



## RESEARCH PAPER

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## Species diversity of freshwater snails (Mollusca: Gastropoda) in different sites of Balochistan province of Pakistan

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### Abstract

In Balochistan province, there is a scarcity of information on the diversity of Snails in different regional sites. Herein, we provide taxonomic descriptions and distributional data for locally occurring snails. A total of 9 species were recorded from diverse habitats of 14 regional sites in Balochistan province. Among these, the 4 species like *Melanoides tuberculata*, *Physa acuta*, *Lymnaea auricularia* and *Lymnaea acuminata f. rufescens* were widely distributed in various aquatic habitats and collected from 7 to 10 sampling regional sites. While, *Lymnaea truncatula*, *Indoplanorbis exustus* and *Gyraulus euphraticus* species were also found to be entirely or nearly restricted to particular habitat and found in 2 to 3 regional sites. However, *Thaira scabra* and *Bellamya bengalensis* species were least collected and found in only 1 regional site. This result emphasized the importance of conserving the freshwater snail fauna which are at risk due to some major threats.

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## Introduction

Balochistan is geographically the largest province among four provinces of Pakistan, spreads over an area of 347,190 km<sup>2</sup>, mountainous but smallest in population approximately 7.5 million (Census, 1998). The population density is comparatively very low due to the mountainous terrain and scarcity of water. Its neighboring regions are Iran to the west, Afghanistan and Khyber Pakhtoonkhwa to the north, Punjab and Sindh provinces to the east (Aslam and Adams, 1989).

The freshwater snails are bio-indicators and play a vital role in the natural ecosystem. They are saprophytic animals and purify water bodies as they consume algae, zooplanktons, diatoms and organic waste. They provide food for many kinds of animals such as fish, birds and also for human beings; they are part of food webs (Burdi *et al.*, 2009). Some snails are act as intermediate hosts of pathogenic trematodes and other animals (Brown, 1994). Being molluscs, they are significant to humans throughout history in case of food source, tools, jewelry and even pets (Bijukumar *et al.*, 2008).

Little work has been done with reference to taxonomy and ecology of freshwater snail fauna of Pakistan by (Khan and Dastagir, 1971; Akhtar, 1978; Khatoon and Ali, 1978; Begum and Nazneen, 1992). These studies were carried out in the Provinces of Sindh,

Khyber Pakhtunkhwa and Punjab only but no work has been done on the freshwater snails of Balochistan province. However, in past, few snail species were collected and identified from some sites of northern Balochistan province by (Annandale and Prasad, 1919). They were reported the taxonomic studies of freshwater molluscs of Afghanistan with adjoining few site of the northern Balochistan and of seistan of Iran. Though, In case of vast diversity, the freshwater snails did not get much attention till present (Graveland *et al.*, 1994).

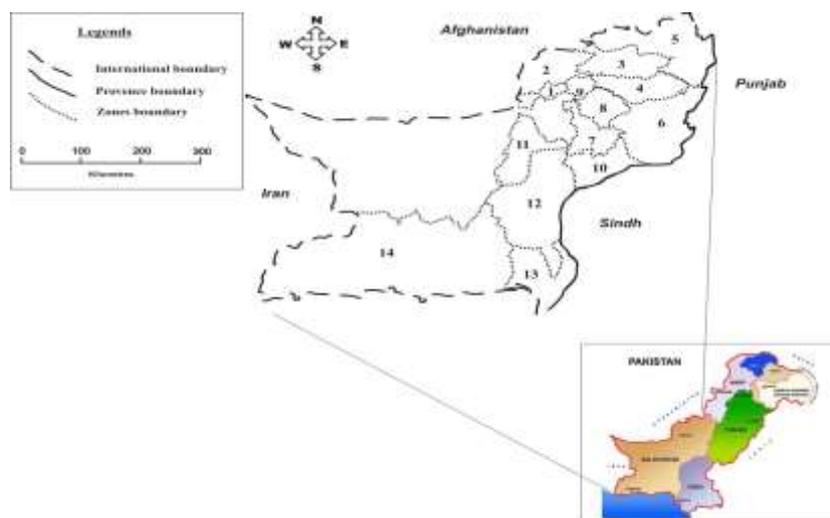
The present study aimed firstly, to provide an inventory of the freshwater snail fauna of the province. Secondly, to keep records mainly on the taxonomy, distribution, status and conservation need of the different species found in the different sites as there is no previous data in this province.

