



Short Communication

Local dispersal of land snail *Zootecus insularis* (Ehrenberg, 1831) (Gastropoda: Subulinidae) shells in mangroves of Karachi

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The present study of the gastropod *Zootecus insularis* found in mangroves of Karachi, Pakistan is the first report of this species from coastal habitat. Although, the species is a land snail, widely distributed in arid and semiarid lands of many countries including Pakistan, and other nearby countries like Afghanistan and India, its presence in marine wetland habitat is reported from Pakistan in the present study. While studying the benthic fauna of the mangrove swamps of *Avicennia marina*, fifteen empty shells of the species were found in intertidal muddy region of Korangi Creek and Sand Spit backwaters, Karachi. It is distributed mostly along intertidal zones, more commonly in high and low tidal zones during an average tidal height of 0.5 m. The presence of empty shells of *Zootecus insularis* in the mangroves sediments is probably, a consequence of a passive transport by external sources.

[Keywords: *Zootecus*, empty shells, Mangrove, *Avicennia marina*]

Introduction

In Pakistan, the presence of these tiny snails *Zootecus* has been recorded in the past and is more widely distributed in Sindh, Punjab and Balochistan¹⁻³. Three empty shells and live animals also has been reported in the past³. In the present study, fifteen shells of *Zootecus* have been observed and collected from two mangrove sites of Korangi creek and only once from Sand Spit area with a canopy of *Avicennia marina*. Although Tirmizi & Barkati⁴, Rahman⁵ & Hamdard *et al.*⁶ worked on mangrove molluscs from Karachi, they did not mention the accidental occurrence of empty shells of the terrestrial species of *Zootecus* in their studies.

Altogether, six species of genus *Zootecus* have been reported from Pakistan namely *Z. insularis* (Ehrenburg, 1831), *Z. chion* (Pfeiffer, 1856), *Z. agrensis* (Pfeiffer, 1853), *Z. gracilor minor* (Pfeiffer, 1856), *Z. polygyratus* (Reeve, 1849) and *Z. pullus* (Gray, 1834).

Malacologists identified and described these taxa solely on the basis of morphological characteristics of the shells; their anatomy has been described by Neubert⁷. Prashad⁸ recorded these from excavations at Harappa in the Punjab and Biagi & Pessina⁹ and Negrino *et al.*¹⁰ recorded from Sindh region showing the existence of these species in Pakistan in the prehistoric times also, dating to 3rd millennium cal. BC, Mature Indus Civilisation⁹⁻¹¹.

Zootecus insularis (Ehrenburg) –is a species that is widely distributed in the arid and semi-arid areas. In Pakistan, the erosion of hills and fossil dunes over centuries/millennia has resulted in the transport of *Zootecus* shells towards Ut hla area and Lake Siranda (Las Bela, Balochistan) where the empty shells of *Zootecus* are accumulated everywhere. Its present distribution is said to be artificial and probably the product of human activity¹².

The present paper reports this species record as empty shells from the eastern side of Karachi, between Karachi and Keti bandar, the area extending from Korangi to Rehri creek is known as the Korangi creek which further extends to Phitti and Khuddi creeks. The complex network of Korangi and adjacent creeks has vast mangrove dominated areas creating a highly productive ecosystem¹³, however Korangi creek is considered as one of the most polluted coastal areas of the Karachi coast. It consists of backwaters, adjacent salt pans and covering of mangrove marshy land which is mostly dominated by *Avicennia marina*. Geographically, the site is located in the northern creek mangroves of the Indus delta. Whereas, the study site at Sand Spit is located within the mangrove habitat, (24°46'55" N; 67°17'33" E), representing the backwaters of Karachi harbour. It forms the most of the western part of Indus delta mangroves ecosystem (Fig. 1)

Materials and Methods

All shells, except one, were collected from sediments of Korangi creek during April to September 2017, from high tide to low tidal zone in three different transects having salt pans in adjacent areas. The sediments samples were sieved through a 0.5 mm mesh sieve and the shells were found along with other benthic invertebrates during a macrobenthic study of

