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COMPARATIVE MORPHOLOGY OF THREE GASTROPOD SPECIES RADULA FOUND ALONG BULEJI ROCKY SHORE, KARACHI, PAKISTAN

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ABSTRACT

Radula is an important organ and has immense role in feeding of gastropods and also play vital role for taxonomic studies. The structure of radula is species specific. It has role in feeding and also important structure for identification. In present study the morphology of three gastropod species radula (*Turbo pentholatus*. *Personia verculata*, *Chiton* sp) has been investigated. The samples were collected from Buleji rocky shore. The results revealed morphological variation among these species. Two species (*Turbo* and *Chiton*) have Rhipidoglassan radula, while *Personia verculata* has Rachiglossi radula. Scan electron microscopic studies are suggested for further analysis.

Keywords: Radula, *Turbo pentholatus*. *Personia verculata*, *Chiton* sp., buleji.

INTRODUCTION

Molluscs are soft bodies' animals and considered as largest phylum among other groups found in marine environment, a group of great diversity, habitat, size, distribution throughout the world, covers. The range of their distribution is as extensive as it covers terrestrial, marine, and freshwater habitats (Yakhchali *et al*., 2013). The popular classes of this phyla includes Gastropoda, Bivalve and Cephalopoda. Excluding class Bivalvia (Eisapour *et al*., 2015), feed on a variety of different food sources they can be, detritus feeders, predators, herbivores , parasites, scavengers, and ciliary feeders.

This is possible because they carry a key innovation for mechanical food processing, the radula (Krings *et al*., 2019), a rasping structure called as Radula (Tongue). This important structure has chitinous teeth and mainly it's characteristic function is to work as feeding apparatus, however this is also used for systematics investigations (Eisapour *et al*., 2015). According to (Roberts, 2000; Jörger and Schrödl, 2013; Kruta *et al*., 2013, 2014) radular teeths of the molluscans are unique to a species and genus such as tooth number in order to investigate mollucans in higher taxonomic levels. Moreover, its special morphological characteristics are important for the species allocation (De los Rios *et al*., 2020). Until now, several species of class gastropod has been investigated for structural morphology of their radula such as studies of (Macenstedt and Markel, 1987; Franklin *et al*., 2007; Ramesh and Ravichandran, 2008; Eisapour *et al*., 2015).

MATERIALS AND METHODS

Study Area:

Karachi is located in southern Pakistan in the north of Arabian Sea. It lies 67°00′36″east longitudes and 24°51′36″ north latitudes comprising 3,527 Km². Altitude of 8 meters average mean sea level (Afsar *et al*., 2013).

Buleji 24 50 N, 66 48' and southwest of Karachi near fishing village of buleji (Fig. 1). The Buleji rocky ledge is triangular platform, which extends into the open Arabian sea. The right flank of the ledge faces the open sea and its maximum wave action, and tends to be rich in fauna and flora. The middle and lower part of the rocky ledge are made up rather flat rocks and small boulders. The left margin of the ledge has less wave action as compared to the right one. Main body of the triangular ledge consists of small and large tide pools which inhibit different species and other benthic life with abundances of algal growth (Afsar *et al*., 2012).

Specimens' collection:

Different individuals of gastropods species of *Turbo* spp., (*Personia verculata*, *Chiton* sp.) were collected during low tide from the coasts of Buleji, Karachi, Pakistan and brought to the laboratory in Centre of Excellence in Marine Biology.

They were identified from Dance (Dance, 1998*)*.To study the distal end for the radula, an isotonic $MgCl_2$ solution (5%) prior to fixation was used to relax all specimens. All material was fixed in 2.5% glutaraldehyde in 0.1 mol L^{-1} PBS (pH 7.2–7.4) (Elena and Alexander, 2019).

Hammer was used to break the hard shells carefully taking care of soft parts. The anterior portion of the proboscis was cut and used for the radular analysis (De los Ríos *et al*., 2019) and radulae of *Turbo* sp, (*Personia verculata*, *Chiton* sp.) were carefully taken out from the dissected head of each individual. Complete soft tissues of radula teeth's were dissolved in hypochlorite solution (10%) followed by double distilled water and for obtaining the intact radula. After the procedure radula was preserved in 70% alcohol until photographs were taken. Furthermore, Microscopic observations were done (Eisapour *et al*., 2015).

