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Effect of Heavy Metals on Freshwater Crab Species Inhabiting Jammu Region of J&K, India.

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Abstract: ***Presently acute toxicity of pesticide of heavy metal salts viz., Copper sulphate and Mercuric chloride has been studied on freshwater crabs viz, Maydelliathelphusa masoniana and Himalayapotamon emphysetum. Median lethal concentration (LC_{50}) of Copper sulphate for 24, 48, 72, 96 h were recorded to be 246, 210, 184, 170 ppm respectively in M. masoniana while 194, 176, 160, 148 for H. emphysetum respectively. Median lethal concentration (LC_{50}) of mercuric chloride for 24, 48, 72 and 96 h were observed to be 0.98, 0.82, 0.64 and 0.46 ppm in case of M. masoniana whereas 0.70, 0.58, 0.46 and 0.34 ppm for 24, 48, 72 and 96 h respectively in case of H. Emphysetum . H. emphysetum species therefore observed to be more sensitive to either of pesticide compare to M. masoniana. Further both the species were observed to be highly sensitive for mercuric chloride than copper sulphate.***

Key words: crabs, heavy metals, LC_{50}, toxicity,

I. INTRODUCTION

Water pollution is one of the serious problems in most of the countries. Abundant use of fertilizers and pesticides became essential for better agricultural practices in most of the developing countries including India (Phirke, 2008). Out of number of heavy metals that leads to water pollution some of the most hazardous heavy metals are Zn, Cu, Pb, Cd, Hg, Ni and Cr as they become more toxic at higher concentrations (Agrahari, 2009). Heavy metal from man-made pollution sources are continually released into aquatic ecosystem (Ozturk, et al., 2008). Total concentration of most metals in sediments are several orders of magnitude higher than aqueous concentrations (Louma, S.N. 1989). The contamination of fresh waters with a wide range of pollutants has become a matter of concern over the last few decades (Vinodhini and Narayanan, 2008).

Determination of the LC_{50} values is of immense importance since it provides fundamental data for the design of more complex disposal model. Pesticide affects behavior and get accumulate in the body of test animals resulting reduction in their survival rate (Minakshi and Mahajan, 2012). Extensive studies have been carried out all over the world for the effects of pesticides on aquatic organism (Cripe, 1994 and Shanmugam et al., 2000). As crabs constitute significant proportion of freshwater bodies, therefore presently an attempt has been made to study the toxic effect of heavy metals i.e. Copper Sulphate ($CUSO_4$) & Mercuric Chloride ($HgCl_2$) on two crab species viz., M. masoniana and H. emphysetum.

II. MATERIAL AND METHODS

Freshwater crabs viz., M. masoniana and H. emphysetum were collected from Gho-manhasan and Jhajjar stream of Jammu region. Crabs were brought to the laboratory, acclimatized for one week. For experiment, healthy crabs were selected though size were vary due to species variations.. Two heavy metal selected were $CUSO_4$ and $HgCl_2$. For selection of test concentration some pilot tests were carried out (Chourpagar and Kulkarni, 2011). Percentage of mortality was calculated using the Abbott's formula (1952). Correct mortality so obtained were analysed to determine the LC_{50}values for 24, 48, 72 and 96 h (Finney, 1971).

III. RESULTS AND DISCUSSION

The physico-chemical and biological components of the environment play an important role in the manifestation of biological response to the pesticide (Macek et al., 1969). Mortality in the crabs is a more sensitive measure of toxicants. The present study of toxicity of heavy metal to Maydellithelphusa masoniana and H. emphysetum indicated that percent survival rate of the crabs decreases with increasing concentration of these heavy metals. The animals used in present studies fulfilled almost all major criterion for the test animals laid down by APHA et al., 1985. As bioassay tests have been proved as one of the important tool for the evaluation of chemical toxicity thereby much attention has been drawn on it during few last decades. Presently median lethal concentration (LC_{50}) of Copper sulphate for 24, 48, 72, 96 h were recorded to be 246, 210, 184, 170 ppm respectively in M. masoniana while 194, 176, 160, and 148 for H. emphysetum respectively. Median lethal concentration (LC 50) of mercuric chloride for 24, 48, 72 and 96 h were observed to be 0.98, 0.82, 0.64 and 0.46 ppm in case of M .masoniana whereas 0.70, 0.58, 0.46 and

0.34 ppm for 24, 48, 72 and 96 h respectively in case of H. emphysetum. Results of bioassay test like LC_{50} values and their regression result have been shown in tables 1-4. The LC_{50} clearly indicates thatH. emphysetum species was more sensitive to either of pesticide compare to M. masoniana.

