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ECOLOGICAL STUDIES ON FRESHWATER BIVALVE MUSSELS (PELECYPODA) OF INDUS RIVER AND ITS CANALS AT KOTRI BARRAGE SINDH, PAKISTAN

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Abstract

Freshwater pelecypod occurrence was studied from October 2005 to September 2006 in Indus River and its canals at Kotri Barrage, near Jamshoro, Sindh. Sampling area included five stations namely, Pinyari Canal, Phuleli Canal, K.B. Feeder, Chakumber (Ring Dam) and River Indus (downstream). A total of four (04) genera including seven (07) species of pelecypods were identified where *Parreysia (Radiatula) wynegungansis* was found most dominant.

Pelecypod populations were fairly good and more or less same numbers of individuals were recorded at K.B. Feeder, Pinyari Canal, Phuleli Canal and Chakumber. The Indus River (downstream) was very poor in live Pelecypods, where only empty shells were found.

The lowest temperature was in January (16.7°C) while highest being in August (32.5°C). Lowest D.O was 5.0 mg/l at Chakumber in August and highest was 6.2 mg/l in January. TDS and conductivity were higher at Chakumber in January. Water transparency was very low (2.0 cm) throughout all stations during flood season (July–September) and higher (58.0 cm) during dry season (January-March). The Chakumber was more transparent than other stations because of its shallow and stagnant water. The pH ranged in between 7.4 to 8.2 whereas hardness ranged between 70-mg/l to130 mg/l.

The Pelecypod populations showed a direct relationship with the temperature and strong correlation was evident. On the other hand pH, hardness and secchi transparency showed a negative correlation with the population density.

Keywords: Pelecypoda, occurrence, ecology, Indus River.

1. Introduction

Freshwater mussels are soft-bodied animals that usually produce an external skeleton or a shell, which is composed of a limy material or calcium carbonate ($CaCO_3$). The shell serves both protective and supportive purposes. Most pelecypods have two shells from which the body can be withdrawn. The pelecypods play a vital role in the natural ecosystem. They purify water bodies because these are saprophytic animals. They eat algae, zooplankton and organic waste, and provide food for many types of fish, birds and also for human beings. They are passive indicators to environmental degradation. Through their high respiration rate they mineralize a great amount of organic matter and through filtration decrease the concentration of suspended particles.

The distribution and diversity of freshwater mussels depend on their abilities of colonization in a habitat and survival. That is regulated by the physico-chemical factors like temperature, hardness and pH. Previous work on mollusks taxonomy of East and West Pakistan including marine mollusks was undertaken by Khan and Dastagir (1972), later on Tirmizi (1973) gave the taxonomic account of the freshwater mollusks of Pakistan in her unpublished thesis. Akhtar (1978) and, Khatoon and Ali (1978) also worked on taxonomy of Mollusca while Nazneen

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and Begum (1990) worked on taxonomy of bivalves. These researchers have mostly concentrated on taxonomical studies and no work on ecological studies of Pelecypod fauna of Pakistan is so far available. Present work aims to shed light on occurrence and ecology of Pelecypoda of Indus River.

2. Materials and Methods

Sampling area

Kotri Barrage is the last barrage on Indus River to supply water Phuleli, Pinyari and K.B. Feeder through lined channels to enhance agriculture in the lower Sindh region.

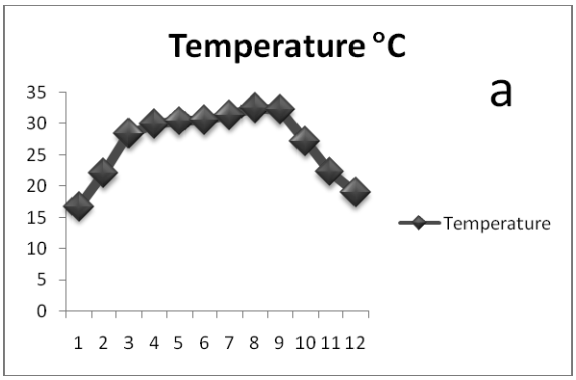
Five stations were fixed for the sample collection. These included 1**.** K.B Feeder, 2. Pinyari canal, 3. Phuleli canal, 4. Indus River (downstream) and 5. Chakumber (Ring Dam, where water remains stagnant). Monthly samples were collected from October 2005 to September 2006.

The specimens were collected by hand picking when or where water was shallow. During flood season however, fishermen were deployed for shell collection. The specimens were then taken to laboratory in wide-mouth plastic bottles. In the laboratory they were washed in freshwater and preserved in 70% alcohol. The identification of species was carried out using standard methods given by Preston (1915). Physico-chemical parameters were determined using digital meters. Temperature, E. conductivity and TDS were measured using digital meter (WTW Cond 330i). Dissolved oxygen and pH were determined by WTW Oxi 315i and Ecoscan pH5, respectively. The transparency was measured by secchi disk while hardness was determined by titration method in laboratory by EDTA method.

