

ALLEVIATE POTENTIAL OF *PISONIA ALPA* IN CYPERMETHRIN TOXICITY ON ACID PHOSPHATASE P AND ALKALINE PHOSPHATASE ACTIVITIES IN THE FRESH WATER FISH *CYPRINUS CARPIO* (HAMILTON)

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Article History: Received 4th April ,2016, Accepted 30th April 2016, Published 1st May,2016

ABSTRACT

The present study was undertaken to evaluate the Alleviate potential effect of *Pisonia alpa* against the toxicity effects of herbicide cypermethrin on antioxidant enzyme such as acid phosphatase (ACP), and alkaline phosphatase (ALP), in the freshwater fish *cyprinus carpio*. In the present experimental study, *cyprinus carpio* were exposed to sublethal concentration of cypermethrin (23 mg/L of cypermethrin for 120 hours). The antioxidants acid phosphatase (ACP), and alkaline phosphatase (ALP), levels were increased compared to control. During the treatment of *Pisonia alpa* against cypermethrin exposed fish were restored near normal level (Group III and IV). The observed results were discussed in detail. This observation clearly indicates the defensive nature and the adaptive mechanism of cells against free radical induced toxicity, *Cardiospermum halicacabum* in plant extracts may afford protection from pesticide toxicity.

Keywords: Alleviate potential, Cypermethrin, *Cyprinus carpio*, *Pisonia alpa* ACP, ALP.

1.INTRODUCTION

Pesticides are known to affect all members of an ecosystem from the smallest invertebrates to birds and humans, and their toxicities in both urban and agricultural settings are responsible for the death of many birds and fishes, and smaller aquatic animals that fishes depend on for food (Khan Ehsan *et al.*, 1992). On application, pesticides are carried away by rain flood, wind drift, precipitation and runoffs to ponds, lakes and rivers (Richard, 1991). Cypermethrin, Alpha-cyano-3-phenoxybenzyl -cis - trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylate, is a widely used herbicide for the control of grass and broad leaf weeds in crops such as sorghum, maize, sugarcane, lupins, pine and eucalyptus plantations. Cypermethrin is a synthetic pyrethroid used to kill insects on cotton and vegetable crops. It has eight isomers and all of its containers is a combination of the various isomers. It kills target organisms by the disruption of the normal functioning of the nervous system, thereby, causing excitability and convulsion through the inhibition of gamma-aminobutyric acid receptors in the nervous system (Ramadan, 1988). It has also been observed to inhibit succinate dehydrogenase and ATPase activities in

the brain, kidney and liver of *Labeo rohita* fingerlings (Das & Mukhejee, 2003). Besides, in the same fish species, Philip & Reddy (1996) observed that the agrochemical caused an increase in transamination and oxidative deamination, manifested by elevation in the activities of ACP and ALP. Interestingly, these changes occurred at very low concentrations of the chemical, indicating its high toxicity to fish. *Pisonia grandis* (Synmyn: *Pisonia alba*, *Pisonia morindifolia*) commonly known as Leechikottai kerai in Tamil, Velati salet in Hindi Khare (2007). The plant *Pisonia grandis*, belonging to the family Nyctaginaceae, is an evergreen glabrous garden tree with young shoots are minutely puberulous. It is native of Hawaii island and naturalized throughout India. In the alternative system of medicine *Pisonia grandis* leaves are used as analgesic, antiinflammatory, diuretic (Radha, *et al.*, 2008) hypoglycemic agent (Sunil, *et al.*, 2009), antifungal Shubashini and Poongothai (2010). It is also used in the treatment of ulcer, dysentery and snake bite. The leaves are edible and mostly used to treat wound healing, rheumatism and arthritis (Prabu, *et al.*, 2008). Leaves also consumed as vegetable and salad, fed to cattle Chatterjee and Prakashi., (1997).

