LABORATORY STUDIES ON THE EFFECT OF A PYRETHROID INSECTICIDE ON HISTOPATHOLOGICAL CHANGES IN TESTES OF THE CATFISH, *HETEROPNEUSTES FOSSILIS* (BLOCH) DURING BREEDING SEASON

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Introduction:

Pyrethroid compounds are considered safe as compared to organochlorine, organophosphate and carbamate compounds owing to its low persistence in nature. The wide use of synthetic pyrethroids is increasing worldwide pollution risks. The synthetic pyrethroids are among the most potent and effective insecticides available, account for more than 30% in the world market [1]. Cypermethrin is a pyrethroid insecticide widely used for pest control programmes in domestic, industrial and agricultural situations because of its low environmental persistence and toxicity. Reports are available which indicate the destruction of interstitial cells of testes in *Glossogobius giuris* after fenthion exposure. Recent review on pesticide-induced reproduction in Indian fish has been reported. It has also been reported that sperm motility is affected by toxicants, osmotic concentration and pH. Sperm biology has been widely studied in domesticated freshwater fish [2, 3]. The quality of sperm is a major contributing factor in the successful production of fish larvae, measurement of its motility could provide a sensitive and accurate bioindicator of pollution [3]. The information available on the effect of cypermethrin induced changes on testes and sperm motility after pesticide exposure are very few.

Methods:

H. fossilis were exposed at sublethal concentration for 45 days during breeding phase (pre-monsoon), of the annual reproductive cycle. After decapitation, testes were dissected, washed in saline (0.6% NaCl) blotted and fixed in Bouin's fluid for histological examination (2). The sperm motility was done just after decapitation (3). The gonadosomatic index (GSI) was calculated as gonad weight x 100/total weight.

Results and Discussion:

Extensive cytotoxic damage and gross condensation of spermatogenic cells by clump formation in testes has been noticed. Testes of *H. fossilis* show significant changes when exposed to cypermethrin. Extensive cytotoxic damage, general inflammatory response and other histological abnormalities are quite prominent. Gross condensation of spermatogenic cells, which are evident by clump formation and appearance of inflammatory lesions are also quite prominent. The tubular epithelial vacuolization increased in cypermethrin treated testes of *H. fossilis*. The interstitial cells were found to be degranulated, accompanied by weak chromophobia and vacuolization in the cytoplasm. The dilution of testicular milt of *H. fossilis* up to 600 times with extender does not initiate motility (forward progression) of the spermatozoa present in it. However, further dilutions, up to 2000 times result in maximum motility of sperm cells in dilution-dependent manner.

Fig.1. T. S. testes showing structural differences of control and 45 d exposed with cypermethrin in *H. fossilis*. T. S. of control testes showing lumen of testes (LT) filled with mature sperms during prespermiating stage HE x 40

E. Lobules (L) of testes filled with mature sperms (S) and interstitial cells (IC). HE x 400
F. T. S. testes after 45 d exposure showing cytotoxic damage (CD), condensation of spermatogenic cells (CSC), vacuolization (V) in the tubular epithelium. HE x 40
G. Showing CD, CSC and V and disruption of IC (DIC) in magnification. HE x 400

