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Diversity and distribution of land snails (Gastropoda: Mollusca) in the different sites of Balochistan Province, Pakistan

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Abstract

To study the diversity of land-snail fauna in the province of Balochistan, fourteen different sites were surveyed. Five land snail species were found as the Bradybaena *similaris*, *Macrochlamys sequax, Zootecus insularis*, *Allopeas gracile* and *Zebrina detrita*. Among these, the *Zootecus insularis* was showed a wide distribution and found in 8 of the total 14 surveyed sites. Followed by *Bradybaena similaris* and *Macrochlamys sequax* in 6 and 4 sites respectively in the province. On the other hand, *Allopeas gracile* and *Zebrina detrita* was collected from only site 1 but in different areas of the foresaid site which revealed the fact of their extinction in near future if immediate measures have not taken. The current study brought the present status and diversity of the land snail fauna into the pages of scientific record across the province as there is a dearth of reports about the diversity of land snail fauna in diverse provincial sites. Herein, this research offered first and detailed taxonomic description and distribution data of land snails' fauna occurring in the province. Additionally, it might provide a way to carry out taxonomic studies about land snail fauna in the other provinces of the country.

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Introduction

Gastropoda is the most important class of the phylum Mollusca with the animals having well-developed head bearing tentacles, eyes and a large muscular foot which is helpful for crawling. Snails, limpets, and slugs are familiar members of this class (Boonngam *et al.*, 2008). Most members of the class Gastropoda bears a protective coiled shell accept the slugs, which have no shell. Land snails entails of the two main groups' the prosobranchs and pulmonates. Prosobranchs have hardened shells and opercula which cover the apertures or openings of shells. Pulmonates, lack opercula and used lung for gaseous exchange. They live under leaves, woodland litters, logs, stones and trash, gardens, on the soil, in the cracks and even beside the hill-slopes (Srihata *et al.*, 2010). The temperature and moisture play a significant role in their occurrence and distribution. Some land snails serve as intermediate hosts of infectious trematodes and other parasites of animals and human beings. However, most of the land snails have an important role in the ecosystems in which they live: they contribute to litter decomposition and concentration of soil calcium and are an important food source for other animals (Lange, 2003). Their generally short life span (i.e. a few months or years) and their limited powers of dispersal make them excellent bioindicators (Watters *et al.*, 2005). To vast diversity, the land molluscan fauna did not get much consideration until the current (Graveland *et al.*, 1994). Previously little work has been carried out in the areas adjacent to Afghanistan and northern India by some authors (Solem, 1979; Subba, 1979) but very poor work has been done on land snails of Pakistan. The author (Pokryszko *et al.*, 2009) reported the Pupilloidae of Pakistan during the summers of 1990-1992. Although, there seems to be no information on the land snails of Balochistan province. This paper aims to provide an inventory of the land snail fauna along with a detail taxonomic description and distribution data of these snails in the different sites of the province.

Materials and methods

Study area

Snail samples were collected from fourteen different sites of Balochistan Province, Pakistan during the period of study from March 2013 to March 2014. The sampling sites were based on topography, water resources, consistency of soil, flora, temperature variations and precipitation among the regions (Fig.1).

