



**Full Length Research Article**

**PROTECTIVE ROLE OF *Denolex elata* AGAINST THE CADMIUM TOXICITY IN THE GLUTATHIONE PEROXIDASE (GPX) IN THE FRESH WATER FISH *Labeo rohita* (HAMILTON)**

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**ABSTRACT**

The effect of sublethal exposure of cadmium (51.82 mg/kg) for 96 hours on various antioxidant enzymes was carried out in the freshwater fish *Labeo rohita*. The activity of antioxidant enzymes, such as glutathione peroxidase (GPx) were decreased was increased. This observation clearly indicates the defensive nature and the adaptive mechanism of cells against free radical induced toxicity, *Denolex elata* in plant extracts may afford protection from pesticide toxicity.

**Key words:**

Cadmium,

*Denolex elata*. GPx

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**INTRODUCTION**

Heavy metals coming out from various sources enter the fresh water habitats and bring about morphological and physiological changes in the aquatic system. Metal pollution cause direct toxicity both to humans and other living being, due to their presence beyond specific limits. The current uses of cadmium include nuclear power plants, gas turbine engines, cryogenic containers and pollution abatement equipment's (Galvin, 1996). Generally heavy metal toxicity is low but elevated concentrations cadmium can cause sub lethal effects (Khangarot and Ray, 1990). Anthropogenic activities like mining, electroplating and steel plant operations can results in cadmium discharge into water and air. Calcium is also one of the essential elements for enzyme like ureases and methyl coenzyme reductase (Galvin, 2003). Metals in fish are transported by the blood stream which brings it into contact with the various organs and tissues (Vardhani and Gowri, 1982). Therefore the blood is said to be a mirror of the entire vital process taking place in the organism.

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**MATERIALS AND METHODS**

**Cadmium**

Cadmium was obtained from the Department of Zoology, Annamalai University.

**Experimental animals**

Healthy *Labeo rohita* were procured from the freshwater farm located in Puthur, Nagappattinam district. They were acclimatized for a maximum period of 15 days in the laboratory condition. The fish each measuring 8.0 to 10.0 cm in length and weighing 10 to 15 g were used for the experimental studies. *Labeo rohita* fingerlings were exposed to sublethal concentration of cadmium 51.82 mg/l for a period of 96 hrs.

**Plants preparation**

The leaves of plants *Delonix elata* harvested during the period of June, 2011 from their habitat in Chidambaram. Identification of the plant was confirmed in the Department of botany, Annamalai University.

**Table 1. Variation GPx ( $\mu\text{g}/\text{min}/\text{mg}$  protein) activity in the fresh water fish *Labeo rohita* exposed to cadmium and *Delonix elata* for 96 hours**

ORGANS	GROUPS	HOURS OF EXPOSURE				
		24	48	72	96	120
GILL	I	0.241 $\pm$ 0.01	0.245 $\pm$ 0.01	0.244 $\pm$ 0.01	0.242 $\pm$ 0.01	0.248 $\pm$ 0.01
	Control					
	II	0.285 $^{**}\pm$ 0.01	0.319 $^{**}\pm$ 0.01	0.342 $^{**}\pm$ 0.02	0.367 $^{**}\pm$ 0.02	0.392 $^{**}\pm$ 0.02
	Cadmium	7.05	30.20	40.16	51.65	58.06
	III	0.322 $^{**}\pm$ 0.02	0.347 $^{**}\pm$ 0.01	0.362 $^{**}\pm$ 0.02	0.397 $^{**}\pm$ 0.02	0.412 $^{**}\pm$ 0.02
	Cadmium + <i>Delonix elata</i>	33.60 -12.98	41.63 -8.77	48.36 -5.84	64.04 -8.17	66.12 -5.10
	IV	0.256 $^{NS}\pm$ 0.01	0.258 $^{NS}\pm$ 0.01	0.261 $^{NS}\pm$ 0.01	0.254 $^{NS}\pm$ 0.01	0.266 $^{NS}\pm$ 0.01
	<i>Delonix elata</i>	6.22	5.30	12.70	16.94	-7.25
	I	0.145 $\pm$ 0.01	0.148 $\pm$ 0.01	0.151 $\pm$ 0.01	0.149 $\pm$ 0.01	0.154 $\pm$ 0.01
	Control					
LIVER	II	0.144 $^{**}\pm$ 0.01	0.152 $^{*}\pm$ 0.02	0.153 $^{NS}\pm$ 0.01	0.157 $^{NS}\pm$ 0.01	0.169 $^{NS}\pm$ 0.01
	Cadmium	0.68	2.70	1.32	5.36	9.74
	III	0.149 $^{NS}\pm$ 0.02	0.154 $^{*}\pm$ 0.01	0.160 $^{NS}\pm$ 0.01	0.168 $^{*}\pm$ 0.01	0.183 $^{*}\pm$ 0.01
	Cadmium + <i>Delonix elata</i>	2.75 2.05	8.10 -8.45	5.96 -4.57	1.9 -7.00	18.83 -8.28
	IV	0.148 $^{**}\pm$ 0.01	0.155 $^{*}\pm$ 0.02	0.158 $^{NS}\pm$ 0.02	0.156 $^{NS}\pm$ 0.01	0.160 $^{NS}\pm$ 0.01
	<i>Delonix elata</i>	2.06	6.75	-4.63	4.45	3.89
	I	0.172 $\pm$ 0.01	0.178 $\pm$ 0.01	0.175 $\pm$ 0.02	0.180 $\pm$ 0.01	0.182 $\pm$ 0.02
	Control				36.66	
	II	0.212 $^{NS}\pm$ 0.01	0.226 $^{NS}\pm$ 0.01	0.235 $^{**}\pm$ 0.05	0.246 $^{**}\pm$ 0.01	0.257 $^{**}\pm$ 0.1
	Cadmium	23.25	26.96	34.28	36.66	41.20
KIDNEY	III	0.232 $^{*}\pm$ 0.02	0.248 $^{**}\pm$ 0.01	0.254 $^{**}\pm$ 0.02	0.278 $^{**}\pm$ 0.01	0.293 $^{**}\pm$ 0.02
	Cadmium + <i>Delonix elata</i>	34.88 -9.43	39.32 -9.97	45.14 -7.48	54.44 -13.00	60.43 -14.00
	IV	0.175 $^{NS}\pm$ 0.01	0.180 $^{NS}\pm$ 0.01	0.178 $^{NS}\pm$ 0.01	0.188 $^{NS}\pm$ 0.01	0.192 $^{NS}\pm$ 0.01
	<i>Delonix elata</i>	1.74	1.12	1.71	4.44	7.69

