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Assessment of seasonal changes in biochemical composition of freshwater bivalve, *Parreysia cylindrica* in relation to heavy metal pollution of Jayakwadi reservoir (M.S.), India

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Abstract
The objective of present study is to determine seasonal changes in biochemical content of freshwater bivalve, *Parreysia cylindrica* in relation to heavy metal pollution of Jayakwadi reservoir. Heavy metal concentrations were determined seasonally from surface water, soil sediment and soft body tissues of freshwater bivalve, *Parreysia cylindrica*. The heavy metal concentrations in surface water, soil sediment and soft body tissues of *Parreysia cylindrica* were highest during summer season than winter and monsoon season. The Protein, DNA, RNA and Ascorbic acid content were estimated during summer, monsoon and winter season from mantle, gills, digestive glands and whole soft body tissues. In the present study Protein, DNA, RNA and Ascorbic acid content were highest during monsoon than summer and winter season.

Keywords: Heavy metal, Jayakwadi reservoir, *Parreysia cylindrica*, biochemical

Introduction
Freshwater reservoirs are one of the most important water resources used for domestic, irrigation and industrial purposes. Water pollution by heavy metals is greater concern because every organism depends on water. Heavy metal pollution of aquatic environment has increased considerably due to industrial revolution. Some heavy metals may transform into highly toxic constant metallic compounds, which can be bioaccumulated in the organisms and magnified in the food chain and ultimately threatening human health (Jin, 1992) [8]. Longterm exposure of pollutants to aquatic organisms produces cellular changes in body tissues. Heavy metals may affect on biochemical and physiological mechanisms of animal (Radhakrishnan *et al.*, 1991) [16].

Pollutants exert their effect first at biochemical and molecular level in any tissues (Robbins and Angel, 1976) [20]. Changes in biochemical parameters acts as the sensitive indicators of toxic effect on tissues (Thaker and Haritos, 1989) [23]. Metal toxicity will occur only when the rate of metal accumulation higher than combined rate of excretion and detoxification of the bioavailable metal in the environment (Rainbow, 1993) [17]. In the body of aquatic organisms metals are not removed quickly, nor are they easily detoxified, as results they accumulate in the important organs (Rainbow and Moore, 1986) [18].

Changes in biochemical components of organisms such as protein, DNA, RNA and ascorbic acid is useful to know effect of different toxicant on different soft body tissues and defence mechanism of the body in response to harmful effects of heavy metals. These biochemical responses are useful to measure toxicity of pollutants (Deshmukh, 2013) [5]. Seasonal changes in biochemical components have been reported by several researchers, Bidarkar (1975) [3] on *Crassostrea cucullata*, Dhamane (1975) [6] on *Paphia laterisulca*, Nagabhushanam and Mane (1975, 1978) [12, 13] on *Mytilus viridis*, Salaskar and Nayak (2011) [22] on *Crassostrea madrasensis* and *Perna viridis*.

Changes in biochemical components of freshwater bivalve, *Parreysia cylindrica* such as proteins, DNA, RNA and ascorbic acid are useful to know effects of different pollutant and defensive mechanism of the body against pollutants. These biochemical components are indicators of pollution they are helpful to determine status of aquatic ecosystem.

Materials and Methods

Surface water, soil sediment and freshwater bivalve, *Parreysia cylindrica* were collected from Jayakwadi reservoir at Paithan in Aurangabad district of Maharashtra state, India. The collected surface water sample is filtered, mixed with HNO_3 and preserved in refrigerator at 4 ^{0}C until analysis. Soil sediment was collected from 5cm depth and air dried in laboratory, 5gm oven dried sieved (mesh size 0.5mm) powder of soil sediment was taken in conical flask and about 20ml of concentrated HCL was added in soil sample. The sample was digested on hot plate by placing watch glass on conical flask for about 1 hour and evaporated to about dryness, the digested sample was ready for heavy metal analysis (Ahmed *et al.*, 2002) [2]. Medium sized 20 specimens were selected from *Parreysia cylindrica*. The bivalves were dissected within 12 hours of collection and their mantle, gills, digestive glands and whole soft body tissues were separated, washed in distilled water and dried separately in oven at about 70^0-80 ^{0}C. After complete drying the tissues were powdered and stored separately by labeling with tissue name. The analysis of heavy metal concentrations in surface water, soil sediment and soft body tissue (mantle, gills, digestive glands and whole soft body tissues) of *Parreysia cylindrica* was carried out by Atomic Absorption Spectrophotometer.

