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Effect of Pesticides (Fenvalerate) on the Behavior of Freshwater Fish *Channa punctatus*

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Abstract

The indiscriminate use of pesticides in agriculture has led to the contamination of aquatic ecosystems, adversely affecting non-target organisms such as freshwater fish. This study investigates the behavioral responses of the freshwater fish *Channa punctatus* to sub-lethal concentrations of the synthetic pyrethroid pesticide, fenvalerate. The results reveal significant alterations in swimming behavior, respiratory patterns, feeding activity, and overall responsiveness, indicating neurotoxic and physiological stress. These behavioral changes may impair the survival and ecological fitness of the species, emphasizing the need for stringent regulation of pesticide usage.

Keywords: Fenvalerate, *Channa punctatus*, behavioral toxicity, freshwater fish, neurotoxicity, aquatic pollution.

1. INTRODUCTION

The widespread application of pesticides in agriculture has increased the risk of environmental contamination, particularly in aquatic habitats adjacent to agricultural fields. Among various classes of pesticides, pyrethroids such as fenvalerate are known for their high toxicity to aquatic life despite their low persistence in the environment. Fish, being sensitive indicators of aquatic pollutions (Kumari and Ram Kumari, 1997; Saxena and Seth, 2002) often exhibit behavioral changes when exposed to sub-lethal concentrations of contaminants. (Quasim and Siddique, 1960; David and Ray, 1966; Venkataraman, 1966; Hingoroni *et al.*, 1979) *Channa punctatus*, a common freshwater teleost in South and Southeast Asia, serves as an ideal model for toxicological studies due to its ecological and economic significance.

2. MATERIALS AND METHODS

2.1 Test Organism: Healthy specimens of *Channa punctatus* (length: 10-12 cm, weight: 30-40 g) were collected from unpolluted freshwater bodies and acclimatized in laboratory conditions for 15 days. During this period, fish were fed a standard diet and maintained under a 12:12 light-dark cycle.

2.2 Pesticide and Exposure Setup: Technical grade fenvalerate was procured and diluted to prepare stock solutions. The LC50 value of fenvalerate for *Channa punctatus* is 3ppb. Sub-lethal concentrations 10% (0.3ppb) and 20% (0.6ppb), of the LC50 value) were selected for behavioral observations over different exposure periods (24, 48, 72, and 96 hours). A control group was maintained without pesticide exposure.

2.3 Behavioral Parameters Observed Fish were observed for changes in:

- Swimming pattern
- Opercular (gill) movement rate
- Feeding behavior
- Equilibrium and posture
- Response to external stimuli

3. RESULTS

3.1 Swimming Behavior: Fish exposed to fenvalerate exhibited erratic swimming, darting movements, and increased surface activity. With increased exposure duration and concentration, loss of coordination and lethargy became evident.

3.2 Respiratory Distress: A dose-dependent increase in opercular movement rate was recorded, suggesting respiratory distress. At higher concentrations, gill damage may have contributed to impaired gas exchange.

3.3 Feeding Suppression: Significant reduction in feeding activity was observed within 24 hours of

exposure. In some cases, fish showed complete refusal to feed.

3.4 Loss of Equilibrium: Fish showed difficulty in maintaining posture, especially at 20% and 30% LC50 exposures. Some fish were observed floating upside down or lying motionless at the tank bottom.

3.5 Stimulus Response: Decreased responsiveness to visual and tactile stimuli was recorded over time, indicating possible central nervous system depression.

4. DISCUSSION

The behavioral changes observed in *Channa punctatus* upon fenvalerate exposure are consistent with neurotoxic effects of pyrethroids, (Hingoroni *et al.*, 1979) which disrupt sodium channel function in neurons. The resulting hyperexcitability followed by CNS depression can account for the observed behavioral anomalies (Ramona *et al.*, 2001). Respiratory and feeding disruptions further point to systemic physiological stress (David and Ray, 1966; Venkataraman, 1966). These changes, though reversible at lower doses and shorter exposures, can lead to long-term ecological consequences if exposure persists.

5. CONCLUSION

Fenvalerate, even at sub-lethal concentrations, induces significant behavioral disturbances in *Channa punctatus*. These effects highlight the sensitivity of aquatic organisms to pesticide pollution and underscore the importance of regular monitoring and stricter pesticide management practices to protect freshwater biodiversity.

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