### Analysed of glutathione peroxidase (Gpx)

Glutathione peroxidase (Gpx) activity was measured in the PMS by the method of Paglia and Valentine (1976) as modified by the Lawrence and Burk, (1976)

### Statistical analysis

The statistical analysis was evaluated by using student 't' test by the method of Trivedy and Heel, (1984).

### RESULTS

In the present investigation, fresh water fish *Labeo rohita* exposed to group 2 has resulted in gill tissue at all period causing a significant ( $p < 0.05$ ) changes in the values which are 5.15, 9.87, 22.34, 30.10 and 47.13 for 24, 48, 72, 96 and 120 hours, respectively. The cadmium along with *Delonix elata* (Group 3), the GSH response gradually recovers when compared to group 2. In the *Delonix elata* fish (group 4), there were no makeable changes occurring in the Gpx content. The increased and decreased values of Gpx activity in gill tissue were statistically significant in all groups (Table 1). The Gpx level of tissue exhibit remarkable changes. The increased Gpx content is observed in group 2. The per cent changes were 7.38, 10.33, 37.90, 46.33 and 65.66 for 24, 48, 72, 96 and 120 hours, respectively. In the administration of group 3, the Gpx response was gradually recovered. The decreased per cent changes were -5.53, -10.33, -23.67, -27.35 and -35.27 for 24, 48, 72, 96 and 120 hours, respectively. The increased and decreased activities of Gpx in liver are statistically significant in all groups (Table 1). The per cent increase in Gpx activities for 24, 48, 72, 96 and 120 hours of sub lethal concentration of cadmium and the per cent changes were 3.01, 4.22, 4.63, 13.27 and 16.00 for 24, 48, 72, 96 and 120 hours, respectively. When exposed to group 3, the Gpx content is recovered when

compared to group 2. The per cent decreased where -2.05, -2.27, -2.53, -8.97, and -10.89 for 24, 48, 72, 96 and 120 hours, respectively. While in the fish exposed group 4, the Gpx response in kidney is recovered without any changes. The percentage recoveries were 0.10, 0.79, 0.94, 1.00 and 1.05 for 24, 48, 72, 96 and 120 hours, respectively. The increased and decreased levels of Gpx in kidney tissue were statistically significant in group 2, 3 and 4 at 1% and 5% levels (Table 1).

### DISCUSSION

In the present investigation *Labeo rohita* fish exposed to sub lethal concentration of cadmium and *Delonix elata* plant supplementary feed shows a significant change of glutathione peroxidase (Gpx). The Gpx enzymes play a critical role in the defence against oxidative stress. The activity of Gpx can be induced by xenobiotic and detoxification of peroxides can be achieved by this induction (Hamed *et al.*, 1999). The biological function of Gpx is to reduce  $\text{H}_2\text{O}_2$  and lipid hydro peroxides (Verma *et al.*, 2007). The decreased activities of antioxidant enzyme SOD, CAT and increasing of Gpx in all tissues of cadmium treated fish, which indicated the failure of antioxidant defence system to overcome the influence of ROS induced by cadmium. The Gpx enzymes play a critical role in protecting the cell from free radical damage, particularly lipid peroxidation. The Gpx enzymes catalyse the reduction of  $\text{H}_2\text{O}_2$  to water and organic peroxides (R-O-O-H) to the corresponding stable alcohols (R-OH) using glutathione (GSH) as a sources of reducing equivalents. Giray *et al.* (2000) observed that the liver can be accepted as sources of GSHPx and therefore a higher activity was found in this organ compared to the other organs. Uner *et al.* (2001) reported that cadmium caused an increase in Gpx activity while it caused a decreased in CAT activity in the liver and kidney of some fresh water fish species. Because GSH-Px is found mainly in cytosol and mitochondria, it is widely affected by xenobiotic.

The increase in Gpx activity is observed, predominantly in liver and kidney similar to the resulted reported by Li *et al.*(2003) who have studied the responses of the antioxidant systems in the hepatocytes of common carp (*Labeo rohita*) to microcystin-LR.

### Conclusion

In view of cadmium toxicity on *Labeo rohita* fresh water fish has severely affected where as in supplemented feed *Delonix elata* exposed group gradually recovered from the toxic effect. Because of the presence of active compound which have rich antioxidant potential.

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