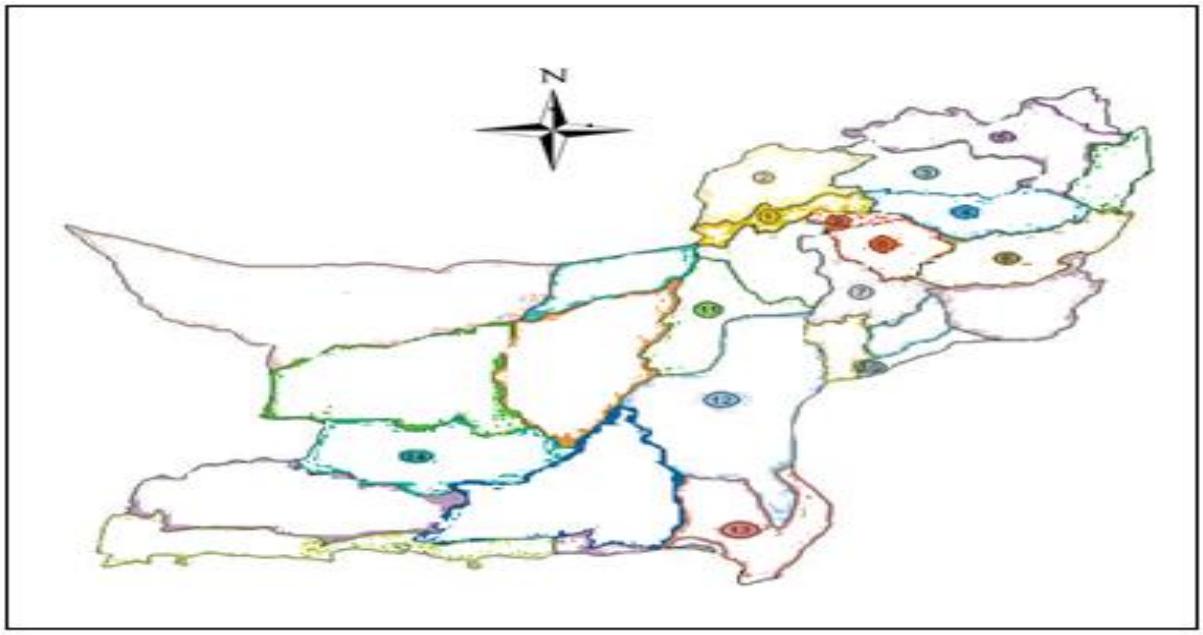

Fig. 1. Map of land snail collecting sites in the province Balochistan: (1) Quetta; (2) Pishin & Killa-Abdullah; (3) Killa- Saifullah; (4) Loralai; (5) Zhob; (6) Kohlu / Barkan; (7) Bolan; (8) Sibi; (9) Harnai; (10) Jaffarabad; (11) Kalat; (12) Khuzdar; (13) Lasbella; (14) Panjgoar.

Collection and preservation of snails

Specimens were collected manually by small cages from the soil, vegetations, gardens, humid and shaded places and preserved in 70-80% ethyl alcohol in specimen bottles. The habitat and other ecological characteristics were also recorded. The Collected specimens were taken to the malacology laboratory on the same or later day for detailed description. Before the examination, the Shells, hard covers with mineral and algae coating were placed in dilute oxalic acid solution for few minutes and then washed with tap-water before final preservation.

Snail identification

The analysis and identification of specimens were based on peculiar characteristics of their shells along with their shape, size, color, ornamentation and shell coiling. Umbilicus shape and size, number of whorls, aperture shape with size (sinistral/dextral), also differentiate them from each other such as the whorls may be rounded, angular or keeled. Additionally, the Spire number, length, and shape. The presence or absence of the Opercula (trap door) and their shape. Apex shape, size. and the Suture depth or narrowness. Columellar position and shape, perforation and imperforation. Outer covering-Periostracum color, pattering (ridged, striated).

The position of Tentacle with eye and another morphometric parameter was taken. Species Identification was done based on major keys and monographs of Preston, 1915; Brandt, 1974; Solem, 1979; Subba *et al*., 1979; Abbott, 1989; Prabhakar, 2008). Species were identified under a binocular Stereo microscope. The measurements were taken by vernier caliper while the Photographs were taken using a digital camera.

Results and discussion

A total of five species were recorded from fourteen sampling sites during the study period. These taxa were represented by a class Gastropoda; two orders viz., Stylommatophora and Pulmonata; five families and five genera (Table 1).

Table 1. Distribution of land snail community at different sampling sites of the Province.

Taxa	Sampling sites														Total
Phylum Mollusca	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Class Gastropoda (Cuvier, 1797)															
Order Stylommatophora															
Family Bradybaenidae															
Genus *Bradybaena* Back, 1832															
1. *Bradybaena similaris* (Ferussac,1821)	+	-	-	+	+	+	-	+	+	-	-	-	-	-	06
Family Ariophantidae															
Genus *Macrochlamys* Benson, 1832	+	-	-	+	-	+	-	-	+	-	-	-	-	-	04
2. *Macrochlamys sequax* (Godwin-Austen, 1907)															
Family Subulinidae															
Genus *Zootecus* Westerlund, 1887															
3. *Zootecus insularis* (Ehrenberg, 1831)	-	-	+	+	+	+	-	+	+	-	-	+	+	-	08
Genus: *Allopeas* Baker, 1935															
4. *Allopeas gracile* (Hutton,1834.)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	01
Order Pulmonata															
Family Enidae															
Genus *Zebrina* (Held, 1838)															
5. *Zebrina detrita* (Muller,1773)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	01

