International Journal for Multidisciplinary Research
International Conference on Multidisciplinary Research & Studies 2023
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Study of Toxicity effect of Cadmium nitrate in the Fresh Water Crab, Paratelphusa jacquemontii (Rathbun)

Nita S. Labhsetwar

Department of Zoology, B.B. Arts, N.B. Commerce and B.P. Science College, Digras, Dist. Yavatmal, Maharashtra, India

Abstract:

Pollutants enter the aquatic environment in various ways. Pollution of heavy metals in ecosystems is a serious and long lasting effect. The aim of this research work was to assess the effect of cadmium nitrate on the organism paratelphasa jacquemontii (Rathbun) with environment parameters interaction. It is also to investigate the effect of environmental factors along the heavy metallic pollutants.

Keywords: Cadmium nitrate, metal, pollutant, Crab.

1) Introduction:

Water is the most valuable natural resources existing on our planet. Without this invaluable compound, the life on the earth would not exist. Although pollution of water is a common problem, pollutants enter the aquatic environment in various ways. It is unclear whether toxicity in the field is greater or smaller than toxicity found in the laboratory. (Bradshaw and Hardwick, 1989).

Toxicants and environmental factors can interact in a variety of ways. Changing environmental conditions may influence the bioavailability of chemicals.

The important persistent pollutants in aquatic ecosystems are the trace metals. Moreover recent studies indicate that human activities significantly affect trace metal levels even in remote parts of the globe such as the Arctic and Antarctic. (Bargagli 2000, Sanchez – Hernander, 2000).

Metals can accumulate in aquatic organisms and are easily transferred through the food chain to the top consumers, including humans (Wallace and Loper, 1996, 1997; Wallace and Luoma, 2003 Wallace et al., 2003; Fisk et al, 2005).

2) Material and Methods:

The crabs, *P. jaquemontii* were collected from around Amravati (Vidarbha, Maharashtra) brought to the laboratory and maintained in plastic containers having sufficient amount of freshwater.

Medium sized male and female crabs, *P. Jacquemontii* of intermoult stage and more or less of same size and weight, 55-65 gms with carapace width 6.5 x 5.3 cms were selected for experiments. Crabs were not fed during the experimental periods. The test medium was changed every 24 hrs to maintain the concentration.

The experimental crabs were nearly uniform in size, having the same weight, age male and female with intermoult stage and reared under the same conditions in order to reduce any bias in the experiment (Tankar, 1985; Nimgare, 1992). The crabs were chosen as test animals because of their availability throughout the year, easy to rear and their wide distribution in natural water particularly in Amravati.

3) Observation, Results and Discussion:

Toxicity of cadmium nitrate and interaction of ecological parameters:

After 24-hour exposure, the percentage mortality of freshwater crab was 23.3, 30.0, 36.7, 43.3, 50.0, 60.0 and 86.7, respectively in corresponds to the concentrations of Cadmium nitrate used 15, 30, 45, 60, 75, 90, 105, and 120 mg/l (Table 1). Crabs in the highest concentration of cadmium nitrate had the greatest mortality. The 24-hour LC50 value for the crab was 36.10 mg/l.

Table 1 The 24 –hour acute toxicity of cadmium nitrate bioassay on freshwater crab, *Patatelphusa jacquemontii* (3.610)							
Cone. (mg/l)	Log Once.	Mean no. Crabs exposed	Mean no. Crabs dead	Expected Mortality %	Mortality rate %	Graphical Interpolation	Probit analysis
15	1.1760	10	1	10	10	10	3.7184
30	1.4771	10	2	22	20	20	4.1584
45	1.6532	10	3	40	30	30	4.7467
60	1.7781	10	6	50	60	60	5.0000
75	1.8750	10	6	68	60	80	5.2533
90	1.9542	10	7	86	70	90	5.5244
105	2.0211	10	8	88	80	92	5.8416
120	2.0791	1	9	90	80	90	6.2816

When the crabs were exposed to cadmium nitrate at 05, 15, 30, 45, 60, 75, 90 and 105 mg/l for 48-hour, their percentage mortality was 13.3, 26.7, 30.0, 33.3, 43.3, 60.0 and 76.6, respectively (Table 2). Crab in the highest concentration of Cadmium had the greatest mortality. The 48-hour LC_{50} value for the crab was 31.33 mg/l.

Table 2 The 48 –hour acute toxicity of cadmium nitrate bioassay on freshwater crab, *Patatelphusa jacquemontii* (3.133)							
Cone. (mg/l)	Log Once.	Mean no. Crabs exposed	Mean no. Crabs dead	Expected Mortality %	Mortality rate %	Graphical Interpolation	Probit analysis
05	0.6989	10	01	10	10	10	3.7184
15	1.1760	10	02	22	20	28	4.1584
30	1.4771	10	04	44	40	36	4.7467
45	1.6532	10	07	58	70	66	5.0000
60	1.7781	10	08	74	80	86	5.2533
75	1.8750	10	09	86	90	90	5.5244
90	1.9542	10	09	90	90	90	5.8416
105	2.0211	1	9	90	90	88	5.8416

When the crabs were exposed to cadmium nitrate at 05, 15, 30, 45, 60, 75, 90 and 105 mg/l for 72-hour, their percentage mortality was 30.0, 36.7, 43.3, 50.0, 56.7, 66.7 and 96.7, respectively (Table 3). Crabs in the highest concentration of cadmium had the greatest mortality. The 72-hour LC_{50} value for the crab was 24.50 mg/l.

