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Effect of malathion on DNA of marine edible crab *Uca marionis* (Des)

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Abstract

The impact of pesticide Malathion on DNA contents in different tissues of marine crab ***Uca marionis*** (Des) after acute and chronic treatment was studied. The DNA contents were estimated from gills, testes, ovaries, larger and smaller chelae muscles and hepatopancrease. These tissues are of vital metabolic importance and any stress on the animal is depicted by the changes in the DNA constituents in them.

Pollutants affects the organisms not only at physical level but also at cellular level. One such important component is Nucleic acid, which are the most vital component of cellular structures in any organism. It is the carrier of hereditary information. It also determines the adaptability of organism to its surrounding environment and equips the organism with means of protective mechanism to counteract any environmental changes. Most importantly it passes on this information to the next generation so that every new generation is more adapted to the changing environment. Any alteration in DNA affects the organism at genetic level, which may not be immediately noticed but is transmitted to next generation. Their effects are permanent and appear after a long term.

Crabs as an important seafood item is well recognised. A lot of information is available on the biochemical features of a number of species. The knowledge of biochemical composition of any edible organism is extremely important since it reflects the nutritive value, which in turn is determined by Nucleic acids, DNA and RNA.

Material and methods

The crab *Uca marionis* (Des) was collected from the Mithbav creek lagoon region. They were brought to laboratory and maintained in plastic trough containing saline water. The crabs were acclimatized to laboratory condition for two days.

The water was changed two times a day. After acclimatization healthy crabs of approximately same size and weight were selected for the experiment. To study the effect of pesticide Malathion on DNA the crabs were exposed to mediam lethal concentration 0.0205 ppm of Malathion (*ie.* $LC_{50}/2$ value for a period of 96 hrs) and sublethal concentration 0.008 ppm of Malathion (*ie.* $LC_{50}/5$ value for same duration). At the end of treatment the crabs were scarified to analyse the DNA content. The crabs were dissected and gills, testes, ovaries, larger chelae and smaller chelae muscles, and hepatopancrease were separated. The DNA content in the above wet tissues of treated and control crabs were analysed and compared for determining the DNA content by the Indole method

(Ceriotti, 1952). Appropriate modifications as suggested by Hutchinson and Munro (1961) were followed.

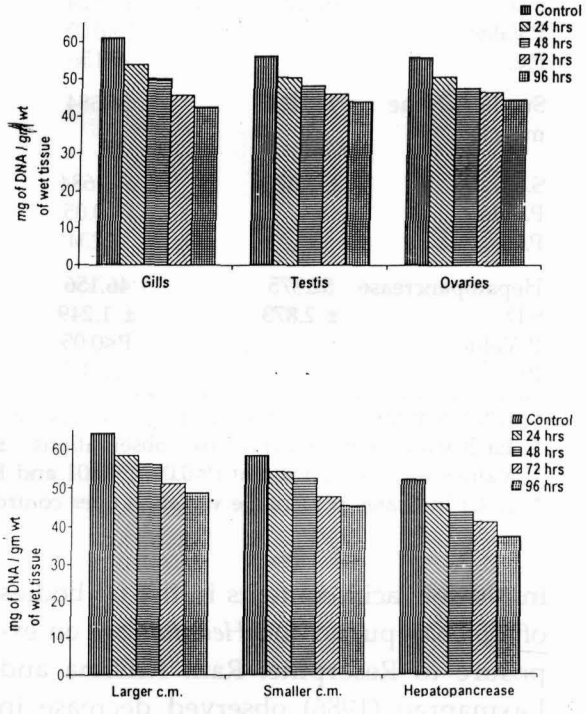
Results

Bio-chemical component, Deoxyribo Nucleic Acid (DNA) was studied in normal and pesticide (Malathion) treated gills, testes, ovaries, large chelae muscle, smaller chelae muscle and hepatopancrease of control crab and were 61.125, 56.167, 55.875, 64.381, 58.625 and 52.375 mg/g wet weight of tissue of the crab. But it decreased after exposure to Malathion in acute treatment. The decrease ranged from 7.2% over control in smaller chelae muscle for 24 hrs exposure to 30.3% in gills for 96 hrs exposure (Table - 1). The decrease of DNA content was found to be significant at $P<0.05$, $P<0.01$ and $P<0.001$. The comparative aspect is represented in figure 1 and 2.