Bradybaena similaris (Ferussac, 1821)

Description (Fig. 2, 3): Average size SL 09-12 mm, SW 12-16 mm. shells are helicoid rounded having a thickened lip and perforated. The whorls are 5 to 5.5 in number. Commonly a single spiral peripheral chestnut band present on the whorl. The color of the shell is light brown or yellow. The shell surface is ornamented with well, rough growth lines and well spiral striae. The lip of the shell is reflected as well as the columella appearances somewhat covering the umbilicus. The color of the animal body is light brown and a darker line is present from the base of each eye tentacle to the halfway nearby shell edge. The above-mentioned snail species were found to be distributed in areas 1, 4, 5, 6, 8, and 9 as indicated in Fig. 1.

Table 2. Total Number of individuals collected from selected sampling sites of Balochistan Province, Pakistan.

S. No	Sampling sites	*B. similaris*	*M. sequax*	*Z .insularis*	*A.gracile*	*Z.detrita*	Total
01	Quetta	80	480	-	110	-	670
02	Pishin K.Abdullah	-	-	-	-	-	-
03	Killa-Saifullah	-	-	70	-	-	70
04	Loralai	260	110	80	-	-	450
05	Zhob	110	-	130	-	-	240
06	Kohlu/Barkan	40	80	160	-	22	302
07	Bolan	-	-	-	-	-	-
08	Sibi	120	-	180	-	-	300
09	Harnai	380	170	260	-	-	810
10	Affarabad	-	-	-	-	-	-
11	Kalat	-	-	-	-	-	-
12	Khuzda	-	-	120	-	-	120
13	Lasbella	-	-	60	-	-	60
14	Panjgoar.	-	-	-	-	-	-
	Total (%)	990 (33)	840 (28)	1060 (35)	110 (04)	22 (01)	3022

Habitation

Usually found on vegetables, gardens, weeds and humid places with fallen grasses. However, I collected the specimens from gardens, alfalfa and also from herbaceous weeds, grasses of moistness areas.

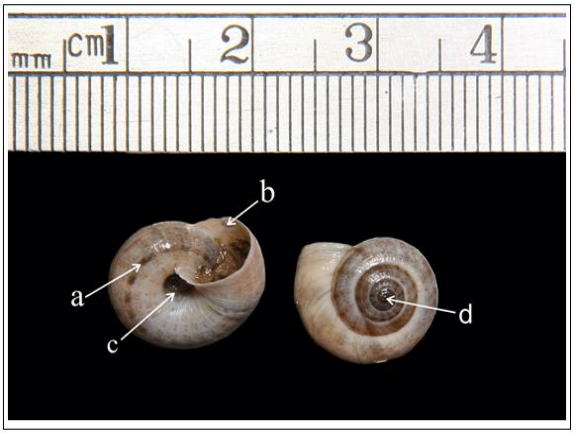

Fig. 2. *B. similaris* showing (a) color band, (b) aperture, (c) umbilicus and (d) protoconch**.**

Remarks

Bradybaena similaris is found in tanned, brown and white and commonly contains a distinguishing feature of the dark spiral band taking place on the shell. The common name is Asian tramp snail and it is native to Asia, but also introducing to other areas of the world by plants trading and other products such as seedlings, soil products, etc. (Junqueira *et al.*, 2004). This species is observed very actively after rainfall. It is a plants feeder and observed as a pest of agriculture (Stange, 2006). Naturally, it makes love dart during mating.

Macrochlamys sequax (Godwin-Austen, 1907)

Description (Fig. 4, 5): SL 8 – 9 mm, SW 16 – 18.5 mm. The shell is smooth, thin, depressed, polished and microscopically decussated. Nearly papillose,

with striae of growth and faint, close, waved longitudinal, impressed lines. Yellowish horny in color. Spire is low and the sides are slightly concaved. Usually, the suture is impressed. The shell comprises 5 Whorls which are convex, rapidly increasing.