Since the presence of the toxicant in water has been found to alter the physiology and biochemistry of fish there is, therefore, the need to examine the enzymatic changes associated with cypermethrin-polluted environment in

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selected organs (gill, liver, kidney and muscle) tissue of *Cyprinus carpio* under laboratory conditions.

2.MATERIALS AND METHODS

Experimental animal collection and maintenance

The freshwater fish *Cyprinus carpio* were collected from the Navarathna fish farm at Pinnaluru, Cuddalore district. The fish were brought to the laboratory and transferred to the rectangular cement tanks (100 x 175) of 500 liters capacity containing chlorine free aerated well water. The fishes measuring 14-17 cm in length and 70-80 g in weight were selected irrespective of their sex for the experiments. During this time they were fed every 24 hour with a commercial diet. The physico-chemical parameters of the water were monitored throughout the acclimation period and remained constant (pH: 7.18 ± 0.5 , conductivity: $118.25 \pm 8.7 \mu\text{S cm}^{-1}$, dissolved oxygen: $8.49 \pm 0.9 \text{ mg O}_2 \text{ L}^{-1}$, temperature: $21.96 \pm 2.7 \text{ }^\circ\text{C}$).

Supplementary feed

Healthy disease free leaves of *Pisonia alba* were collected from Cuddalore district in and around Chidambaram Village, plant was identified. The leaves were washed in running tap water for 10 minutes leaves were dried, aerial parts (1kg) of *Pisonia alba* were macerated thrice at room temperature and prepared in powdered condition and equal amount of rice bran mixed well and small amount water added and prepared small pellet for used in treated fish.

Enzymatic assay

Acid and alkaline phosphatase were assayed following the procedure adopted by Tenniswood *et al.*, (1976). p-Nitrophenyl phosphate was colorless in solution but upon hydrolysis the phosphate group liberated p-nitrophenyl which was highly coloured in an alkaline solution. The rate of hydrolysis of p-nitrophenyl phosphate was proportional to the enzyme present in the tissue which recorded at spectrophotometrically at 540 nm.

Experimental design

Group- I: Fish exposed to tap water (control)

Group- II: Fish exposed to cypermethrin

Group-III: Fish exposed to cypermethrin along with *Pisonia alba*

Group- IV: Fish exposed to *Pisonia alba* alone

Statistically analyses

The data obtained in the present work were expressed as means \pm SE, percentage changes and were statistically analyzed using student t-test (Milton and Tsokos, 1983), to compare means of treated data against their control ones and the result were considered significant at ($P < 0.05$) and ($P < 0.01$) level.

3.OBSERVATION

In the present study, observed that gill, liver kidney and muscle tissues antioxidant dehydrogenase activity enzymes

such as ACP and ALP levels are increased significantly at 5 % level ($p < 0.05$) in the treated group II (Fig – 1 and 2). At the end of 120 hours ACP and ALP levels are decreased when compared to control group I. In the group III and IV ACP and ALP levels are near to normal when compared to group II.

In the group III and IV ACP and ALP levels are decreased significantly at 120 hours compared to group II and which was near to control group I. ACP levels were significantly increased in the group II when compared to control group I (Fig - 2). In the group III and IV ALP level was regained compared to group II. In the group III and IV ACP level near to normal significantly at 120 hours compared to group II and which was near to normal when compared to control group I.

4.DISCUSSION

Enzymes are fragile substances with a tendency to undergo denaturation and inactivation under unsuitable conditions. The variations in the activity of acid phosphatase enzyme in liver of freshwater fish *Cyprinus carpio* exposed to (cypermethrin were studied in the present investigation. Alkaline phosphatase is a general enzyme present in almost all the tissues. It is a hydrolytic enzyme concerned with the process of transphosphorylation and has an important role in the general energetics of an organism (Srivastava *et al.*, 1996). In the present experiment the level of ACP was decreased when the fish exposed to cypermethrin. But the group IV (cypermethrin along with *Pisonia alba*) the ACP level was gradually increased when compared to the group II. Moreover, the group III (cypermethrin along with *Pisonia alba*) also increase the ACP level very leisurely than the group IV.