## Materials and methods

### Sampling

The snail samples were collected from 14 regional sites of Balochistan Province, Pakistan during the 2 years period of study (2011 to 2013).

The sampling regional sites were based on the geography, temperature variations, water resources, and rainfalls (Fig. 1). The Specimens were assembled using hand-picking and scoop method (Kitikoon *et al.*, 1981) then preserved in 70-80% ethyl alcohol and in 5% formalin solution (Kamran *et al.*, 2017).



**Fig. 1.** Map of Balochistan province, showing different study sites; 1-Quetta, 2-Pishin and Killa-Abdullah, 3-Killa-Saifullah, 4-Loralai; 5-Zhob, 6-Kohlu/Barkan; 7-Bolan, 8-Sibi, 9-Harnai, 10-Jaffarabad, 11-Kalat, 12-Khuzdar, 13-Lasbella, 14-Panjgoar.

### Identification

The specimens were categorized and identified on the basis of characteristics of the shell such as shape, size, color and ornamentation of coiled shell. Other characteristics include whorls as rounded, angular, keel over including shape, length and number of the spire, aperture (mouth opening) as sinistral/dextral, opercula (trap door) absence/presence and their shape.

Few minute characteristics such as the size and shape of apex, suture deepness, low, the shape, position, size of umbilicus and columellar, Imperforated and perforated, the outer covering (periostracum), pigment, pattering (ribbed and striated), eye and tentacle position were also studied this course of work.

Following identification keys, literatures were studied for the species identification of snail fauna (Preston, 1915; Annandale and Prashad, 1919; Khan and Dastagir, 1971; the keys of Brandt, 1974; Akhtar, 1978; Begum, 1987; Subba, 1989; Chitramvong, 1992;

Strong and Gargominy, 2008; Prabhakar and Roy, 2008).

Species were identified by using binocular Stereo microscope (ER.59-1990 Wild Heerbrug) and a diameter measuring caliper and Vernier caliper for the measurements. The photographs were taken by a digital camera. Abbreviations used in the text are as follows: shell length (SL), shell width (SW), + (present), - (absent) Fig. (Figure). All measurements were taken in mm. Voucher specimens of species sampled from the Province were deposited in the Zoological Museum Reference Collection (ZMRC: 005207-0052507), University of Balochistan Quetta, Pakistan.

### Results

A total of 9 species of snails were found from the 14 diverse collection sites of Balochistan province during the period of study. These species were belonging to; class Gastropoda; 2 subclass viz; prosobranchia and pulmonata; 2 orders; 5 families and 7 genera (Table 1).

**Table 1.** Inventory of freshwater snail fauna in different regional sites.\*

Taxa	Distribution in sites (1-14)*	Total
Class Gastropoda Subclass Prosobranchia		
Order Mesogastropoda		
Family Viviparidae		
1. <i>Melanoides tuberculata</i> , Muller, 1774	4,5,6,7,8,9,14	7
2. <i>Thiara scabra</i> , Muller, 1774	14	1
Family Viviparidae		
3. <i>Bellamya bengalensis</i> Lamarck, 1882	12	1
Subclass Pulmonata Order Basommatophora		
Family Planorbidae		
4. <i>Indoplanorbis exustus</i> Deshayes, 1834	8,9,10,14	4
5. <i>Gyraulus euphraticus</i> Mousson, 1874	1,3,5	3
Family Lymnaeidae		
6. <i>Lymnaea acuminata f. rufescens</i> Gray, 1820	1,2,3,7,8,9,10,11,12,14	10
7. <i>Lymnaea auricularia</i> , Linnaeus, 1758	1,2,3,4,5,6,9,11	8
8. <i>Lymnaea truncatula</i> Muller, 1774	1,10	2
Family Physidae		
9. <i>Physa acuta</i> Draparnaud, 1805	1,2,3,4,7,8,10,11	8

Regional sites\*: 1- Quetta, 2-Pishin and Killa-Abdullah, 3-Killa-Saifullah, 4-Loralai, 5- Zhob, 6-Kohlu/Barkan, 7-Bolan, 8-Sibi, 9-Harnai, 10-Jaffarabad, 11-Kalat, 12-Khuzdar, 13-Lasbella, 14- Panjgoar.

