



Interference of Synthetic Pyrethroid Deltamethrin on fecundity Zebrafish, *Danio rerio*”

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ABSTRACT

The present study is designed to know the possible disruption caused by deltamethrin in the mature male and female adult zebrafish. In order to screen the possible places of interference of this toxicant, “Fecundity” were selected as the end points. This parameter has specific focus in understanding the reproductive functioning of Zebrafish in control and treated fishes in different concentrations of deltamethrin.

Key words: Deltamethrin Pyrethroid, Fecundity, Zebrafish

Introduction

Fish are often used as sentinel organisms for ecotoxicological studies because they play number of roles in the trophic web, accumulating toxic substances, responding to low concentration of mutagens (Cavas and Ergene-Gozukara, 2005) and also serve as bio-indicators of environmental pollution playing a significant role in assessing potential risk associated with contamination in aquatic environment since they are directly exposed to chemicals resulting from agricultural production via surface run-off or indirectly through food chain of ecosystem (Lakra, 2009).

Zebrafish may seem to be a strange comparator to humans, but like us they are vertebrates and we share a common ancestor. They are remarkably biologically similar to people and share the majority of the same genes as humans, making them an important model for understanding how genes work in health and disease.

70 per cent of protein-coding human genes are related to genes found in the zebrafish and that 84 per cent of genes known to be associated with human disease have a zebrafish counterpart. The study highlights the importance of zebrafish as a model organism for human disease research (Science News Apr. 17, 2013).

Interdisciplinary relevance

The topic has a connection with Ecology of water and so directly with humans. Deltamethrin on metabolism releases toxins related to organic chemistry and biochemistry and also has relevance especially with environmental sciences.

Review of Research and Development in the Subject:

- Pesticide/herbicide pollution severely affects aquatic organisms at higher trophic levels including human beings. The effects of pesticides on fishes are of great concern (Nwani et al., 2010).
- The knowledge of fecundity of fish from a specific aquatic body is extremely important in the successful management and exploitation of its fishery. Fecundity is one of the most important biological aspects of a fish species. For efficient fish culture and effective management practices it is prime important to know the fecundity of fish (Mian and Dewan, 1984).
- The early life stages (embryo, larval, and early juvenile stages) of fish are generally regarded as the most sensitive life-history stages to toxic agents (Power, 1997; Hutchington et al., 1998), they are ideal for determining responses to environmental contaminants.

➤ Deltamethrin is widely used in agriculture and to control household pests which in turn affects humans. A strict control on the proper usage is very much essential.

Methodology

MAINTENANCE OF ZEBRAFISH

Wild type adult Zebrafish (*Danio rerio*) used in this study were bred in our aquarium facility for two generations. 12 Females and 6 males are kept in a ratio of 2:1 in an aquaria filled with filtered tap water with the oxygen saturation of more than 80% and P^H at 7.0±0.3. The water temperature was maintained at 26±1°C at a 14h: 10h day and light regime. Fish were regularly provided with varied diet comprising of freshly hatched live brine shrimp (*Artemia nauplii*) once a day, supplemented with vitamin fed dried flake food twice a day. The aquarium water was aerated continuously with stone diffusers connected to mechanical air compressor. Renewal of water is done in a semi-static manner and the aquaria screens were cleaned daily. The excess amount of food and fecal matter was removed from the water and provided the healthy environment before experimentation. Due to surplus feeding, the water quality and cleanliness of aquaria is monitored regularly and reset to initial state. Less than 1% of the population died during acclimatization.

Experiment will be conducted after exposing the fish for 6 days with 2µg/L and 4µg/L of deltamethrin. Controls were maintained. Eggs were collected every day, 6 days before the addition of toxicant and for 6 days during the exposure time. The experiment will be done in triplicates.

RESULTS: FECUNDITY TEST

	1 st day	2 nd day	3 rd day	4 th day	5 th day	6 th day	cumulative
control	1248	1234	1197	1256	1252	1203	7403
2 µg/l	1160	1158	1132	1127	1092	1087	6756
4 µg/l	890	877	861	842	821	802	5093

The present study indicates that the cumulative per-

centage of fecundity rates of control and 1g/l were relatively high. But as concentration of toxicant and increasing in number of days the fecundity rates are decreasing drastically. The number of eggs produced per female per unit time (e.g., per spawning season).

DISCUSSION

Fecundity has been considered as the number of ripening eggs in the female prior to spawning. Fecundity of the fish is the most important aspects of the reproductive biology of the fish which must be understood to explain the variation in the level of production as well as to make efforts to increase the amount of harvest. Alternatively fecundity may be expressed per unit body weight of post stripes fish when it is known as relative fecundity because the number of eggs produced for each unit increase in weight shows significant linear variation

There has been concern that uncontrolled uses of pesticides that reach the environment exert great and harmful effects on wildlife and human health since the publication of "Silent spring" book by Rachel Carson in 1962. Then term "endocrine disruptor" was introduced since publication of book entitled "Our Stolen Future, Are We Threatening Our Fertility, Intelligence and Survival. By Colborn et al.(1996). In this book, she recorded that environmental chemicals disrupt the development of the endocrine system and exposure during development is often permanent. Endocrine disrupting chemicals (EDCs) are defined as chemical substances that alter the normal endocrine function (McKinlay et al., 2008) including either naturally occurring chemicals as phytoestrogen or synthetic chemicals such as Pesticides, plasticizers, polychlorinated biphenyls (PCBs) and alkylphenolic compounds. EDCs exert their effect either through mimicking (act like a natural hormone) such as methoxychlor pesticide, certain polychlorinated biphenyls (PCBs) and bisphenol A

(BPA) or antagonizing endogenous hormones such as tamoxifen disrupt the synthesis and metabolism of hormones or interact with the hormone receptors (Sonnenschein and Soto, 1998).

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