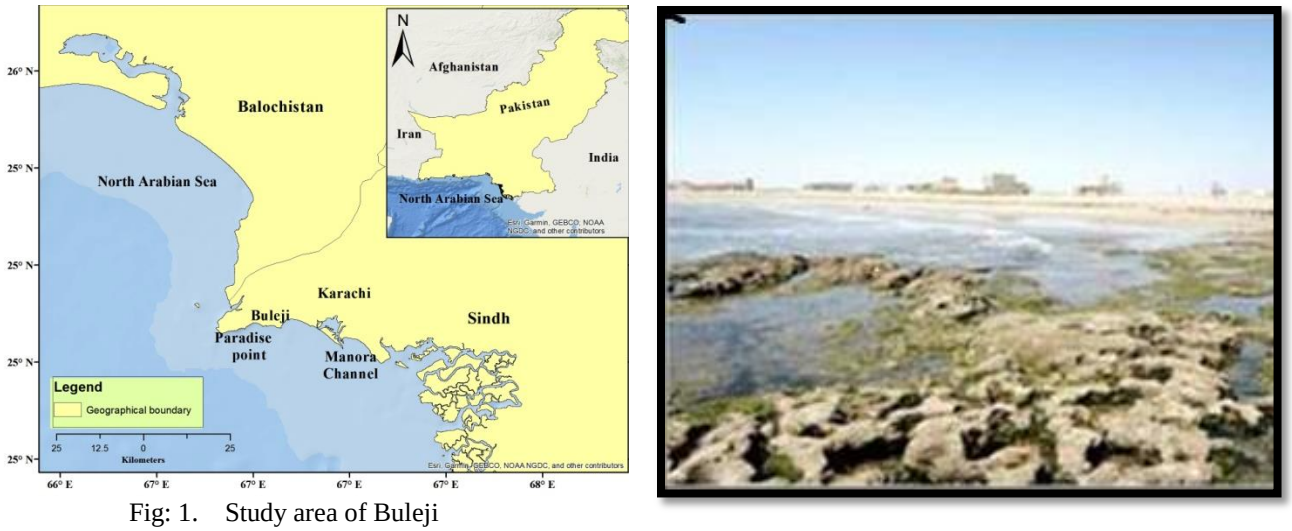

Fig: 1. Study area of Buleji

RESULTS AND DISCUSSION

Uptil now 409 families of recent gastropods has been recognized, out of which 26 are restricted to freshwater. Gastropods were found distributed in a particular aquatic zone prevailing environmental factors like duration of wetting by immersion and by splashs from the waves, waves impact, food sources etc. (Purchon, 1968). Along with other gastropods Chiton, *Personia verculata* and *Turbo pentholatus* found in abundance in the coastal zone of Buleji. These species belong to families Chitonidae, Onchidiidae and Turbinidae. Radular morphology of these genus depends upon the feeding habitats along with food preferences which reflects the fundamental role of radula. They are often found attached to rocks and other substratum and feed of microscopic algae by radula. The study reveals the significant structure of radula of all three species. *Personia verculata* shows harpoon like radula (Rachiglossi) whereas , *T. Pentholaus* and chiton has a rhipidoglassan radula.

Among the 3 under study species (Chiton, *Peronia verruculata, T. Pentholatus)* of mullusca, 2 different types of radula were found. Morphology of radula differs fromspecies to species, thus useful in identification, depending upon the different feeding habits of gastropods like scarping, rasping of hardened microalga, working like harpoon into the prey, drilling, penetration into the prey etc (Reid and Mak, 1999; Simison and Lindberg, 1999; Franklin, 2007; Venkatesan, *et al*., 2016). The radula of chiton and *T. Pentholatus* (Fig. 2 & 3), Rhipidoglassan type , have rachidian tooth with secondary cusp, bilaterally symmetrical around a central rachidian tooth, polystichous, has (usually) 17 teeth to each transverse row whereas the location of radula of *Peronia verruculata* (Fig. 4) is at anterior portion of visceral cavity between two large postero lateral muscular masses, radula is inverted heart shaped, radian tooth are tricuspid which is present on each radula which consist of half rows of lateral teeth, which are hook shaped, angled at 45^0 from rachidian axis, their bases are perpendicular to the radula membrane (Chang, 2018). According to (Eernisse and Reynolds, 1994; Macey and Brooker, 1996; Brooker and Macey, 2001; Shaw *et al*., 2002, 2008; Brooker *et al*., 2006), arrangement of tooth differs depending on the species, there are many different teeth in each row, and serially repeated, since all rows are composed of the same tooth arrangement, with from 25 to 150 rows of teeth in chiton. Lateral major teeth consists of shaft which is stylus and cusp, are distinguished by their glossy black cusps because of their impregnation with magnetite (Kaas and Jones1998), shaft and cusp are connected with a region called conjuction zone (Macy and Brooker, 1996). Shape of the cusp depend on the species from pointed to simple disc or shovel shape possessing two to four denticles (Brooker and Macey, 2001). The base

of the cusps are anchored to the radula membrane, sides of the radian tooth are extended from the membrane which are either mild convex or straight in *Peronia verruculata* (Fig. 4 F) (Chang *et al*., 2018).