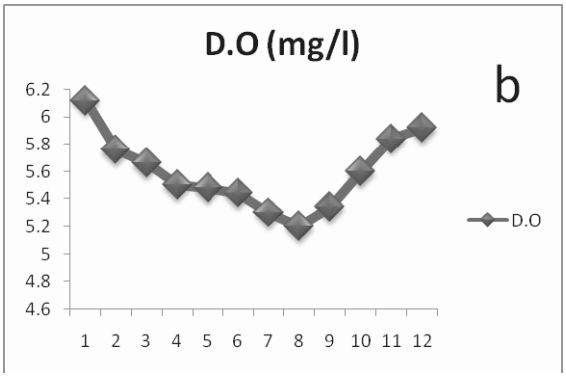
3. Results and Discussion

Water quality

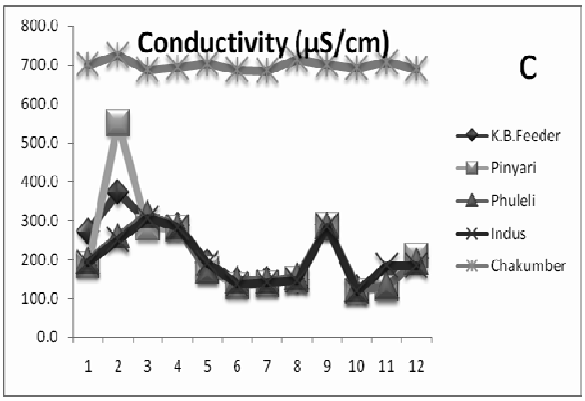
The temperature was lowest (16.5°C) in January that gradually increased and reached to highest (32.9°C) in August and September and decreased to the lowest then after **(Fig. 1a).**

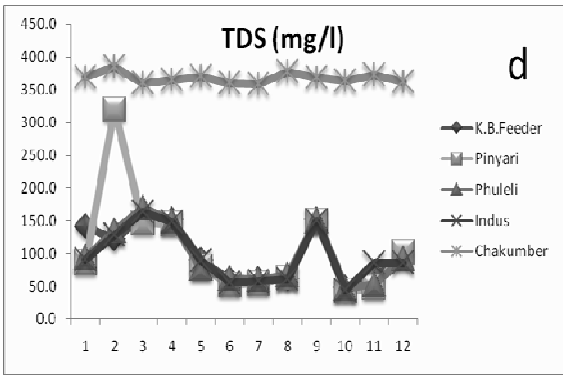


An inverse proportion was evident in dissolved oxygen that was highest (6.2 mg/l) in January while lowest (5.0 mg/l) was noted in August **(Fig. 1b).**



The TDS were more or less same in Main River Indus (downstream), Pinyari canal, Phuleli canal and K.B. Feeder, but in February highest TDS and conductivity were seen at Pinyari canal. In general among all stations Chakumber showed higher TDS and conductivity throughout whole year **(Fig. 1c, d).**





The pH ranged from 7.4 to 8.2, where lowest being at Chakumber and Phuleli (September) while highest at K.B. Feeder (August) and at Chakumber (June). The transparency was very high from January to April because there was no floodwater. Highest transparency was 58.0 cm at Chakumber (February) and it was lowest (2.0 cm) during July and August due to flooding at all stations except at Chakumber. The lowest hardness (70 mg/l) was noted in January at Indus River (downstream) while it was highest in March and October (130 mg/l) at Pinyari canal.

Pelecypod populations

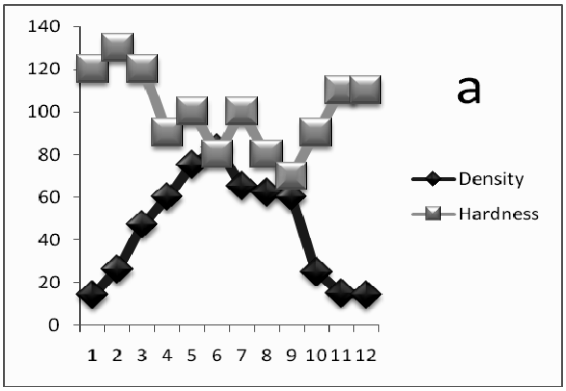
There occurred four (04) genera including seven (07) species of pelecypods. Among all species, *P. wynegungansis* was found dominant while the lowest population was of *Carbicula alberti* **(Table-1)**. The density increased sharply from February to April while a gradual increase continued till September. There was a sharp decline in population then after. The annual contribution of *P. wynegungansis* was 31.3% that was highest among all species. The other prominent contributors were *Nodularia pachysoma*, *N. caeruleus* and *Lamellidens marginalis*, their average annual contribution was 20.0, 16.6 and 11.5 %, respectively. *Corbicula* genus was lowest in contribution. The population density was low in colder months while it increased with the increase in temperature.

Table 1. List of Pelecypod species and their average annual density.