Fig. 3. Alive *B. similaris* showing color band.

The last whorl is wider, rounded at the periphery as well as beneath. Aperture is somewhat oblique, broadly lunar and greatly broader than high.

The peristome is thin while the Comellar margin is curved, narrowly vertical above and concisely reflected. Animal color is pale ochraceous onward including the mantle; whereas the neck is greenish, the foot is pinkish, and tentacles are dark in color.

Fig. 4. *M. sequax* showing (a) white callus, (b) umbilicus and (c) body whorl.

Two parallel dark lines run diagonally from the base of the tentacle towards the aperture. The presence of the species, *Macrochlamys sequax,* was confirmed in the localities 1, 3, 4, and 9 in Balochistan (Fig. 1).

Remarks

Macrochlamys sequax is commonly called disk snail. It is described as a vegetable pest as in Bangladesh, it was observed to cause heavy damages to mulberry plants (Jahan, 1993).

Zootecus insularis (Ehrenberg, 1831)

Description (Fig. 6): SL 10 – 13.5 mm, SW 4 – 5.5 mm. The shell was thick, small, turreted with the apical whorls broad and conical in shape. The whorls are 7-8 in numbers. The shell is white. Protoconch showing certain irregular crinkles.

The teleconch whorls are cylindrical, seemed very fine axial riblets that were frequently arched. Irregular spiral furrows are intersecting the axial pattern. Aperture is semi-ovate with a thick, blunt peristome. Umbilicus is opened and almost covered by the reflection of the columellar rims of the peristome.

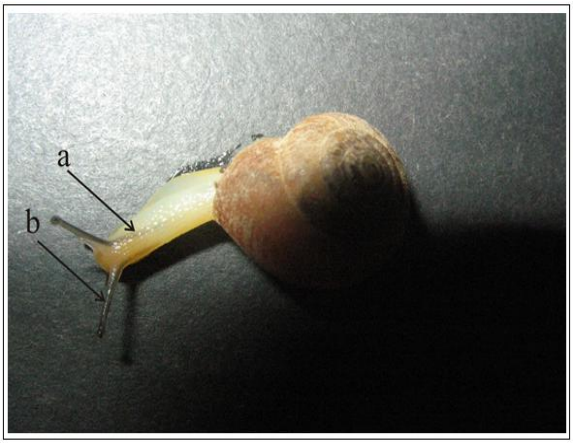

Fig. 5. Alive *M. sequax* showing (a) black tentacles and (b) parallel dark lines.

Animals are viviparous. Diversity of the aforesaid species were recorded from the following areas 3, 4, 5, 6,8,9,12, and 13 of the study areas (Fig. 1).

Habitation

Inhabit the moist places nearby vegetation.

Remarks

Morphologically the shell of *Zootecus insularis* has seemed as Bullet-shaped, it is commonly distributed in warmness regional places of the province Balochistan. Various empty shells are collected from mountainous areas near vegetation and open places.

This species is also reported from the mountainous sites of the bordering country Afghanistan and Hajar Mountains of the eastern UAE (Feulner and Green, 1999).During inactiveness, they normally sealed the aperture of their shells with a thin plug of mucus. In this manner, they can also aestivate to survive prolonged periods of drought.

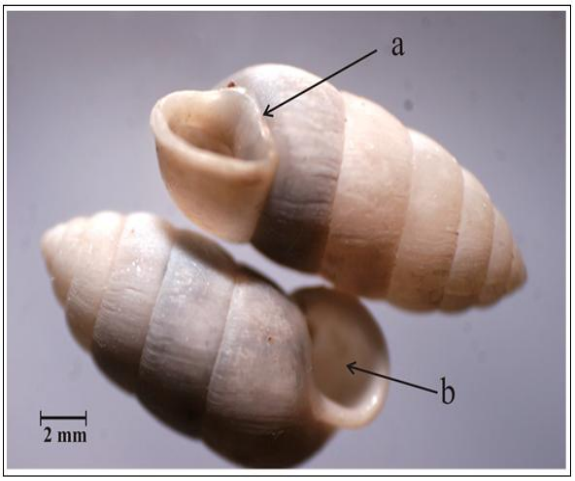

Fig. 6. *Z. insularis* showing (a) blunt peristome and (b) aperture.