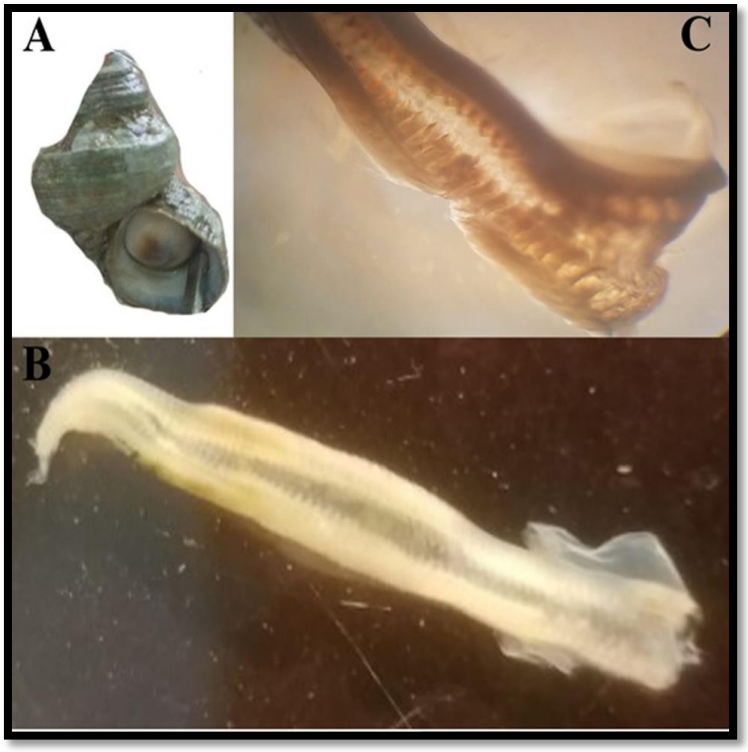

Fig. 2 *A.Turbo pentholatus, B and C. Radula.*

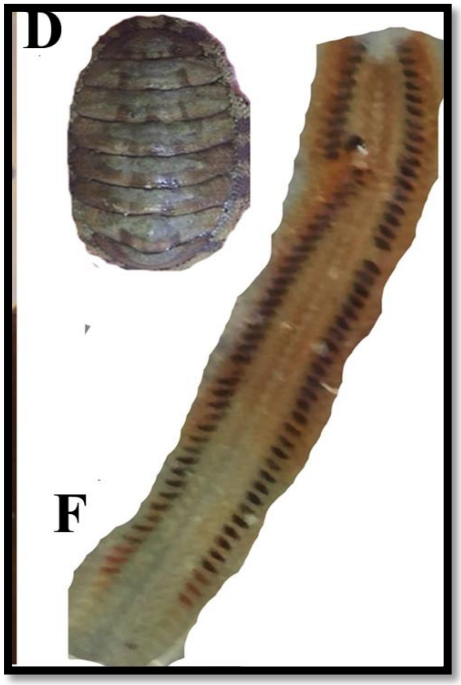

Fig. 3D. Chiton, F. Radula of chiton (Rhipidoglassan radula);

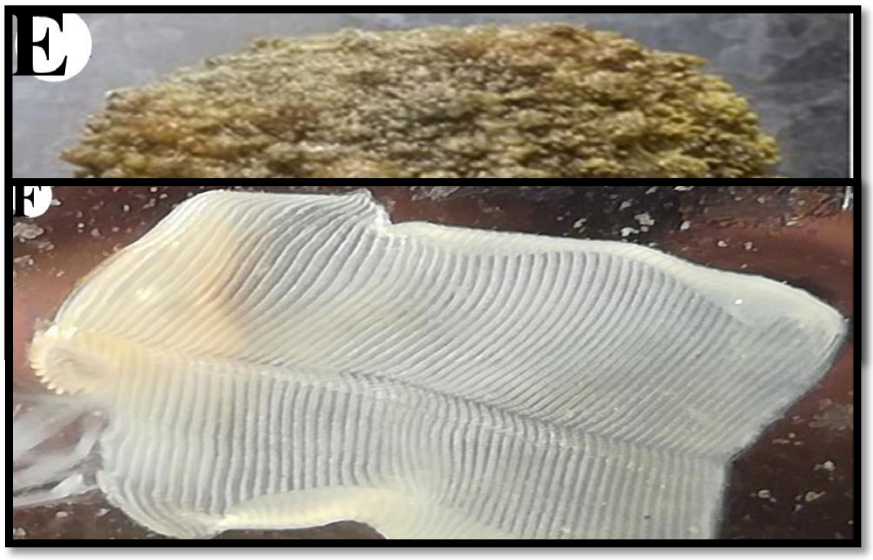

Fig. 4 E. *Personia verculata,* F. Radula (*Rachiglossi radula*)

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