### Class Gastropoda

#### Subclass Mesogastropoda

#### Family Viviparidae

1. *Melanoides tuberculata* Muller, 1774 (Fig. 2).

Diagnostic Features: SL 21-37, SW 7-11mm.

The shell is light-brown in color and normally mottled by rust-colored spots forming a spiral row beneath the suture.

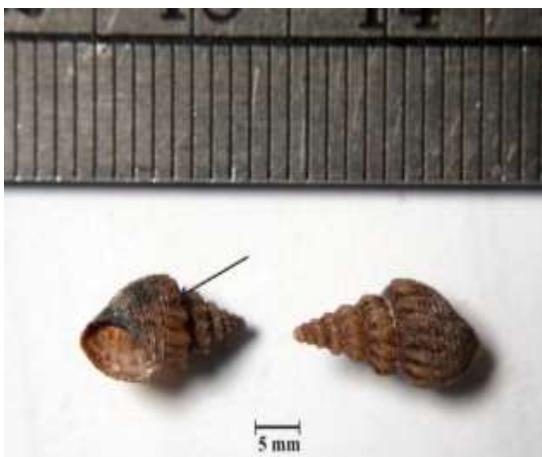
Dark-red spiral bands present on the base of shell. The shell is dextral having oval, horny paucispiral and dark colored operculum. Shell contains 7-11 whorls, sculptured with weakly vertical curved ribs and strong, well, spirally arranged tuberculated ridges. Conspicuous vertical ribs on middle and upper whorls.



**Fig. 2.** *Melanoides tuberculata* arrow showing spiral red-brown band.

**Distribution:** Distributed in 4, 5, 6,7,8,9 and 14 sites.

**Remarks:** The distinguishing feature of this species is the occurrence of dark red-brown dots either unevenly distributed or arranged longitudinally on the shell. This species is called the red-rimmed melania; this name originates as of the occurrence of reddish spots on the greenish-brown shell. The species is native to southern Asia and introduced to other countries through aquarium trade (Murray, 1964).



**Fig. 3.** *Thiara scabra* arrow showing vertical ribs and short spines.

2. *Thiara scabra* Muller, 1774 (Fig. 3)

**Diagnostic Features:** SL 13-25, SW 6-11mm. The Shell ovately elongated, sculpture with thin, brownish-olive dotted or sometime streaked with purple rust. Shell contains 7-9 whorls which are unequally straightly ridged. Whorls are spine round the upper part with aperture ovate.

**Distribution:** Collections were made for a small number of dead shells from a moistened adjoining field of Punjgoar sites only (site number 14).

**Remarks:** The shell is coroneted i.e., each consecutive whorl bearing distinct vertical ribs at the top which may project as short spines resembling a crown.

**Family:** Viviparidae

3. *Bellamyia bengalensis* Lamarck, 1882 (Fig. 4)

**Diagnostic Features:** SL 21-36, SW 14-26 mm. shell is thin, overtly conical pale brownish or green in color containing 6-7 convex whorls with a sharp apex. The body whorls inflated. The sutures are depressed. Aperture like mango-shaped i.e., rounded below and angularly pointed above. The shell sculptures with very finely striated and reddish brown bands over the surface. The narrowly perforated umbilicus is present and arched columella is covered with thin callus.



**Fig. 4.** *Bellamyia bengalensis* indicates; (a) umbilicus, (b) broad spiral band and (c) elevated spire.

**Distribution:** Specimens were collected from Khuzdarregion only (Site number 12).

*Remarks:* ovately conical shell with mango-shaped aperture and the presence of narrow and broad spiral reddish brown bands on the body whorl are the distinguishing characters of this species. It is used as a food in some countries (Budha *et al.*, 2010).

Although, it also acts as a vector of parasitic nematode of human being and other animals particularly fish (Farahnak *et al.*, 2006).

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*Subclass:* Pulmonata

*Order:* Basommatophora

*Family:* Planorbidae

4. *Indoplanorbis esustus* Deshayes, 1834 (Fig. 5)

*Diagnostic Features:* SL 3.5-15, SW 6-9 mm. Shell thick, depressed, concavely flattened from both sides and contains 3-5 whorls arranged spirally coiled in one horizontal plane. The depressed spires become sunken inward. The body whorl is large, swollen with a large, expanded, ear-shaped aperture. The umbilicus becomes wide and the outer lip is somewhat thickened and weakly reflected outwards. The shell surface is smooth or finely transpirally striated but toughly striated on the body whorl. The shell color may be greenish brown or yellowish with red pattern.