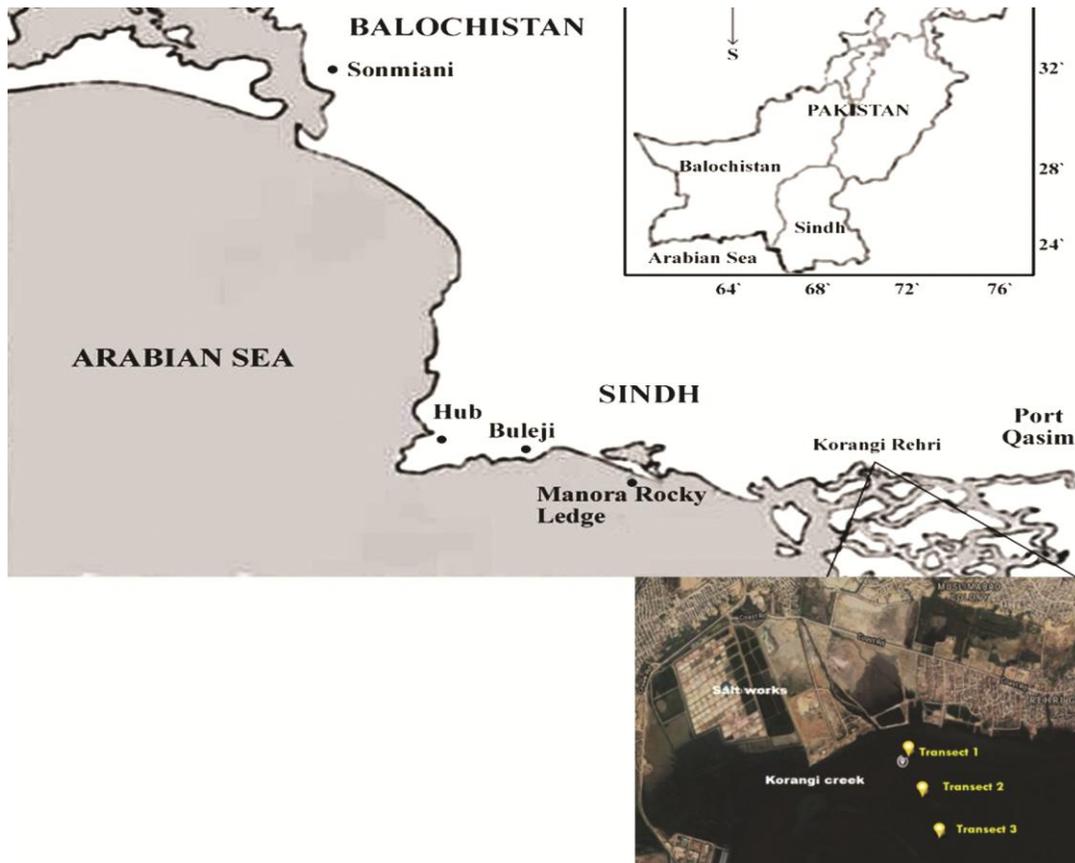


Fig. 1 — Map of study areas (Korangi Creek and Sand Spit, Karachi)

the area. Only once, the species was collected from sediments sieved from mangroves of Sand Spit backwaters. The shells look sub-fossiled as the shells were bleached and were having partly covered by traces of soil. The shells are described along with photographic evidence in the present study.

Results and Discussion

Brief description

Shell sub cylindrical, perforate, whitish with decussating sculpture, aperture vertically ovate, apex rather obtuse (Fig. 2). Finely marked by vertical striae which are bent at the suture, consist of 7 – 8 whorls, in which the last whorl ascending a little in front, fairly convex; aperture sub vertical, semi-ovate, angled above; columella thickened, slightly reflected, outer lip thickened inside¹⁴. The approximate maximum height observed is between 10 – 12 mm and diameter ranges between 4 – 5 mm.

Distribution

The current range of this species extends from the Cape Verde Islands and West, North and East Africa through the Arabian Peninsula (Saudi Arabia,

Qatar, U.A.E. Oman, Yemen) to South Asia (India, Pakistan, Sri Lanka, and Afghanistan) and northern Myanmar^{7,15,16}. This is a species of dry plain deserts and semi-arid region, empty shells of which are often found along the coasts floated from elsewhere as reported by Neubert¹⁷ and Mordan¹⁸.