Protein, DNA, RNA and ascorbic acid content was estimated from dry powder of different tissues. Protein content was estimated by Lowry's method (Lowry *et al.*, 1951) [11]. DNA content was measured by using Diphenylamine method of Burton (1956) [4]. RNA content was measured by following Orcinol method of Volkin and Cohn (1954) [24]. Ascorbic acid estimation was carried out by the method of Roe (1967) [21]. The protein, DNA, RNA and ascorbic acid content was calculated by referring standard graph value and it was expressed in terms of mg/100 mg of dry tissue.

Results and Discussion

The heavy metals Zn, Pb, Cu, Cd and As concentrations were determined seasonally from surface water, soil sediment and different tissues of freshwater bivalve, *Parreysia cylindrica* (Table 1). The results showed that the heavy metals Zn, Pb, Cu, Cd and As concentrations in surface water, soil sediment and different tissues of freshwater bivalve, *Parreysia cylindrica* were lowest during monsoon season. The heavy metal concentrations in bivalves was decreased in monsoon season as compared to summer and winter season this might be due to increased water level of reservoir and decreased metal concentrations in water and sediments (Deshmukh, 2013) [5].

The results showed that the heavy metals Zn, Pb, Cu, Cd and As concentrations in surface water, soil sediment and different tissues of freshwater bivalve, *Parreysia cylindrica* were highest during summer season. This trend could be due to the decrease in water level of reservoir during summer season and increase in water level during monsoon season due to precipitation and run-off from the catchment area (Paka and Rao 1997; Jain and Salman 1995; Patil *et al.*, 2004, Deshmukh, 2013) [14, 7, 15, 5]. Ravera *et al.*, (2007) [19] reported high Zn concentration during summer season in all tissues of *Pictorum mancus*.

Table 1: Heavy metal concentrations in surface water (mg/l), soil sediment (µg/g) and different tissues of freshwater bivalve, *Parreysia cylindrica* (µg/g) collected from Jayakwadi reservoir.

Heavy metals		Zn	Pb	Cu	Cd	As
Surface water	Summer	0.1238±0.0004	0.0294±0.0004	0.0205±0.0002	0.0085±0.0003	0.0083±0.0004
	Monsoon	0.0726±0.0006	0.0259±0.0006	0.0154±0.0003	0.0069±0.0004	0.0062±0.0001
	Winter	0.1107±0.0005	0.0272±0.0002	0.0169±0.0003	0.0078±0.0001	0.0071±0.0002
Highest permitted value for drinking water IS (1991)		15	0.05	1.5	0.01	0.01
Soil Sediment	Summer	224.18±2.49	21.01±1.08	59.72±1.80	4.02±0.24	3.58±0.58
	Monsoon	142.83±1.92	16.38±0.79	42.31±1.26	2.39±0.52	2.15±0.35
	Winter	205.87±2.27	20.14±1.13	45.95±1.05	3.58±0.43	2.43±0.41
Mantle	Summer	512.09±4.86	108.05±2.87	132.40±1.77	21.47±0.59	3.28±0.33
	Monsoon	395.42±5.29	79.31±1.46	113.24±1.34	16.38±0.83	2.55±0.49
	Winter	438.13±4.47	97.19±1.94	115.89±1.29	19.53±0.45	3.08±0.56
Gills	Summer	683.68±6.52	124.97±2.49	143.66±2.16	27.91±0.62	4.93±0.37
	Monsoon	539.81±5.41	98.46±1.68	123.71±1.95	22.05±0.78	4.02±0.42
	Winter	608.33±5.07	116.05±2.93	129.96±1.19	24.32±0.49	4.60±34
Digestive glands	Summer	876.92±7.24	129.64±1.56	172.43±2.40	29.76±0.71	5.19±0.46
	Monsoon	704.34±6.38	109.22±1.35	145.27±1.72	24.57±0.82	3.98±0.41
	Winter	781.20±5.98	125.51±2.23	153.78±1.26	27.29±0.63	4.85±0.55
Whole soft body tissue	Summer	609.38±4.55	114.40±2.84	148.63±2.58	22.61±0.54	4.01±0.48
	Monsoon	426.63±4.12	87.81±1.31	117.25±1.62	20.01±0.65	2.93±0.32
	Winter	460.57±5.90	107.18±2.08	123.33±1.20	21.84±0.86	4.05±0.57