Similar decrease in value of DNA for chronic treatment was noticed. The normal value of DNA in control crab was 62.351 in gills, 57.251 in testes, 58.352 in ovaries, 64.513 in larger chelae muscle 53.652 mg/g wet weight of tissue (Table. 2.). The values were found to be significant at $P<0.05$, $P<0.01$ and $P<0.001$. A comparative aspect is given in fig. 3 and 4.

Discussion

Pesticide pollutant causes stress to aquatic animals and is responsible for altering their physiological and metabolic activities. In the present investigation, pesticide Malathion altered the bio-chemical composition under consideration *ie*. DNA content after exposure to acute and chronic treatment due to metabolic and physiological stress condition. This may also cause alteration in the future genetic composition of the species in the long run. Synthesis of Nucleic acid is also affected due to impact of pesticide on bio-chemical process. The level of DNA was found to decrease in gills, testes, ovaries, larger and smaller chelae muscle and hepatopancrease, exposed to sublethal concentration of pesticide Malathion. Ring (1973), observed the change in the dry weight protein and Nucleic acid content in Brow fly. Keeley (1983) reported decrease



Figs. 1 & 2. *Effect of Malathion on DNA content in gills, testis, ovaries, larger chelae muscle, smaller chelae muscle hepatopancrease of Uca marionis (Desmarest) in acute exposure*

Table 1. *Effect of Malathion on DNA content in gills, testes, ovaries, larger chelae muscle, smaller chelae muscle and hepatopancrease of Uca marionis in acute exposure.*

Tissue	Control	24hrs	48hr	72hr	96hrs
Gills	61.125	53.712	50.099	45.842	45.585
S.D.	± 3.486	± 1.024	± 1.846	± 1.056	± 2.842
P.Value		P<0.05	P<0.05	P<0.05	P<0.001
P.C.		-12.127	-18.037	-25.003	-30.331
Testes	56.167	50.450	48.478	46.213	44.072
S.D.	± 2.394	± 1.256	± 1.9625	± 2.649	± 2.872
P. Value		P<0.05	P<0.05	P<0.05	P<0.05
P.C		-10.178	-13.689	-17.723	-21.534
Ovaries	55.875	50.705	47.736	46.790	44.625
S.D.	± 2.753	± 1.725	± 1.335	± 1.921	± 1.862
P. Value		P<0.05	P<0.05	P<0.05	P<0.01
P.C.		-9.253	-14.567	-16.259	-20.135
Larger chelae muscle	64.381	58.486	56.149	51.321	48.879
S.D.	±3.250	±1.124	±1.863	±1.488	±2.146
P.Value		P<0.05	P<0.05	P<0.05	P<0.01
P.C.		-9.156	-12.787	-20.285	-24.079
Smaller chelae muscle	58.625	54.384	52.547	47.854	4.617
S.D.	± 2.372	± 1.684	± 2.010	± 2.983	±3.451
P.Value		P<0.05	P<0.05	P<0.05	P<0.01
P.C.		-7.234	-10.368	-18.373	-22.189
Hepatopancrease	52.375	46.156	43.883	41.300	37.448
S.D.	± 2.873	± 1.249	± 1.894	± 2.048	± 2.984
P. Value		P<0.05	P<0.05	P<0.05	P<0.01
P.C.		-11.874	-16.213	-21.145	-28.423

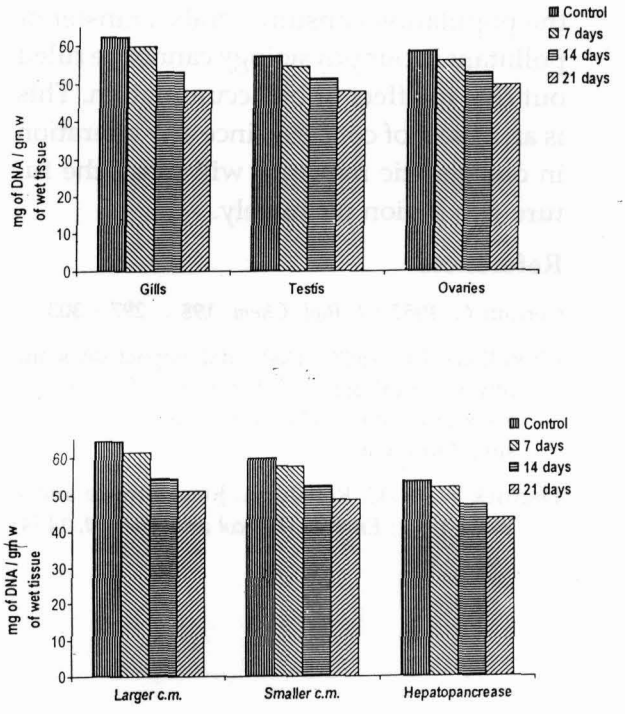
* DNA activity is expressed as mg/g weight of wet tissue.
* Each value is the mean of five observations : ± (S.D).
* Values were significant at P<0.05, P<0.01 and P<0.001.
* (P.C) Indicates percentage variation over control.