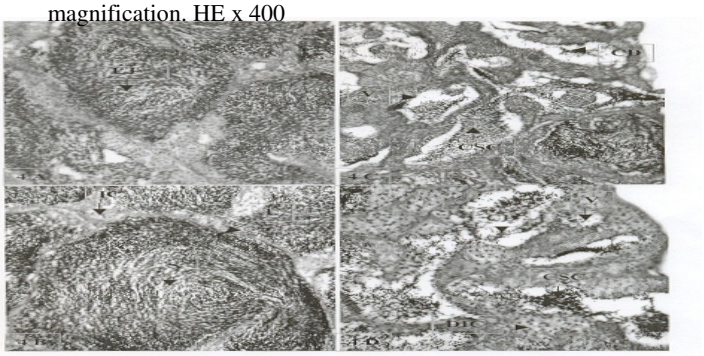
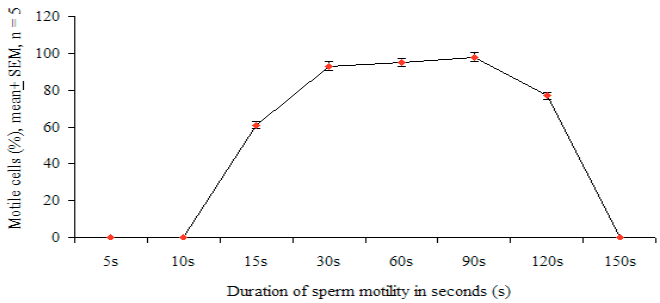


Fig. 2. Percentage of motile spermatozoa and duration of sperm motility after dilution (testis milt : extender, 1 : 2000) in *H. fossilis*.



The motility duration is only for two minutes. The maximum sperm motility has been observed at 90 seconds of duration (Fig 2,3).The decreased motilityof sperm from exposed fish indicated the decreased fertility

Fig.3. Percentage of motile spermatozoa at different duration after activation in *H. fossilis* after cypermethrin exposure. Control versus exposed fish were compared by Students t-test. The level of significance (P)- *P < 0.001, **P < 0.01. ANOVA TW : Cypermethrin F = 1376.30, P < 0.001; Motility F = 1150.16, P < 0.001, Cypermethrin x Motility F = 217.83, P < 0.001.

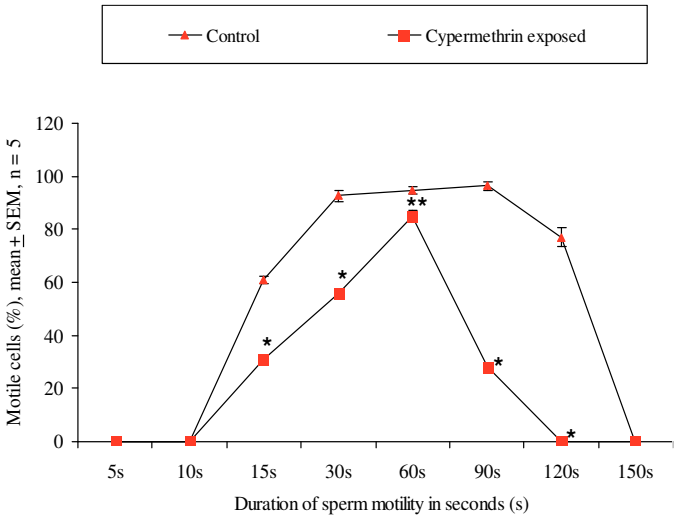


Table 1. Plasma levels of estradiol-17β (E2), and gonadosomatic index (GSI) after 45 days exposure at sublethal concentration (0.02ppm) of technical grade of cypermethrin (94%) during prespawning phase of the annual reproductive cycle in the cat fish, *H.fossilis* (Values are

Batches	Treatments	Female	
		GSI	E2 (ng/ml)
1	Control	6.94 ± 0.42	12.67 ± 0.47
2	Cypermethrin	3.73 ± 0.23*	5.98 ± 0.19*

Control vs cypermethrin treated were compared by students *t*- test. The level of significance (P) - * *P* < 0.001

ultimately decline the fish stock in polluted water or riverine resources.

Conclusion:

It may be safely concluded that cypermethrin causes the disruption of endocrine system by affecting steroidogenesis via hypothalamo – hypophyseal - gonadal axis. Cypermethrin induced decrease of sperm motility may be owing to inhibition of ATP synthesis in mitochondria. This study will help to monitor the quality of sperm (good or bad) on the basis of scale and duration of motility needed during the production of fish seed or in the field monitoring system as indicator of pollution.

References:

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