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ECOLOGICAL STUDIES ON FRESHWATER GASTROPODS (SNAILS) OF INDUS RIVER AND ITS CANALS AT KOTRI BARRAGE SINDH, PAKISTAN

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Abstract

Occurrence of freshwater gastropods in Indus River and its canals at Kotri Barrage, near Jamshoro, Sindh were studied from (October 2005 to September 2006) Sampling area included five stations namely, Pinyari Canal, Phuleli Canal, K.B Feeder, Chakumber (Ring Dam) and River Indus (downstream). A total of seven genera including 10 species of gastropods were identified in which *Bellamya bengalensis* being most dominant

Gastropod 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 gastropods, where only dead 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 to 130 mg/l.

The gastropod population 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: Gastropoda, occurrence, ecology, Indus River.

1. Introduction

The gastropods 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. Some snails are of great importance for being intermediate hosts of infectious trematodes and other parasites of animals and human beings.

The distribution and diversity of freshwater snails depend on their abilities of colonization in a habitat and survival. That is regulated by the physico-chemical factors like temperature, hardness, pH, and pollution.

Previous work on mollusks of East and West Pakistan including marine mollusks was undertaken by Khan and Dastagir (1971) Later on Tirmizi (1973) gave the taxonomic account of the freshwater mollusks of Pakistan in her unpublished thesis. Khatoon and Ali (1978) also worked on Mollusca. A detailed work on taxonomy of bivalves was done by Begum and Nazneen (1991, 1992a, 1992b). These researchers have mostly concentrated on taxonomical studies and literature on ecological studies on gastropod fauna of Pakistan is not available.

2. Materials and Methods

Sampling area

Kotri Barrage is the last barrage on Indus River to irrigate Phuleli, Pinyari and K.B. Feeder through lined channels and 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

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(downstream) and 5. Chakumber (Ring Dam) where water remains stagnant. Monthly samples were collected from (Oct. 2005 to Sep. 2006).

The specimens were collected by hand picking when or where water was shallow. During flood season however, fishermen were deployed for snail 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 were, temperature, E. conductivity and TDS were measured by 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

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 lower 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 (down stream), 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 flood water. Highest transparency was 58.0 cm at Chakumber (Feb.) 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 Jan. at Indus River (downstream) while it was highest in March and October (130 mg /l) at Pinyari canal.

Gastropod populations

A total of seven genera including 10 species of gastropods were identified (**Table -1**). The vivipacrids were abundant and very common throughout all stations. These included *Bellamya bengalensis* and *Bellamya naticoides* in which the former being most abundant. Genus *Lymnaea* was most diverse representing three species where *Lymnaea acuminata chlamys* was dominant among the three. On the population density basis however, it was secondly dominated genera (**Table-1**). *Thiara tuberculata* showed fair number of population density and ranked third in the community. The population of *Physa acuta*, *Gabia arcula*, *Planorbis exustus* and *Gyraulus euphraticus* were very scarce. Only dead shells of *Gabia arcula* and *Gyraulus euphraticus* were seen and no live specimen was collected. On the other hand live specimens of *Physa acuta* and *Planorbis exustus* were only collected from Chakumber station. The Indus River (downstream) was very poor in live snails and only dead shells were found. Whereas K.B. Feeder, Pinyari canal and Phuleli canal showed more or less equal number of individuals. Chakumber was also having low number of individuals.

Table-1. List of gastropod species and their average annual density.

Name of species	Annual contribution (%)					
	St. 1	St. 2	St. 3	St. 4	St. 5	Avg
Bellamya bengalensis (Lamarck)	22.3	20.2	25.9	16.9	23.4	21.7
Bellamya naticoides (Theobald)	16.5	12.8	17.3	13.6	17.8	15.6
Thiara (Melanoides) tuberculata (Muller)	13.6	12.8	13.6	13.6	14.9	13.7
Lymnaea acuminata chlamys Benson	11.6	10.6	12.3	11.8	13.1	11.9
Lymnaea acuminata patula Troschel	10.7	9.6	9.9	8.6	10.3	9.8
Lymnaea acuminata rufescens Gray	7.8	9.6	8.6	16.9	8.4	10.3
Physa acuta Drapanaud	6.7	7.4	6.2	6.7	6.5	6.7
Gabia arcula Benson	5.8	8.6	3.7	8.6	3.7	6.1
Planorbis exustus Deshayes	2.9	5.4	1.2	1.6	0.9	2.4
Gyraulus euphraticus (Mousson)	2.0	3.2	1.2	1.6	0.9	1.8