Allopeas gracile Hutton, 1834

Description (Fig. 7): SL 12.3 mm, SW 3.4 mm. The Shell is conical, elongated in shape and comprises 7-9 whorls. The protoconch is spirited smooth with in the first whorl, but sutural crenulation's stars with the second protoconch whorl. The teleconch whorls were evenly rounded with a deep suture. The whorl's surface was covered by fine and dense axial straie which were curved supernaturally. Aperture was oval.

Columella was straight and slightly thickened with the closed umbilicus. This species was confined to only one locality in Balochistan as in site 1 (Fig. 1).

Habitation

Collected from humid spaces of the garden, lawn, and nursery.

Remarks: Commonly known as elegant Awl snail. The tall, conical and pale-colored with faint stripes is the distinctive feature of this species. It is widely distributed in Asia and also introduces to other countries like Saudi Arabia, Oman, Yemen through human activities (Naser, 2010).

Zebrina detrita (Muller, 1773)

Description (Fig. 8): Average SL 22.2 mm, SW 9.35mm. Shell is creamy white in color, sculpture with irregular blurry reddish-brown radial streaks, running across the whorls, furnishing zebra-like appearance to the snail. However, some shells lost stripes hence pure white in color. Apex is blunt with light brownish aperture, while the umbilicus is opened and partly covered which was observed only in site number 6 (Fig.1).

Habitation

Normally lives in the meadows of dry and warm slopes, in rocky steppes, limestone ground, as well as in vineyards.

Remarks

Commonly *Zebrina detrita* is named detritus Ena. It is reported as the first intermediate host of *Dicrocoelium dendritic* (trematode), while the common second intermediate host of *Dicrocoelium dendriticum* is the Formica fusca in Europe (El-showk, S, 2010).

Fig. 7. *A. gracile*

The zebra-like appearance of dark or red-brown stripes running across the whorls is the characteristic feature of this snail. However, the actual color of the snail is yellowish-grey as well as light grey, but as temperature decreases in autumn, its color changes in to darker and again in spring with increasing temperature it returns back to its actual light color. It is reported as a worm-loving species (De Francesco, 2009). However, this species was also collected from

the warm regions of Baluchistan Province.

Land snails were collected from divergent spots of the province. A total of five species were found with diverse habitat. The distribution of land snail fauna was frequently limited to geographical areas and along rocky. Among snail species at regional sites, the most common was *Zootecus insularis*, widely distributed and collected from 8 warmer hilly areas of the province. Conversely, excluding empty shells, no live form of this species was found.

Fig. 8. *Z. detrita* showing (a) colored radial streaks and (b) partly covered umbilicus.

The shells were dispersed on the rocky and bare soil which was the same as recorded in the previous study by (Solem, 1979), reported from Afghanistan and (Feulner and Green, 1999) from eastern UEA. This continuance also established the likeness of the warm-loving habit of the species as reported by (De Francesco, 2009). The other *Bradybaena similaris* was also showed fair distribution and collected from 6 sites. Followed by *Macrochlamys sequax* was found in 4 sites. The least species were *Alloeas gracile* and *Zebrina detrita* which were reported from only one site each respectively (Table 2). The sporadic distribution of land snail-fauna showed the vulnerability and even extinction which need further investigation to protect them.

The numbers of holotypes collected from different localities, were also showed and conformed the wide distribution of the *Zootecus insularis* (35%), followed by *Bradybaena similaris* (33%), then *Macrochlamys sequas* (28%). While the other two species, the *Allopeas gracile* and *Zebrina detrita* were occurred lowest as (04) and (01) respectively (Table 2).

No records are available on the land-snail fauna of the province except (Annadale and Prashad, 1919), who reported land snail from Afghanistan and few sites of adjoining seistan-Balochistan. Consequently, it is forerunner attempt in the province to fill this gap.

Conclusion

The findings of the contemporary study revealed that all species of land molluscan fauna were facing serious threat on account of the annihilation of the natural habitats by human activities in Baluchistan province of the country Pakistan. Tangible measures are the need of time to preserve the molluscan diversity.

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