



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2019; SP2: 384-386

**Dr. A Bharathi**  
Assistant Professor, P.G &  
Research Department of  
Zoology, Sir Theagaraya College,  
Chennai, Tamil Nadu, India

## Action of monocrotophos on the muscle tissue of *Penaeus monodon*

**Dr. A Bharathi**

### Abstract

Monocrotophos is an organophosphorous insecticide widely used in the field of agriculture. The aim of the study is to prove the impact of the monocrotophos in relation to the alteration in cholesterol content in the muscle of the male and female *Penaeus monodon*. The prawns were exposed to lower (0.002ppm) and higher (0.003ppm) sub lethal concentration of monocrotophos for the experimental periods 5, 10 and 15 days. The muscle tissues were taken for the analysis of cholesterol content. The current study proves that monocrotophos causes imbalances in the cholesterol content in the muscle of male and female *Penaeus monodon*.

**Keywords:** Sub lethal concentration, Muscle tissue and Monocrotophos

### Introduction

Wide use of highly persistent pesticides in agricultural land and its run off to aquatic regions has resulted in contamination of the environment causing hazards to wild and aquatic life. Public health programmes to control vectors have their own contribution to pesticide pollution. In a study by the US Environmental Protection Agency Laboratory (EPA), penaeid shrimps were more sensitive than fishes or molluscs to the toxic effects of most pesticides and it was further recommended that pesticides in the water or in the soil compromises the shrimp immune system and triggers the outbreak of infectious diseases [5, 20, 2, 19, 10, 14]. Pesticides are also extensively used in the aquaculture industry to control marine parasite infestations. After treatment for short periods, the pesticide solution is released to the environment.

*M.monoceros* has significant changes in biochemical parameters on exposure to endosulfan, this species could possibly be used as biosensor of coastal marine and estuarine pollution by organochlorine pesticide [17]. Many aquatic species have been used in pesticide toxicity tests to register new pesticides and to assess their impacts [4]. Effect of trichlorfon on the immune responses and resistance in fresh water prawn *Macrobrachium rosenbergii* [21]. *L. vannamei* shrimp farms in the vicinity of the use of pesticides can cause harm to their health and affect the shrimp industry [15]. Therefore the present study was taken to reveal the effect of monocrotophos on cholesterol content in the muscle of male and female *Penaeus monodon*.

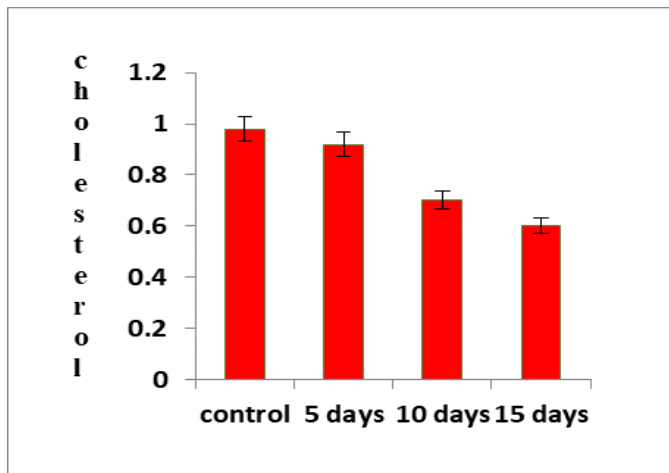
### Materials and Methods

*Penaeus monodon* were collected in and around the Pattipuzham near Mahabalipuram sea shore. Prawns were collected from the Madha Prawn Hatchery Centre and were collected by the local fishermen and they were reared in a big cement tank having the capacity of 0.5 tones water.

The acclimatized prawns were exposed to lethal concentration (0.03 ppm) for 96 hrs and the chronic toxicity study was done with two sub lethal concentrations (lower-0.002 and higher-0.003 ppm) for 5, 10 and 15 days. LC50 values are determined by the guidelines given by Finney (1971) and Annon (1975). Cholesterol content was estimated by Susheela and Radha, 2013 method [18]. Male and female *Penaeus monodon* was selected, dissected and the muscle tissues were taken out from the normal and experimental animal for the analysis of cholesterol content.

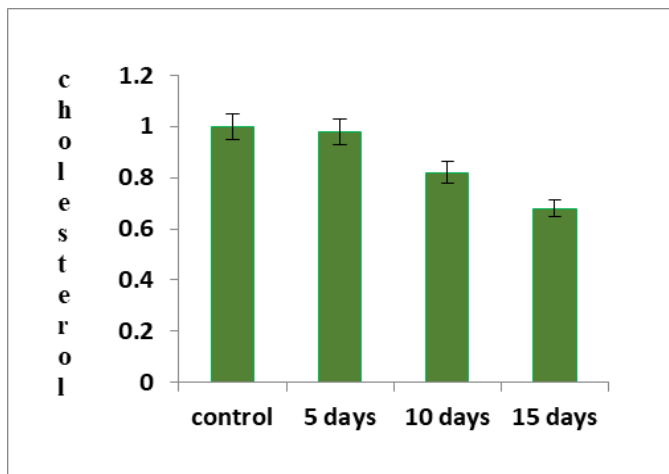
**Correspondence**  
**Dr. A Bharathi**  
Assistant Professor, P.G &  
Research Department of  
Zoology, Sir Theagaraya College,  
Chennai, Tamil Nadu, India