In the present experimental result shows that the, levels of ACP was decreased when the fish exposed to cypermethrin. But the group IV (cypermethrin along with *Pisonia alba*) the ACP level was gradually increases when compared to the group II. Moreover, the group III (cypermethrin along) also enhance the ACP level very slowly than the group IV. Pointed out that a decreased ACP activity response may accompany a first exposure to pollutants, which can be followed by an induction of antioxidant systems.

Das and Mukharjee, (2003) made similar observation in the fish *Labeo rohita* exposed to sublethal concentrations of cypermethrin. Due to the resulting activity of ACP activity, it may be assumed that the liver tissue of the experimental animal exhibited marked inhibition in the activity of phosphatases by cyanide. As hypoxic cell damages are mediated through increased permeability of cell membrane, the localization of phosphatases within the membrane would make it highly susceptible to release in cyanide-induced tissue lesions (Rees *et al.* 2009).

In the present observation, the levels of ALP were decreased when the fish exposed to cypermethrin. But, the group IV (cypermethrin along with *Pisonia alba*) the ALP level was gradually regained when compared to the group II. Moreover, the group III (cypermethrin along) also enhance

Fig. 1. Changes of acid phosphatase (ACP) ($\mu\text{mole}/\text{min}/\text{mg}$ protein) activities in the tissues (Gill, Liver, Kidney and Muscle) of freshwater fish *Cyprinus carpio* exposed to cypermethrin followed by the supplementary feed of *Pisonia alba* exposed to 120 hours

