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ORIGINAL ARTICLE

A STUDY ON ENDOSULFAN INDUCED CHANGES IN PHOSPHOLIPIDS IN THE FRESHWATER CATFISH, HETEROPNEUSTES FOSSILIS (BLOCH)

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ABSTRACT:

The Study of catfish, H. fossilis were exposed to endosulfan for 30 days at sub-lethal concentration (0.002 ppm) during different phases of its annual reproductive cycle. It impact's on total (TP) and different phospholipids- phosphatidylcholine (PC), phosphatidylserine (PS), phosphatdylinositol (PI) and phosphatidylethanolamine (PE) were measured in liver, plasma and ovary. During spawning phase, only plasma and ovarian phospholipids showed decrease in their levels following endosulfan exposure. In the post-spawning phase, endosulfan elevated the levels of TP, PC and PS in ovary but had no effect on their levels in liver and plasma. During resting phase, the TP, PC and PI were found to be decreasing its levels.

KEYWORDS : phosphatidylserine (PS), phosphatdylinositol (PI) and phosphatidylethanolamine (PE).

INTRODUCTION :

Paddy-cum fish culture is very common in eastern part of India, where fishes are directly exposed to endosulfan as non target organism. Endosulfan is an organochlorine insecticide used for the control of insect pests. Pesticides affect the survival, growth rate, fecundity and reproductive activity of fish (Park et al., 2004; Singh and Singh, 2006). Toxicants even in very low concentration have been reported to interfere with basal metabolism and suppress the reproduction steroidogenesis (Wester and Vos, 1994; Singh and Canario, 2004; Sehgal and Goswami, 2005), lipid metabolism (Singh and Kime, 1994), gonadotropin levels (Van Der Kraak et al., 1992; Singh et al., 1994) and also act as reproductive biomarkers (Sepulveda et al., 2004). The pesticide are reported as endocrine disruptors (Pawlowski et al., 2004; Singh and Canario, 2004), contaminant of ground drinking water (Gopal et al., 2004; Kannan et al., 2005), inducing hyper secretion of gonadotropins causing regression of gonads (Zutshi, 2005), enzyme inhibition (Tilak et al., 2005; Agrahari et al., 2006) and reproductive behavioral changes (Prabhakar et al., 1988; Prashanth et al., 2005). Recently, pesticide residues are reported from milk and butter (Battu et al., 2004). Free and conjugated form of sex steroids has also been reported to be affected by

pesticide (Kime and Singh, 1996) which play very important role in pheromonal behaviors and spawning during reproductive seasons (Ebrahimi et al., 1995; Pavlidis et al., 2004).

Unless the various classes of phospholipids in liver, plasma and ovary are considered simultaneously during annual reproductive cycle, a clear picture of relationship between phospholipids and reproduction can not emerge, because phospholipids undergo rapid breakdown, resynthesis and inter-conversions with slight change in regulatory factors. Therefore in the present study, an attempt has been made to explore the effect of endosulfan on the profiles of various phospholipids in relation to reproductive activity of the freshwater female catfish, H. fossilis which is abundantly cultured in paddy fields of State of Bihar, India as well as in the eastern part of West Bangal.

In the present study, endosulfan significantly decreased total phospholipids in liver, plasma and ovary during preparatory, pre-spawning and resting phases suggesting that endosulfan exposure affects the hepatic enzymes due to which synthesis of phospholipids were affected. Lal and Singh (1987), have reported decreased levels of total PL in ovariectomized catfish, Clarias batrachus using microsurgical technique during pre-spawning phase. They have suggested that estradiol-17β (E2) and testosterone (T) are amongst the factors which influence the lipid metabolism. Thus it appears that sex hormones may be responsible for phospholipids decline during reproductive growth following endosulfan treatment. The reports of Singh and Singh (1992), who have reported decline in the levels of E2 from preparatory to prespawning phases in this species after γ-HCH exposure, and recently, Singh and Canario (2004), who have also demonstrated decline in E2 as well as PC, PS, PI and PE in the catfish following γ-HCH treatment during prespawning phase (vitellogenic), support our above contention.

Lipids are an important source of nutrition in fish providing a significant amount of energy and structural components for reproductive growth (Sargent, 1995). Some studies have corroborated the elevation in hepatic PL to the production of vitellogenin (Schwalme and Mac Kay, 1991; Schwalme et al., 1993). Recently, it has been reported that vitellogenin exists as charge isomers (Sehgal and Goswami, 2005) and are stimulated in vitro by estradiol-17β isolated hepatocytes of catfish, Clarias gariepinus (Rajendra Phartyal et al., 2005). Elevated PL and vitellogenin synthesis are related since PL is the predominant lipid in vitellogenin (Ng and Idler, 1983; Tocher et al., 1985) and would be requiring for the proliferation of hepatic rough endoplasmic reticulum for the synthesis of female-specific lipoprotein (Henderson et al., 1984). Fremont and Riazi (1988) have indicated that fish vitellogenin comprises 18% total lipid, of which approximately two-third is phospholipid and the remaining fraction is largely triacylglyceride, sterol and sterol esters. Hence on the basis of these reports and present results, it can be suggested that the secretion of E2 by the ovary (under maturational GtH control) which stimulates the liver for the secretion of phospholipid components or vitellogenin, ultimately to be deposited in growing oocytes (under the influence of vitellogenic GtH) during reproductively active prespawning phase, is disrupted by the endosulfan.

CONCLUSION :

There are insufficient reports for various classes of phospholipids available in the catfish due to which interpretation for decrease or increase in PI and PE is not possible. The magnitude of effects may be due types and grades of pesticide concentration during different phases in different species. The present finding clearly demonstrated that endosulfan significantly altered the phospholipid metabolism and have very selective and specific effect on different phospholipids in H. fossilis during different phases of its annual reproductive cycle. The

mobilization of various hepatic phospholipid to the ovary was also restricted by endosulfan. Thus it appears that this pesticide interfere with the production of lipid deprived, vitellogenin, presently judged by PL, which ultimately results in affecting the reproductive physiology of this species

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