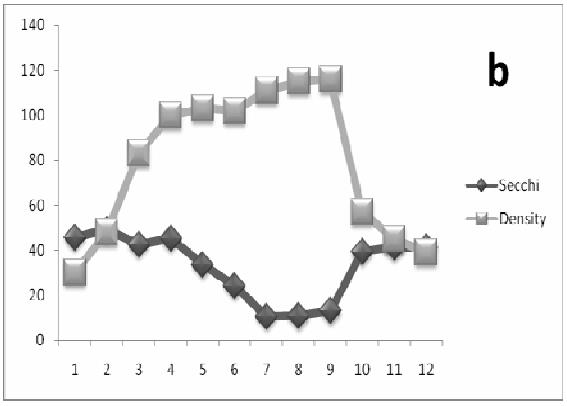
Name of species	Annual contribution (%)					
	St. 1	St. 2	St. 3	St. 4	St. 5	Avg
Parreysia (Radiatula) wynegungansis (Lea)	28.4	29.9	30.2	34.9	33.3	31.3
Nodularia pachysoma (Benson)	17.3	20.1	18.7	23.2	20.8	20.0
Nodularia caeruleus (Lea)	16.9	15.7	14.9	18.7	16.8	16.6
Lamellidens marginalis (Lamarck)	12.9	11.3	11.2	11.7	10.5	11.5
Lamellidens corianus (Lea)	11.5	8.4	10.1	7.0	6.3	8.6
Corbicula striatella Deshayes	7.2	7.3	7.5	2.2	6.3	6.1
Corbicula alberti Preston	5.7	7.3	7.5	2.2	6.3	5.8

St. 1 = K.B. Feeder, St. 2 = Pinyari, St. 3 = Phuleli, St. 4 = Indus, St. 5 = Chakumber, Avg = Average

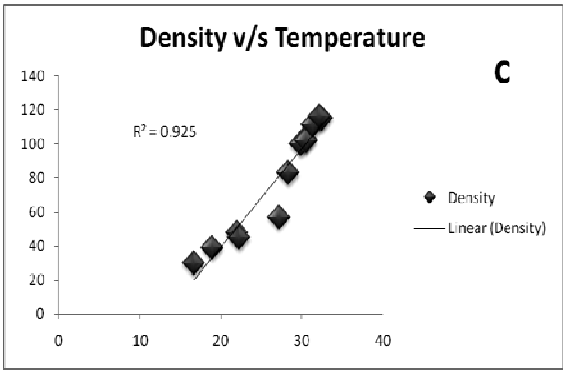
Water quality influences the aquatic biota directly or indirectly. The factors like temperature, hardness, pH, altitude, size of water bodies, vegetation and pollution are among the significant aspects influencing the distribution and abundance of mollusks (Dillon, 2000). A negative correlation with the hardness **(Fig. 2a)** was evident.

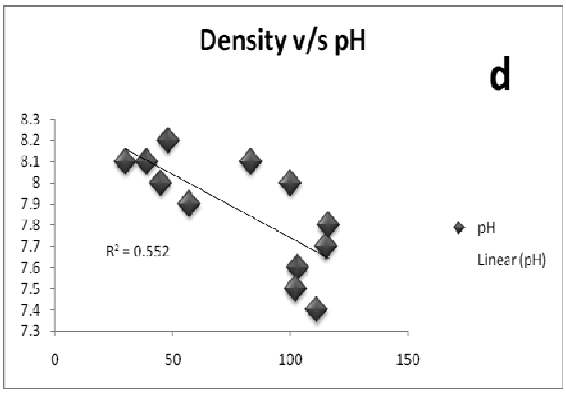


The $CaCO_3$ is generally considered to be utilized for shell construction and thus it has negative correlation with hardness. According to Russel-Hunter and Eversole (1976) calcium salts in both food and water are important for growth of molluscan shell. The population density also showed a negative correlation with secchi transparency and pH. It indicated that during July to September the population was highest when the transparency was lowest **(Fig. 2b).**



The population density was highest during July to September that showed a strong direct relationship (R^2= 0.925) with temperature **(Fig. 2c).** The pH versus density **(Fig. 2d)** showed a strong but negative correlation (R^2=0.552). Hardness and pH are considered important factors directly or indirectly influencing metabolic activities and thereby growth and abundance of freshwater mollusks (Eleutheriadis and Lazaridou-Dimitriadou, 1995).





All the Pelecypods recorded were documented earlier from other water bodies of Pakistan (Khan and Dastagir, 1972; Khatoon and Ali, 1978; Begum and Nazneen, 1992). Khatoon and Ali (1978) recorded only four pelecypod species from various water bodies of Pakistan. On the other hand Begum and Nazneen documented five species from various water bodies of Sindh (1987) and six species from Layari River (1992). We recorded seven species from Indus River (at Kotri Barrage only) is more than other studies. Occurrence of higher number of species and higher populations of Pelecypoda in Indus River are supported by the studies of Coker *et al*., (1921) and Dawley (1947) reflecting that the water quality of Indus River and its canals at Kotri Barrage is quite better.

Plate I. The pelecypod species.

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