**Fig. 5.** *Indoplanorbis esustus* showing; a- inflated body whorl, b- sunken spires, c- clutches of eggs.

*Distribution:* 8,9,10, 14 sites.

*Remarks:* It is native to Asia and act as an intermediate host of the Asiatic schistosomes (blood flukes) and other trematodes (Montgomery, 1906).

5. *Gyraulus euphraticus* Mousson, 1874 (Fig. 6)

*Diagnostic Features:* SL 5-6, SW 4-5mm. The shell is small, thin and almost flattened with 3.5 to 4.5 whorls. The whorls are rounded and rapidly increasing in size. The body whorl is large with a keel at the periphery. Sutures are depressed. The shell surface contains fine oblique and transpirally arranged striations. The body whorl is sub-angulate at the periphery and contains obliquely ovate or semi-circular aperture. Umbilicus is deeper and small. Both inner and outer lips are same in thickness. The shell color is brown.



**Fig. 6.** *Gyraulus euphraticus* indicates presence of peripheral keel.

*Distribution:* 1, 3, 5 collection sites.

*Remarks:* The small sized shell along with 3-4 whorls and a peripheral keel on the body whorl gives the distinguishing characters to this species.

*Family:* Lymnaeiadae

6. *Lymnaea acuminata f. rufescens* Gray, 1820 (Fig. 7)

*Diagnostic Features:* SL 12-25, SW 4-8mm. The shell is thin, smooth, semi-translucent, oblong ovate shaped with 4-5 whorls. The body whorl is large, inflated below and angular above with wide and lanceolate elliptical shaped aperture and oblique and twisted columnella. Sutures obliquely depressed, Apex pointed and the outer lip is thinner than of inner lip.

The shell is sculptured with fine, closely-set, transpirally striations on the surface. The shell color is in various shadows of brown, usually yellowish brown.



**Fig. 7.** *Lymnaea acuminata f. rufescens* showing; (a) aperture and (b) callus.

**Distribution:** Distributed in sites; 1, 2, 3, 7, 8, 9, 10, 11, 12 and 14.

**Remarks:** It is commonly known as pond snail and it is the largest species of the family lymnaeidae. These amphibious snails can resist drought for long time. Its pointed apex and lanceolate aperture gives a distinguishing feature to this species.



**Fig. 8.** *Lymnaea auricularia* showing; (a) shell surface slightly hammered (b) ear-shaped aperture.

7. *Lymnaea auricularia* Linnaeus, 1758 (Fig. 8)

**Diagnostic Features:** SL 8-12, SW 4-8mm. The shell is fragile, thin with large, rounded (globose) body whorl and very short spire along with sharply pointed apex. Whorls are 3-4 in number while the Aperture is large, broad and ear-shaped.

Lip columellar is spirally twisted. Shell surface is smooth, finely, transpirally striated and with a slightly hammered (malleated) appearance. The color of shell is Pale to dark brown.

**Distribution:** 1, 2, 3, 4,5,6,9 and 11 number collection sites of Balochistan province.

**Remarks:** This species is generally called Big-eared lymnaea. The distinguishing characteristics of this species are of its sharp apex, large body whorl and ear-shaped aperture.

8. *Lymnaea truncatula* Muller, 1774 (Fig. 9)

**Diagnostic Features:** SL 4.2-10, SW 2.5-6mm. The Shell is small, pale horn in color, dextral with a blunt apex, deep sutures and 5-6 convex whorls. Spire evenly tapers towards the apex and approximately as high as aperture. Aperture is somewhat less than half of the shell height.

Mature shells hardly reach to 10mm in height with fold on the columella and a narrow umbilicus.