Mean ± Standard deviation

Table 2: Biochemical content in different tissues of freshwater bivalve, *Parreysia cylindrica* from Jayakwadi reservoir (Values are in mg/100mg of dry weight).

Season	Tissues	Protein	DNA	RNA	Ascorbic acid
Summer	Mantle	48.93±0.83	1.38±0.029	5.46±0.31	0.724±0.018
	Gills	55.34±1.58	1.85±0.083	6.35±0.27	0.935±0.023
	Digestive glands	54.42±1.64	1.80±0.078	6.70±0.18	1.083±0.021
	Whole soft body tissue	51.79±1.17	1.62±0.061	5.98±0.22	0.896±0.014
Monsoon	Mantle	54.81±1.55	1.76±0.059	6.32±0.16	0.923±0.016

	Gills	63.27±2.05	2.23±0.064	7.94±0.29	1.109±0.022
	Digestive glands	62.08±1.77	2.14±0.070	8.29±0.26	1.318±0.019
	Whole soft body tissue	59.64±1.32	2.05±0.056	7.63±0.18	1.083±0.023
Winter	Mantle	53.01±1.09	1.63±0.057	5.39±0.30	0.741±0.011
	Gills	60.42±1.64	2.11±0.062	7.64±0.25	0.962±0.015
	Digestive glands	59.05±1.31	2.08±0.075	7.81±0.21	1.090±0.018
	Whole soft body tissue	57.30±1.70	1.98±0.068	7.48±0.17	0.923±0.020

Mean ± Standard deviation

Seasonal changes in protein, DNA, RNA and ascorbic acid contents in mantle, gills, digestive glands and whole soft body tissue were determined in freshwater bivalve, *Parreysia cylindrica* collected from Jayakwadi reservoir (Table 2). Biochemical and physiological changes takes place in the body of organism due to any type of toxic stress of pollutants (Abel 1974; Langstone 1986; Lomte *et al.*, 2000) [1, 9, 10]. The obtained results indicate highest protein, DNA, RNA and ascorbic acid contents in different tissues of freshwater bivalve, *Parreysia cylindrica* during monsoon season. The obtained results indicate lowest protein, DNA, RNA and ascorbic acid contents in different tissues of freshwater bivalve, *Parreysia cylindrica* during summer season. Deshmukh (2013) [5] reported highest protein, ascorbic acid, DNA and RNA content during monsoon season and lowest during summer season in different tissues of freshwater bivalve, *Lamellidens corrianus*.

Conclusion

Results showed that the protein, DNA, RNA and ascorbic acid contents was lowest during summer season as compared to monsoon and winter season due to increase in metal concentration in surface water, soil sediment and soft body tissues. The protein, DNA, RNA and ascorbic content was highest during monsoon season as compared to summer and winter season due to lower metal concentration in surface water, soil sediment and soft body tissues. The protein, DNA, RNA and ascorbic acid content decreased after increase in heavy metal concentrations in surface water and soil sediment this might be due to increased pollution stress.

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