**Results**



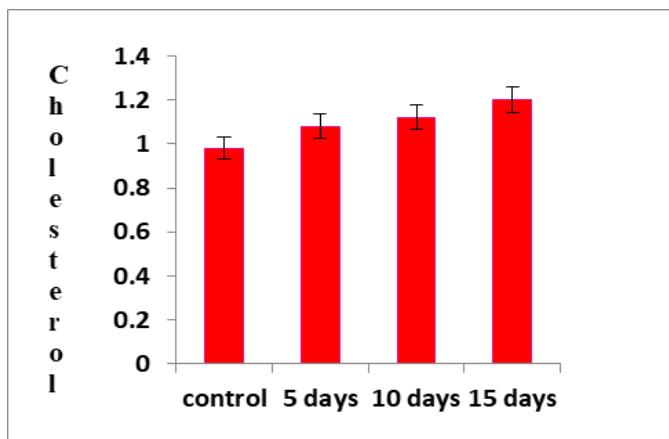
p-value =0.008  
 \*\* p-value < 0.01-Denotes 1% level of significance (significant)

**Fig 1:** Cholesterol content (mg/G) in the muscle of male *Penaeus monodon* exposed to lower sub lethal concentrations of monocrotophos.



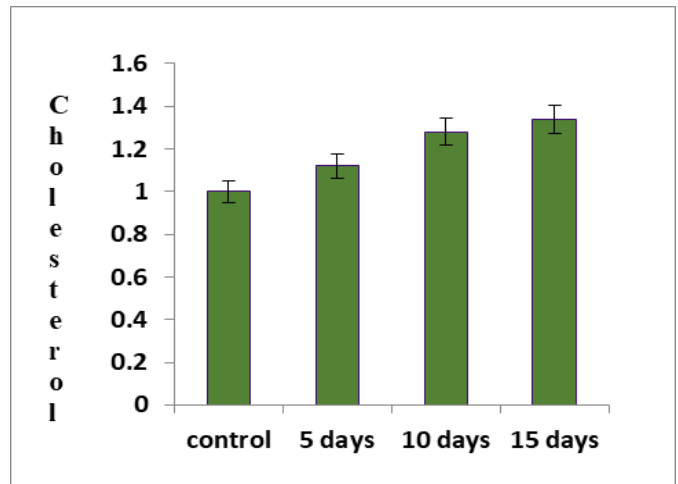
p-value =0.045  
 \* p-value < 0.05- Denotes 5% level of significance (significant)

**Fig 2:** Cholesterol content (mg/G) in the muscle of female *Penaeus monodon* exposed to lower sub lethal concentrations of monocrotophos.



p-value =0.009  
 \*\* p-value < 0.01-Denotes 1% level of significance (significant)

**Fig 3:** Cholesterol content (mg/G) in the muscle of male *Penaeus monodon* exposed to higher sub lethal concentrations of monocrotophos.



p-value =0.049  
 \* p-value < 0.05- Denotes 5% level of significance (significant)

**Fig 4:** Cholesterol content (mg/G) in the muscle of female *Penaeus monodon* exposed to higher sub lethal concentrations of monocrotophos.

Cholesterol content in the muscle was significantly decreased when the experimental animals (male and female) exposed to the lower sub-lethal concentration of monocrotophos at the end of 5th, 10th and 15th day (Fig. 1 and 2). but in higher sub-lethal concentration of monocrotophos at the end of 5th, 10th and 15th days Cholesterol content in the muscle was significantly increased in both male and female prawns (Fig. 3 and 4). This may be due to the mechanism that reserve cholesterol in crustaceans would replace the decrease in cholesterol level in tissues under pesticide exposure. But when compared to males, the muscle tissue of the female prawns has more cholesterol content.

**Discussion**

Conflicting reports like lowering of cholesterol in stress conditions to meet the additional energy requirements in crustaceans was recorded by [9, 16, 12]. Hypocholesteremia in the plasma of fish *Channa punctatus* exposed for the periods of 15 and 60 days, in the sub lethal concentrations of monocrotophos [1]. Cholesterol is the backbone molecule for ecdysone synthesis and is important in yolk lipoprotein production in crustaceans. It is also used as a constituent of cellular membranes, sub-cellular structures, and as a precursor of steroid hormones. Cholesterol is further an essential nutrient because crustaceans are incapable of *de novo* synthesis of the steroid ring and cannot synthesize cholesterol and must be supplied by either natural or artificial diets. Usually unused cholesterol in crustaceans would replenish the reduction in cholesterol level in tissues under pesticide/pesticides exposure [13, 6, 9]. The present scenarios have multiplied the research to establish early-warning signals, or biomarkers, reflecting the adverse biological responses towards anthropogenic environmental toxins [3, 7]. The effect of phosphamidon, an organophosphorus on two species of crustaceans are of the opinion that stable or increase cholesterol content in stress may be due to diversion of acetylCoA to acetoacetate for the synthesis of cholesterol and moreover organophosphorous pesticides inhibit steroid metabolism, unutilized cholesterol would balance the cholesterol content in tissues [11]. AChE activity inhibition and in most cases irreversible inhibition was recorded and reported in *Palaemonetes pugio* exposed to malathion [22].

Neutral lipids (mainly triacylglycerides) are preferentially catabolized during starvation, while polar lipids (Cholesterol) are conserved due to their role as structural components of cell membranes<sup>[8]</sup>. The cholesterol content in the muscle of male and female *Penaeus monodon* exposed to lower (0.001ppm) and higher (0.002ppm) concentrations of monocrotophos in the current experiment proved the above mentioned status on pesticide experience by maintaining a near normal condition of cholesterol content in the muscle tissue.

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