**Fig. 9.** *Lymnaea truncatula* showing; (a) sharp spire and (b) aperture.

**Distribution:** Distributed rarely in sites of Quetta and Kalat (site number 1 and 11).

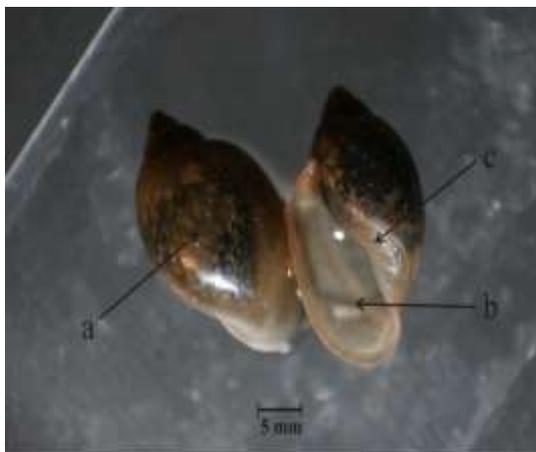
**Remarks:** this species is commonly also called as *Galba truncatula* and it is known to act as an intermediate host of *Fasciola hepatica* (sheep liver fluke) and other parasitic trematodes (Chapius, 2009).

Family: *Physidae*

9. *Physa acuta* Draparnaud, 1805 (Fig. 10)

**Diagnostic Features:** SL 8-15, SW 4-10mm. The shell is thin, smooth, small, elongately-ovate, moderate glossy and translucent along with 4-5 whorls. The body whorl is very large, roundly shouldered, almost rhomboidal with a large, elongated ovate and narrow at the top aperture. Spire is short and conical with sharp (acute) apex. Body whorl contains fine, close-set of lines of growth (striation) on the whole surface and also bear color band. These bands of the body whorl may be yellow black, light brown and white in color and usually 1 to 3 in number. Generally, the bands are found at the basal part of the body whorl. Aperture is large, elongated ovate and narrow at the top. The Inner lip is thicker than the outer lip and reflects over the body whorl to form a strong pillar.

The columella surrounds a thin layer of callus in some. The color of the shell is variable from pale green to brown and tinged with gray, black, red or green.



**Fig. 10.** *Physa acuta* showing; (a) colour bands on body whorl, (b) aperture and (c) reflected inner lip.

**Distribution:** Widely distributed in sites; 1, 2, 3, 4, 7, 8, 10 and 11.

**Remarks:** Widely distributed in the cold regional sites of the Province. It is also called fruit fly of malacology due to its rapid maturation, high reproductive rate and ease of cultural.

## Discussion

During this study period a total 9 species of freshwater snails (Gastropods) along with their distribution in the different regional sites were identified for the first time in the Balochistan province. In earlier, limited work has been done on freshwater molluscan fauna of some areas of northern Balochistan, Baloch-Afghan deserts and Seistan-Balochistan of Iran (Annandale *et al.*, 1919). Although, 12 species of freshwater snail were reported from Pishin, Quetta and Sibi sites of the province. On the other hand, the diversity of snail fauna of the Balochistan province seems to be really less according to number of species as compare to other provinces of Pakistan. According to literature, 31 species were reported from Layari River Karachi of Sindh province, while 10 species were identified from Indus River and its canal of the Sindh province, Lahore sites of the Punjab province and Pothwar regional sites of the northern Punjab province of Pakistan (Akhtar, 1978; Begum, 1988; Burdi *et al.*, 2008; Afshan *et al.*, 2013). The main causes of the less number of snail species in the Balochistan province are the due to scarcity of water, habitat destruction, drought from last decades, temperature variations, unawareness and population density.

Among the species distribution in the different selected regional sites, the species *Lymnaea acuminata* was showed wide distribution and collected from 10 selected regional sites of the province. Whereas, *Lymnaea auricularia*, *Physa acuta* and *Melanooides tuberculata* were also a fairly distributed, as they were recorded in 7 to 8 regional sites. On the contrary, *Thiarascabra* and *Bellamya bengalensis* were found only in one regional site while the two species *Gyraulus euphraticus* as well as *Indoplanorbis exustus* were found in the 3 regional sites of the province (Table 1). These variations in species distribution may be due to lack of water resources, temperature variation, the habitat destruction and species likeness habitats. This result of present studies also showed that 4 species as *Thiarascabra*, *Bellamya bengalensis*, *Gyraulus euphraticus* and *Indoplanorbis exustus* are under threat and need their conservation to save.

### Conclusion

The aim of this research paper is to throw some light on the diversity of freshwater snail fauna and their distribution, threat studies in the different regional sites which were not done before in this province of Balochistan, Pakistan.

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