in Nucleic acid contents in the fat bodies of *Donman* pupae and *Heliothis zeg* on exposure to Reserpine. Ram Krishna and Laxmanrao (1986) observed decrease in Nucleic acid in the gonad of freshwater fish *Tilapia mossambica.* Chaudhari (1988) reported decrease in Nucleic acid content in the snail *Bellamya bengalensis* and Pardeshi (1992), in the snail *Lymnaea accuminata* (Lamark). Dectrick *et al;* (1995) observed similar decrease in DNA content in larger mouth bass. The DNA has no metabolic property except for help in RNA synthesis and hence the content of DNA cannot be correlated with any metabolic process. However, DNA is a vital genetic

Table 2. *Effect of Malathion on DNA content in gills, testes, ovaries, larger chelae muscle, smaller chelae muscle and hepatopancrease of Uca marionis in acute exposure.*

Tissue	Control	7 day	14 days	21 days
Gills	62.351	59.779	53.290	48.3656
S.D.	± 2.231	± 1.326	± 1.986	± 1.333
P.Value		P<0.05	P<0.05	P<0.05
P.C.		-4.125	-14.532	-22.430
Testes	57.251	54.426	51.394	48.016
S.D.	± 1.869	± 1.602	± 1.827	± 1.463
P. Value		P<0.05	P<0.05	P<0.05
P.C		- 4.935	- 10.231	- 16.130
Ovaries	58.352	55.836	52.788	49.475
S.D.	± 1.869	± 1.354	± 1.271	± 2.016
P. Value		P<0.05	P<0.05	P<0.05
P.C.		-4.312	-9.536	-15.212
Larger chelae muscle	64.513	61.513	54.630	51.184
S.D.	± 1.627	± 1.986	± 1.953	± 2.103
P.Value		P<0.05	P<0.05	P<0.05
P.C.		-4.651	-15.319	-20.661
Smaller chelae muscle	59.821	57.714	52.518	48.753
S.D.	± 2.211	± 1.451	± 1.385	± 2.260
P.Value		P<0.05	P<0.05	P<0.05
P.C.		-3.522	-12.208	-18.532
Hepatopancrease	53.652	51.916	47.285	43.663
S.D.	± 2.126	± 1.326	± 1.726	± 1.487
P. Value		P<0.05	P<0.05	P<0.05
P.C.		-3.236	-11.868	-18.619

* DNA activity is expressed as mg/g weight of wet tissue.
* Each value is the mean of five observations : ± (S.D).
* Values were significant at P<0.05, P<0.01 and P<0.001.
* (P.C) Indicates percentage variation over control.



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Figs. 3 & 4. *Effect of Malathion on DNA content in gills, testis, ovaries, larger chelae muscle, smaller chelae muscle* and *Hepatopancrease of Uca marionis (Desmarest) in chronic exposure*

component in hereditary link and hence the changes are liable to affect the genetic make up. The reported decrease in DNA content of *U. marionis,* when exposed to pesticide Malathion might be due to degradation of cell nuclear material, leading to lowering of DNA content. The analysis of the present study and the obsrved results definitely bring about the effect of pesticide on DNA of the animal tissue.

The lowering of DNA level indicates that the response to any change in environment is not only restricted at physiological and metabolic level but reaches even upto genetical level. These studies clearly indicate the changes that can be brought about in the genetical constituents in the long run even by sublethal or very low concentration of pollutants. We cannot overlook this fact as a large section of

the population consume crab. Transfer of pollutant in our physiology cannot be ruled out due to effect of bioaccumulation. This is an aspect of concern since any alteration in our genetic make up will affect the future generation ultimately.

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