Table 3 The 72 – hour acute toxicity of cadmium nitrate bioassay on freshwater crab, *Patatelphusa jacquemontii* (2.450)							
Cone. (mg/l)	Log Once.	Mean no. Crabs exposed	Mean no. Crabs dead	Expected Mortality %	Mortality rate %	Graphical Interpolation	Probit analysis
05	0.6989	10	0	00	00	00	0.000
15	1.1760	10	1	12	10	10	3.7184
30	1.4771	10	2	22	20	18	4.1584
45	1.6532	10	3	32	30	28	4.7467
60	1.7781	10	4	50	50	40	5.0000
75	1.8750	10	5	45	60	62	5.2533
90	1.9542	10	6	65	70	74	5.5244
105	2.0211	10	7	70	80	70	5.8416

When the crabs were exposed to cadmium nitrate at 05, 15, 30, 45, 60, 75, 90 and 105 mg/l for 96-hour, their percentage mortality was 26.7, 30.0, 46.7, 50.0, 53.3, 60.0 and 76.7, respectively (Table 4). Crabs in the highest concentration of Cadmium had the greatest mortality. The 96-hour LC_{50} value for the crab was 15.52 mg/l.

Table 4 The 96 – hour acute toxicity of cadmium nitrate bioassay on freshwater crab, *Patatelphusa jacquemontii* (1.552)

Cone. (mg/l)	Log Once.	Mean no. Crabs exposed	Mean no. Crabs dead	Expected Mortality %	Mortality rate %	Graphical Interpolation	Probit analysis
05	0.6989	10	0	00	00	00	0.000
15	1.1760	10	1	10	10	10	3.7184
30	1.4771	10	2	22	20	18	4.1584
45	1.6532	10	3	32	30	30	4.7467
60	1.7781	10	5	50	50	50	5.0000
75	1.8750	10	6	60	60	64	5.2533
90	1.9542	10	7	70	70	70	5.5244
105	2.0211	10	8	76	80	72	5.8416

Different concentrations of cadmium nitrate showed changes in mortality as 25% mortality for 24.48.72 and 96 hours of treatment period were .25.22, 15.84 13,68 and07.70 mg/l respectively, 50% mortality values were 36.10/24 h, 31.33/48 h.24.50/72h, and 15.22/96 h for exposure period. 59.31, 52.03, 46.55, and 31.62 for 24, 48, 72 and 96 respectively for 75% mortality of the experimental crabs. 90% mortality values were 112.33, 86.42, 94.22 and 51.32 at 24, 48, 72 and 96 h exposure period.

Eisler (1971) also carried out acute toxicity bioassays on various marine invertebrates. He found that the animals tested, Crustaceans, were the most sensitive to cadmium and zinc. The percentage mortality of *Paratelphusa jacquemontii* caused by cadmium increased with increasing concentration and exposure times. Similar trend was observed in case of temperature and pH. Higher mortality was observed in higher temperature and acidic medium with higher exposure period as compared to low temperature and alkaline conditions. Low temperature and alkaline medium had reduced toxic impact. Changed pH of medium also has effect on toxicity i.e. acidic medium was more toxic than alkaline medium.

Table: 5 Series of concentrations used for determining the median lethal concentrations of metal compounds on the freshwater crab, *Paratelphusa jacquemontii* (Rathbun) at different experimental exposure hours.

Metal	**Exposure period(h)**	**Serial dilutions (ppm)**
Cadmium nitrate	24	15,30,45,60,75,90,105,120
	48	05,15,30,45,60,75,90,105,120
	72	05,15,30,45,60,75,90,105
	96	05,15,30,45,60,75,90,105

4) References :

1. Bargagli, R (2000) Trace metals in Antartica related to climate change and increasing human impact. Rev Environ Contam Toxicol 166:129-173
2. Eisler, R. (1971). Cadmium poisoning in Fundulus heteroclitus (pisces: Cyprinodontidae) and other marine organisms. J. Fish. Res. Bd. Can. 28: 1225-1234.
3. Fisk, A.T. de Wit, C.A, Wayland, M, and Z.Z Kuzyk Z.Z (2005) An assessment of the toxicological significance of anthropogenic contaminants in Canadian arctic wildlife. Sci Total Environ 351/352:57-93.
4. Nimghare S.S. (1992). Neuroendocrine and osmorgulatory responses of Paratelphusa Jacquemontii to pollutant stress. Thesis submitted to Amravati University Amravati (M.S.).
5. Sanchez-Hernandez, J.C. (2000) Trace element contamination in Antarctic ecosystems. Rev Environ Contam Toxicol 166:83-127.
6. Tankar S.S. (1985). Effects of some pollutant on edible crab Paratelphusa Jacquemontii. Thesis submitted to Amravati University Amravati (M.S.).
7. Wallace, W. G. and G.R. Lopez (1996) Relationship between subcellular-cadmium distribution in prey and cadmium trophic transfer to a predator. Extuaries 19:923-930.
8. Wallace, W.G. and S.N. Luoma (2003) Subcellular compartmentalization of Cd and Zn in two bivalves. II. Significance of trophically available metal (TAM). Mar Ecol Prog Ser 257:125-137.