Remarks

From Pakistan 31 species of land snails of families Parmacellidae, Agriolimacidae, Vertiginidae, Chondrinidae, Pupillidae and Clausiliidae have been reported so far^{1,19-22}, but the Subulinidae were listed by Dastagir & Khan²³, Qamar *et al.*³, and Girod & Balzarini².

The empty shells of gastropods may be transported by various mechanisms from quite distant places. Land snails have very limited powers of active dispersal, usually of the order of a few metres or tens of metres a year^{24,25}. Clearly, a passive dispersal plays a key role in the distribution of land snails. Several potential vectors for such dispersal have been considered and there is good evidence for some of them²⁶. Wind dispersal has been reported by Kirchner *et al.*²⁷ and Caceres & Soluk²⁸. Floating vegetation at sea and transport in river

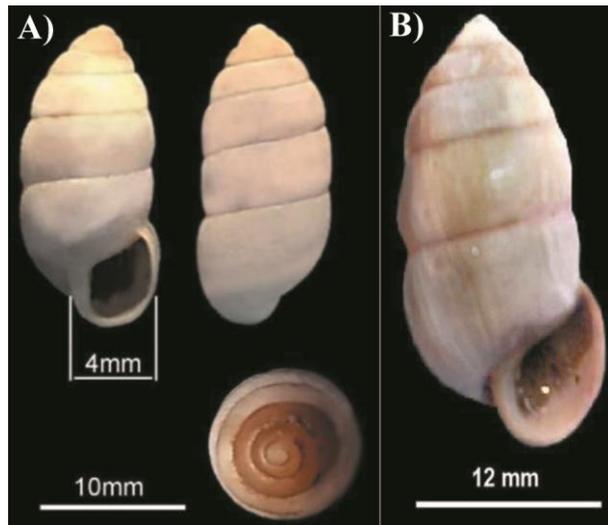


Fig. 2 — Shells of *Zootecus insularis*: A) from Korangi Creek, and B) from Sand spit

debris have also been recorded by Gillespie *et al.*²⁹ and de Queiroz³⁰ and there is also an evidence that land snails can sometimes survive immersion in sea water for several days³¹.

The possibility of survival while passing through the digestive system of birds has been considered less frequently³², while many birds eat snails³³, the powerful digestive juices and the presence of a grinding gizzard in many species would seem to preclude survival. Nevertheless, such survival has been recorded for operculate aquatic snails^{34,35}. Wada *et al.*³⁶ noted that the shells of other larger species of snails eaten by birds were usually broken in their passage through the bird digestive system. Dispersal of land snails by many invertebrates and vertebrates is considered as well-known fact³⁷⁻³⁹.

The snail abundance in the various habitats varied with the months and with the habitat. It is believed that the present shells were carried either by birds or have more likely been transferred accidentally by river flow thus reached to seaside. Further, it is also assumed that the shells have been transported from the Persian Gulf currents. Whenever soils are transported across seas, snails and snail eggs can hitch a free ride. The literature shows that “dispersal” of empty shells through sea currents is not a rare occasion⁴⁰⁻⁴². It would be interesting to collect live specimens from different sites of Pakistan and to analyse their DNA for a better understanding of the problem pertaining to many taxa of Pakistani *Zootecus*. The problem of *Z. insularis* found in Pakistan is still unresolved because of the high variety

of shell shapes one can observe in the empty shells. Based on present study it can be stated that *Z. insularis* is a parthenogenetic species and this strategy of self-fertilization connected with long periods of inactivity and a relative isolation of many populations, are good opportunities to produce local forms and this may be the reason of the number of names for Pakistani *Zootecus*.

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Conflict of Interest

No conflict of interest amongst authors.

Author Contributions

SK: Conceptualization, supervision, draft writing & all correspondence; FI: Collection, sampling analysis, photography & making the map of study site; and QBK: Review & foreign correspondence for identification confirmation.

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