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

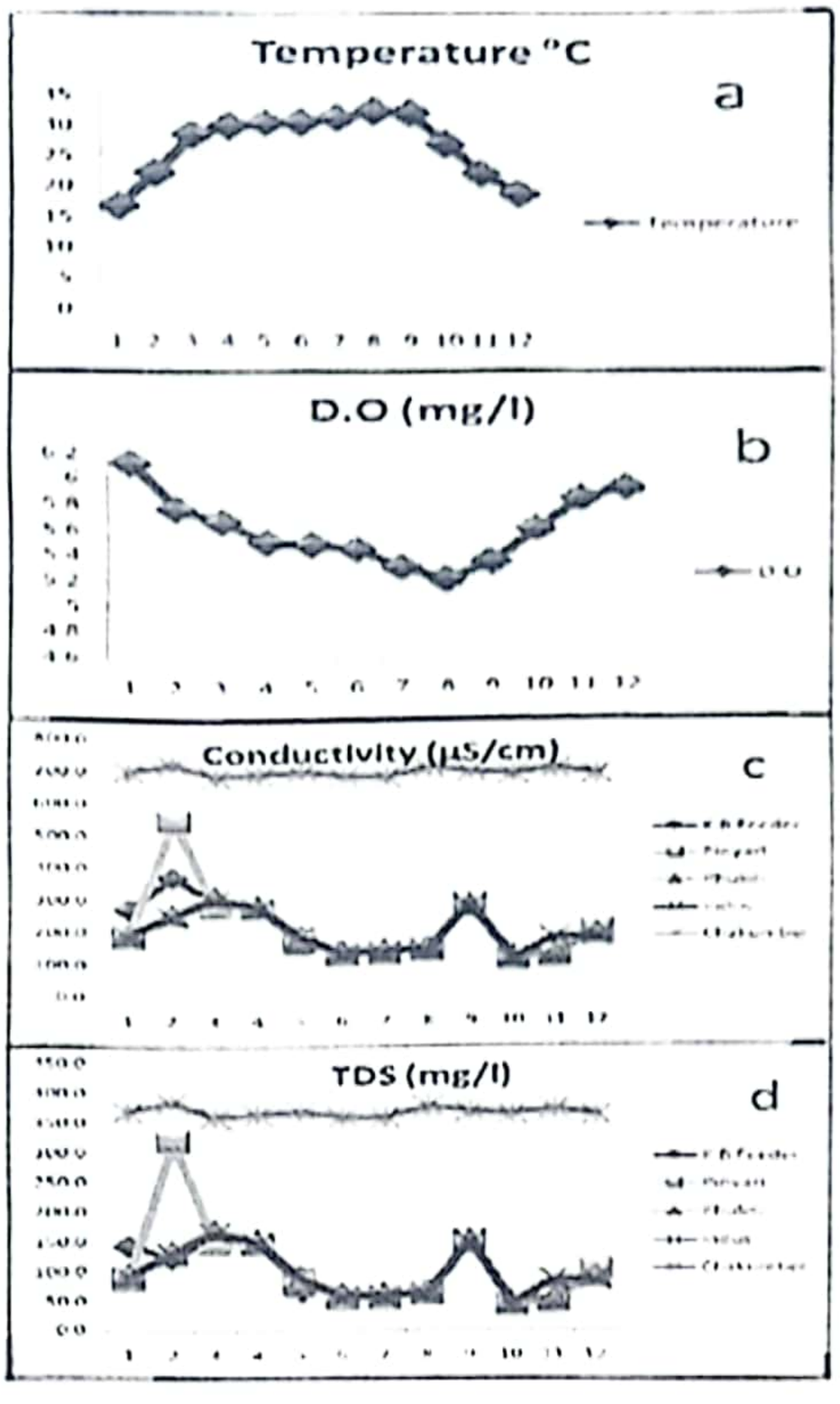

Figure 1. Physico-chemical parameters.

