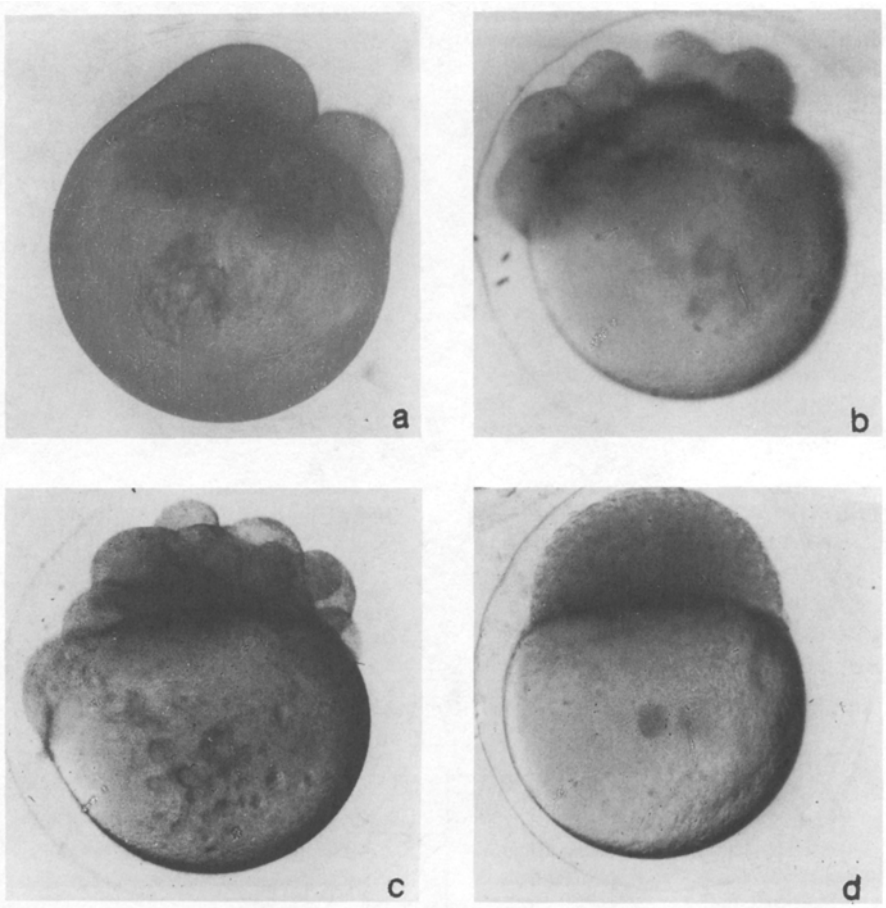

Figure 1. Stages of normal development : a. 2-cell, b. 8-cell, c. 16-cell, d. blastula.

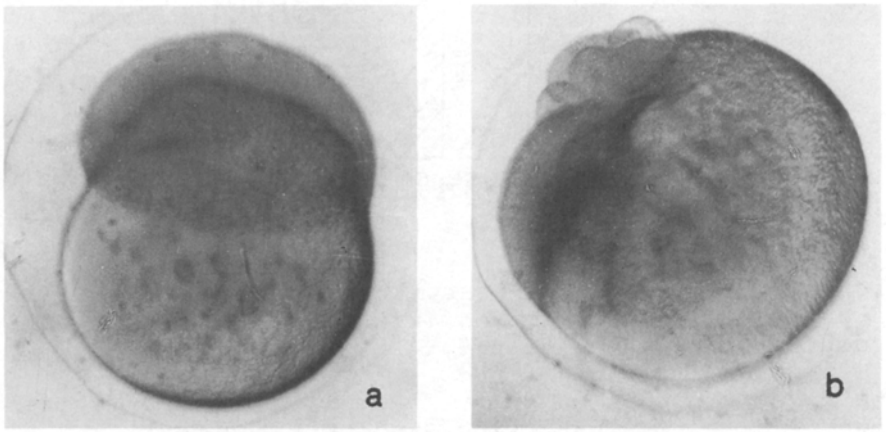

Figure 2. Eggs treated with carbofuran (0.5 mg/L - 2.0 mg/L) : a. unfertilized, b. abnormal cleavage.

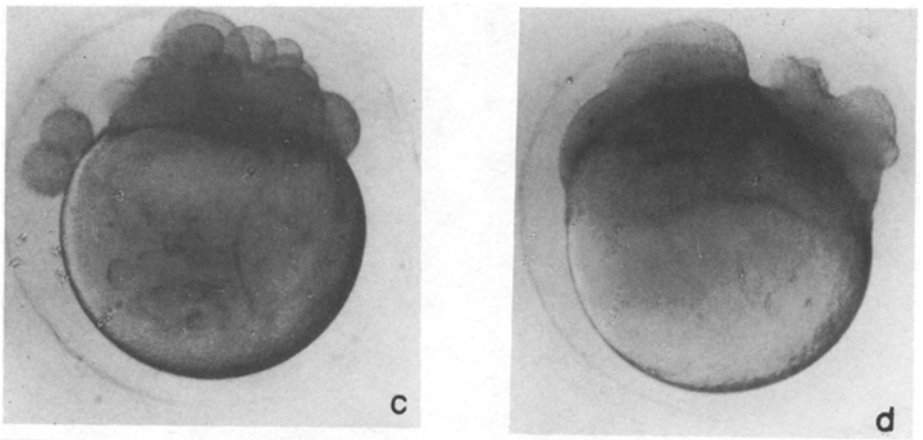

Figure 2.(continued) c. detachment of cells, d. degeneration of cells.

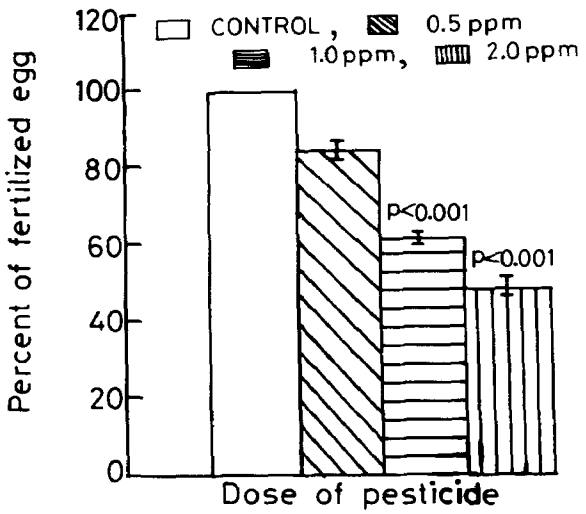

Figure 3. Percentage of fertilization in H. fossilis after carbofuran treatment (with respect to control) (control value = 64±4%, n=5).

The data obtained were tested for Statistical significance ($P<0.05$) using Student's 't'-test.

inhibited completely when the dose of the pesticide increased to 5 mg/L (Kaur and Toor 1977). Smith and Oseid (1974) also recorded that fertilization of eggs and their development are affected by pesticide pollution and consequently may limit fish production in areas suitable for adult fish. On the basis of the present and previous studies it can be concluded that concentration of pesticides in natural water bodies should be reduced to the minimum that there is no detrimental effect on the potency of germ cells, embryonic development and hatching.

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