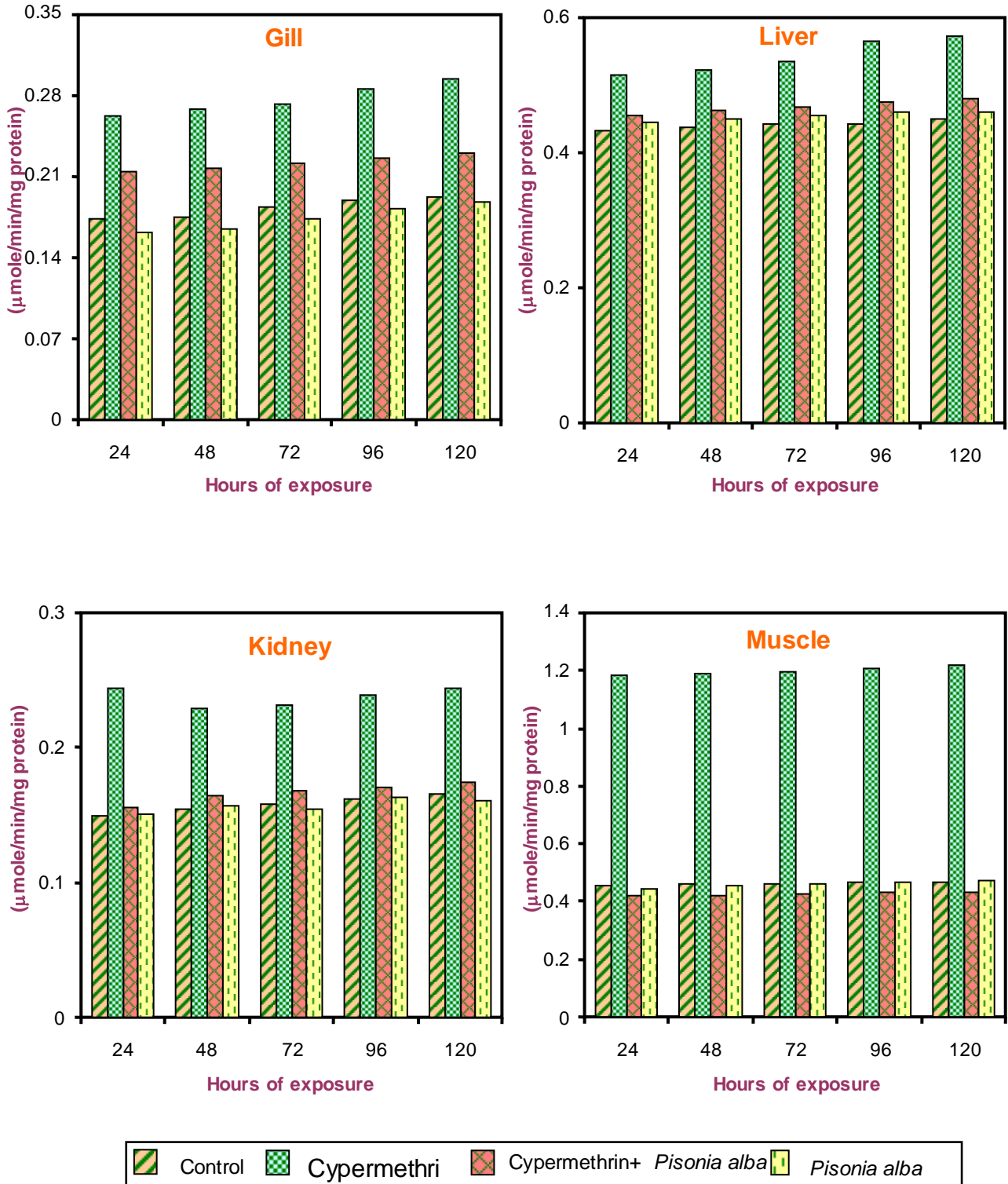
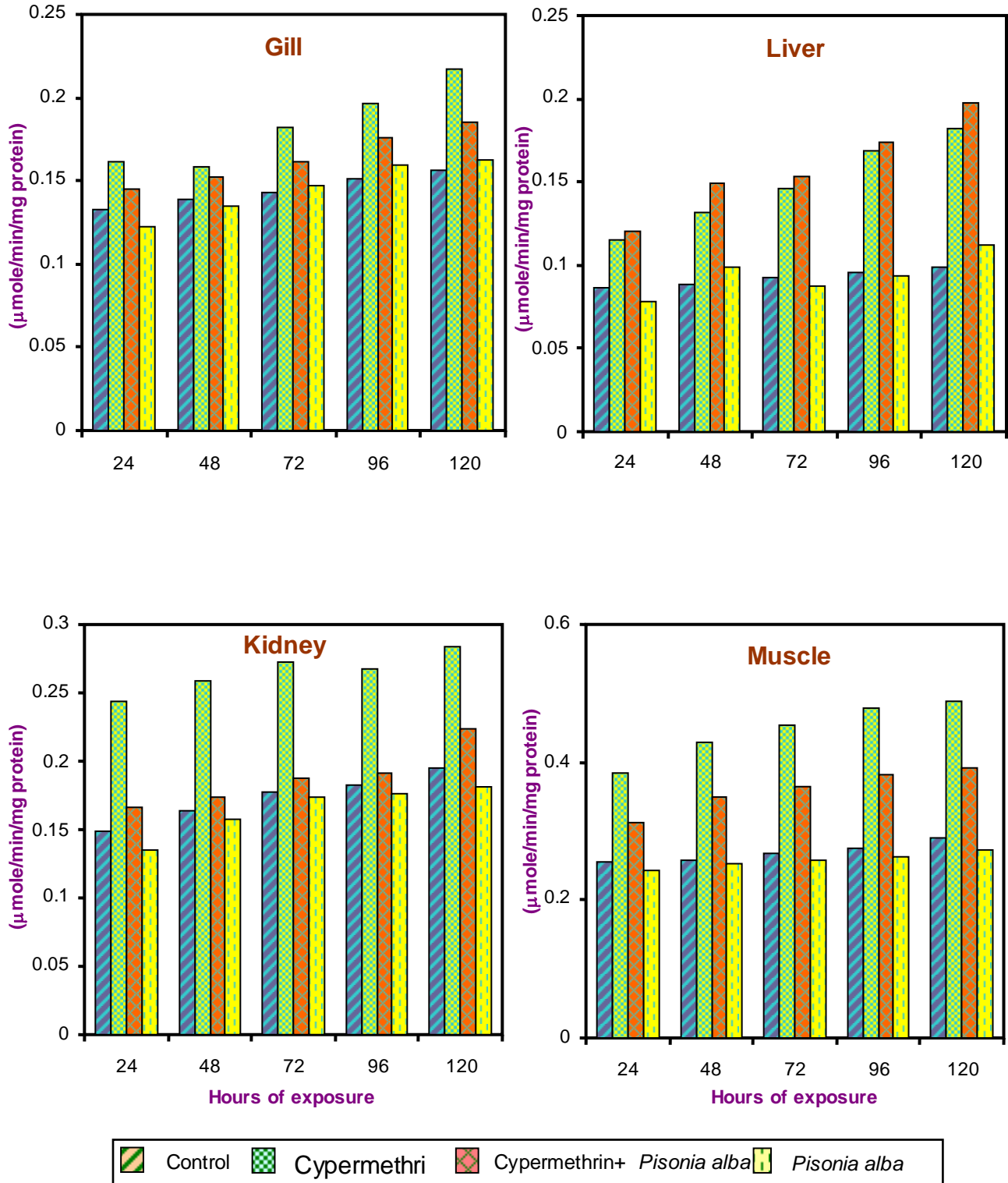