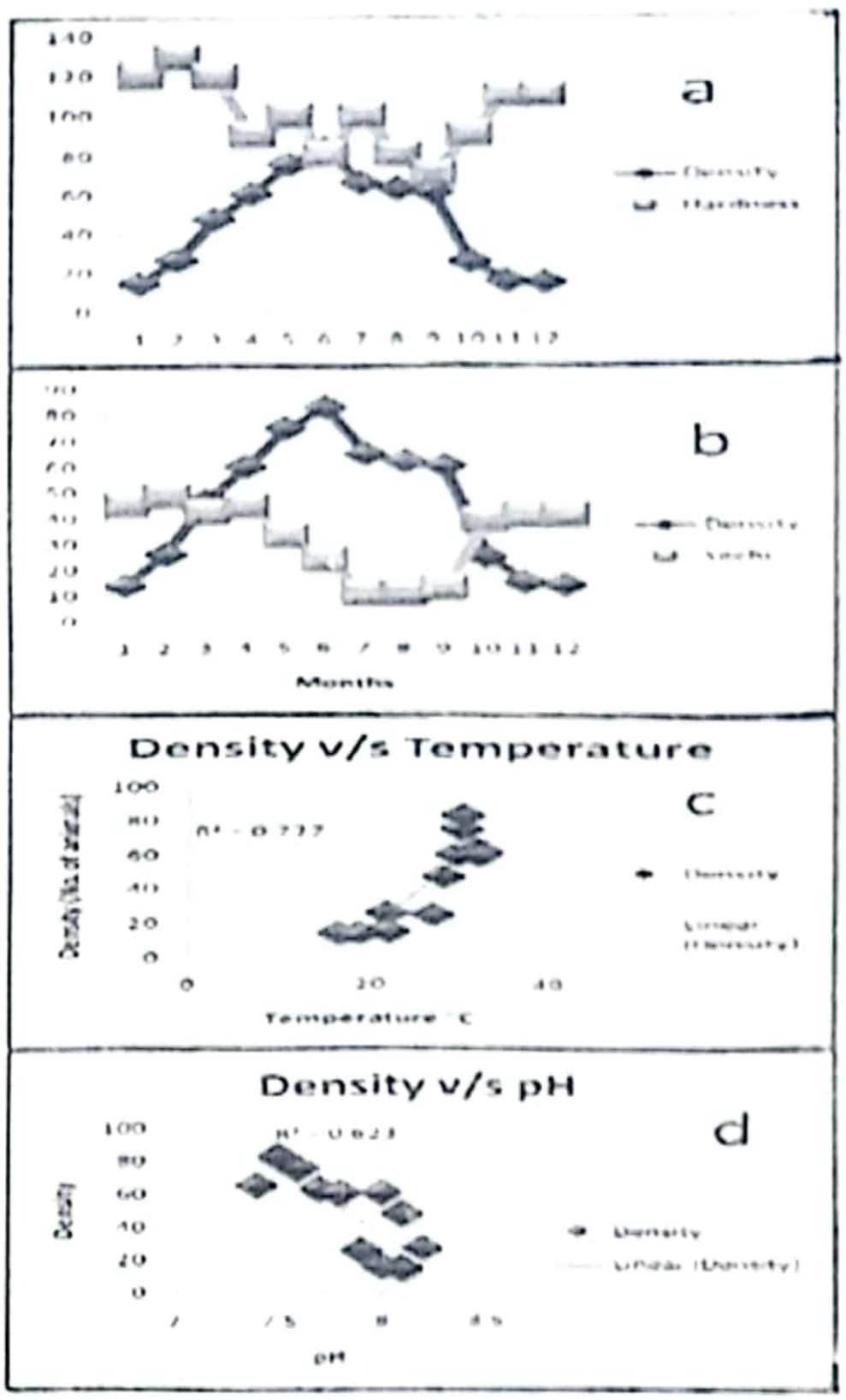

Figure 2. Density versus water quality.

4. Discussion

The distribution of freshwater mollusks depends on their abilities to colonize a habitat and survive there. Their survival, in turn, is regulated by various physico- chemical factors that play major role to determine the ecological traits associated with a particular species. The factors like temperature, hardness, pH, altitude, size of water bodies and vegetation and pollution are among the significant aspects influencing the distribution and abundance of mollusks (Dillon, 2000).

The population density was highest during June that showed a strong positive relationship (R^2= 0.777) with temperature (**Fig. 2c**).while a negative correlation with the hardness was evident (**Fig. 2a**). Chatterjee *et al.*, (2008) found a same correlation of hardness and gastropods. 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 in early monsoon the population was highest and it declined with highest transparency (**Fig. 2b**). The pH versus density showed (**Fig. 2d**) strong but negative correlation (R^2= 0.623). 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 gastropods recorded are already documented from other water bodies of Pakistan (Begum and Nazneen, 1991, 1992a, 1992b). The vivipaerid (mystery-snail) females are equipped with a uterus in which they gestate the eggs until they become juvenile snails hence called viviparous. There were three species of *Lymnaea* altogether their number ranked them as secondly dominant species. Among three species *Lymnaea acuminata chlymas* was dominant over other species. Lymnaeids are known to be distributed worldwide. They are host for larval

stages of the helminthes parasites which cause diseases in man and domestic animals. In Pakistan however, the studies are restricted to taxonomical work only. Akhtar (1978) and Khatoon and Ali (1978) have described *Lymnaea rufescens* as separate species instead of a form (variety) of *Lymnea acuminata*. However, Preston (1915), Subha – rao and Mitra (1979), Subha – Rao *et al.*, (1980), Goel and Sirivastava (1980), and Nazneen and Begum (1990) have described it as the form (variety) of *Lymnaea acuminata*. The living specimens of *Physa acuta* was first time recorded in 1990 from Layari River (Begum and Nazneen, 1990). The Physa snails are cosmopolitan and have been spread through human agency around the world (Dillon *et al.*, 2002). *Physa acuta* is a "weedy" or R-selected in the sense of Dillon (2000). It is most common in lentic water bodies and was found live from the Chakumber station on algal mats.

The dominance of viviparous (prosobranchs) and low number of pulmonates in these water bodies is justified because these water bodies are deeper, weed less and unpolluted.

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