Presently recroded LC_{50} values were closely related to the findings of Chourpagar & Lodhi et al., (2006) and Chourpagar & Kulkarni, (2011). Further, H. emphysetum were found to be more sensitive to heavy metals compare to M. masoniana. Variations between the under studied species may be related to large size ofM. masoniana compare to H. emphysetum and difference in environmental conditions of their habitat (Pickering et al., 1968).

Aquatic pollution of heavy metals is a serious threat because of their toxicity and bioaccumulation as well as biomagnifications in the food cycle takes place. On exposure to heavy metals well marked behavioural changes were recorded in both the species that includes increase in scrapping movement of cheliped during the first 24 hours of their introduction into heavy metal medium. Movement of chelipeds get decrease after 24h and found to be least on 96 h and the crabs at this time responded feebly. Decrease in chelepede scrapping might be due to certain alterations in muscle fibres as also held by Schultz and Kennedy, 1977). Similar type of observations has been recorded by Lodhi et al., 2006 and Ghate & Muherkar, 1979) while working on Macrobrachium lamarrei and M. dayanum. Besides behavioural changes, gill in both the species of crabs secreted mucous profusely that might be response of crabs against heavy metals. Profuse mucus secretion by gills of crustaceans for the purpose of protection against pesticides as well as heavy metals has also been reported by different workers (Ghate & Mulherkar, 1979, Murti & Shukla, 1984 and Sharma & Shukla `1990). The excessive secretion of mucous by under studied crabs species might results its coagulation accompanied by precipitation with metal on gill surface resulting suffocation and the reby death of under studied crabs. Similar types of behaviour all responses have been also reported by different workers (Miller & Mickey, 1982 and Weber & Spieler, 1994).

IV. CONCLUSION

Both the species of crabs exhibited behavioural as well as physiological changes that help to detect heavy metal pollution in water body. H. emphysetum observed to be comparatively more sensitive than M. masoniana with respect to heavy metal.

Table 1: LC_{50} values and regression results for the freshwater crab, *M. masoniana* treated with $CuSO_4$.

Exposure period (hr)	LC_{50} value (ppm)	Regression results Y= (Y-bx)+bx	Chi-square (f^2)	FIducial limits up to 95% Confidence	
				M1	M2
24	246	36.424+15.432x	0.68682	2.366	2.382
48	210	35.596+15.504x	0.04956	2.284	2.325
72	184	32.364+12.642x	0.02860	2.432	2.309
96	170	29.2876+11.572x	0.1829	2.302	2.224

Table 2: LC_{50} values and regression results for the freshwater crab, *H. emphysetum* treated with $CuSO_4$.

Exposure period (hr)	LC_{50} value (ppm)	Regression results Y= (Y-bx)+bx	Chi-square (f^2)	FIducial limits up to 95% Confidence	
				M1	M2
24	194	38.342+15.524x	0.59682	2.234	2.452
48	176	37.427+14.492x	0.07532	2.278	2.434
72	160	33.536+13.532x	0.04322	2.358	2.378
96	148	34.276+12.432x	0.2876	2.344	2.322

Table 3:LC_{50} values and regression results for the freshwater crab, *M. masoniana* treated with $HgCl_2$.

Exposure period (hr)	LC_{50} value (ppm)	Regression results Y= (Y-bx)+bx	Chi-square (f^2)	Fiducial limits up to 95% Confidence	
				M1	M2
24	0.98	38.536+15.512x	0.5872	2.254	2.336
48	0.82	34.476+15.526x	0.03982	2.234	2.334
72	0.64	30.312+13.544x	0.04236	2.356	2.312

96	0.46	32.206+10.412x	0.2768	2.324	2.216

Table 4: LC_{50} values and regression results for the freshwater crab, *H. emphysetum* treated with $HgCl_2$.