Fig. 2. Changes of alkaline phosphatase (ALP) ($\mu\text{mole}/\text{min}/\text{mg}$ protein) activities in the tissues (Gill, Liver, Kidney and Muscle) of freshwater fish *Cyprinus carpio* exposed to cypermethrin followed by the supplementary feed of *Pisonia alba* exposed to 120 hours



the *Pisonia alba* level very slowly than the group IV. Carbaryl produced a simultaneous decrease in ALP at the end of the assay period. Inyang *et al.* (2011) reported inhibition of ACP activity in the fish *Clarias gariepinus* resulting from the Diazinon exposure.

In the present investigation marked decrease in the activities of the enzyme alkaline phosphatase has been observed with the concentrations of the cypermethrin, showed that the, levels of ALP was increased when the fish exposed to cypermethrin. But the group IV (cypermethrin along with *Pisonia alba*) the ALP level was gradually increases when compared to the group II. Moreover, the group III (cypermethrin along with *Pisonia alba*) also enhance the ALP level very slowly than the group IV. Suneel Kumar, (2014) analysed the decline activity of ACP in the fresh water fish *C. punctatus* by the exposure of insecticide Nuvan. Sastry and Siddiqui, (1984) observed decreased activity of acid phosphatase due to physiological function of the tissues, that enzymes activity was affected in catfish *H. fossilis* after exposed to toxic substance similar findings observed Sarasu *et al.*, (2004) and Pugazhendy *et al.*, (2007) observed decreased acid phosphatase due to uncoupling of phosphorylation after exposure of fenvalerate toxicity. These bioactive compounds present in *Pisonia alba* which may give recovery to fish in the presence of toxic stress.

5. CONCLUSION

It has been concluded from the evidence that the plants *Pisonia alba* produced significant hepatoprotective of cypermethrin induced toxicity on freshwater fish *cyperinus carpio*. Besides, the recovery group (group III and IV) regain the SOD and LOP level. Because of the *Pisonia alba* having potential protective effect against cypermethrin toxicity. At the *Pisonia alba* having the certain important medicinal properties and having the more valuable therapeutic properties of the *Pisonia alba* was less. This decrease may be due to the damage and dysfunction of the liver. The hepatic parenchyma of fish exposed to mercury showed lymphocytic infiltration, increase of cytoplasmic vacuolation, hepatocellular necrosis, increased HSI and decreased in the number of hepatocytes nucleus per mm².

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