Exposure period (hr)	LC_{50} value (ppm)	Regression results Y= (Y-bx)+bx	Chi-square (f^2)	Fiducial limits up to 95% Confidence	
				M1	M2
24	0.76	39.312+15.564x	0.5742	2.214	2.412
48	0.58	36.537+14.482x	0.05534	2.252	2.446
72	0.46	32.516+13.526x	0.05362	2.372	2.353
96	0.34	33.288+12.412x	0.5316	2.322	2.323

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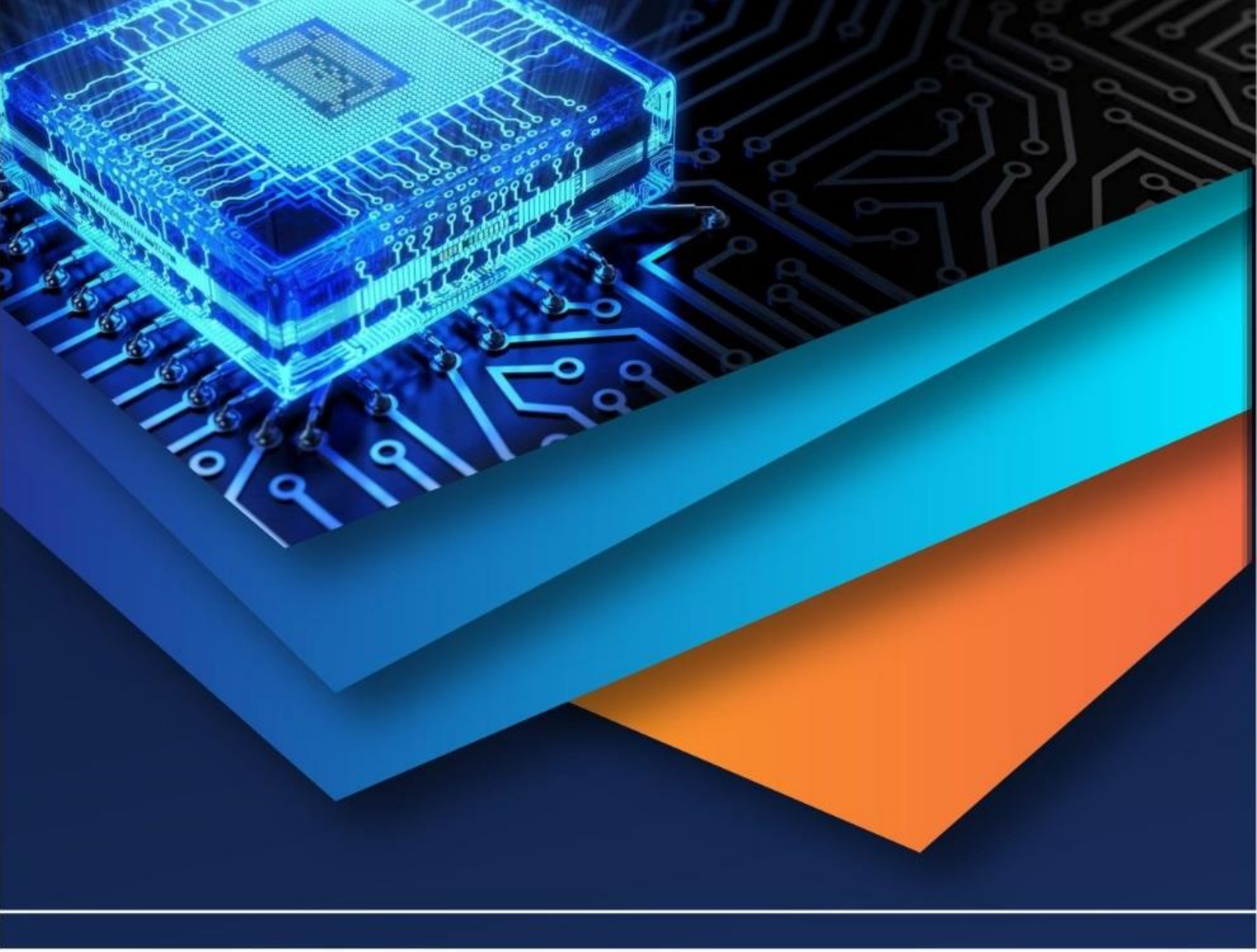

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