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Update of Records of Selected Prosobranch Gastropod Species Found Along the Coasts of Sindh and Balochistan, Pakistan

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Abstract.- Gastropod species were examined from nine sites along the coasts of Sindh and Balochistan, Pakistan. Ten species of gastropods namely, *Monodonta canalifera* (Lamarck, 1801), *Turbo coronatus* (Gmelin, 1791), *Thais carinifera* (Lamarck, 1816), *T. bufo* (Lamarck, 1822), *T. hippocastanum* (Linnaeus, 1758), *T. rudolphi* (Lamarck, 1822), *T. tissoti* (Petit, 1853), *Morula granulata* (Duclos, 1832), *Turricula javana* (Linnaeus, 1767) and *Babylonia spirata* (Linnaeus, 1758; Swainson, 1822), belonging to two orders namely, Archaeo- and Neogastropoda and five families (*Trochidae, Turbinidae, Thaidae, Turridae*, and *Buccinidae*) were studied. The species were identified on the basis of their chonchological characteristics.

Key words: Gastropods, Arabian Sea, Pakistan.

INTRODUCTION

Pakistan is located outside the tropics and its southeastern boundary is only a few miles short of Tropic of Cancer. The coastline of Pakistan is about 1050 km long, enclosing the northern Arabian Sea. This coastline is bestowed with numerous vertebrate and invertebrate fauna including several species of gastropod which inhabit the intertidal zones of sandy, rocky and muddy shores along the Sindh and Balochistan coasts. In Pakistan only cursory information is available on the taxonomy of the gastropod fauna (Melvill and Standen, 1901; Khan and Dastagir, 1970; Tirmizi and Zehra, 1982). However, Burney and Barkati (1995), Ahmed and Hameed (1999a,b), Hameed *et al.* (2000) and Nasreen *et al*. (2000) have listed the species of gastropods from various rocky shores along the coast. The goal of this paper is to describe the taxonomic characteristic of these species and the sites from where the sampling was carried out.

MATERIALS AND METHODS

The specimens were brought live to the laboratory and frozen until analysed. The shell length of each specimen was measured with a vernier caliper to the nearest 0.1 mm. The shell lengths were taken from the apex to the distal end of the siphonal canal (Fig. 1). Identification of species was based on the chonchological characters. The species were identified with the help of following literature: Melvill and Abercrombie (1893), Melvill and Standen (1901), Gravely (1942), Khan and Dastagir (1970), Subrahmanyam *et al.* (1952), Eisenberg (1981), Ahmed (1979), Tirmizi and Zehra (1982), Bosch *et al*. (1995), FAO Manual (1998). The gastropods were collected from nine sites in five surveys during the period 1993 to 2008. The specimens were hand picked from all the sampling sites. On the Sindh coast, sampling was carried out at Manora Channel, Manora rocky ledge, Old Korangi Fish Harbour (OKFH), and New Korangi Fish Harbour (NKFH), Buleji, Pacha, Cape Monze, Mubarak Village. From Balochistan the gastropod species were procured for study from Sonmiani. Description of all nine (9) collection sites (Fig. 2) is as under.

Site 1. Manora channel

Manora channel lies in south of Karachi about 8 km from center of the city. It is 8 km long and 850 to 1000 m wide. The channel receives effluents from Lyari River, Karachi Fish Harbour, and ships visiting the Karachi Port.

Site 2. Manora rocky ledge

Manora rocky ledge is located at 24° 48′ N and 66° 58′ E, south west of Karachi facing the open Arabian Sea. The rocky ledge measures about

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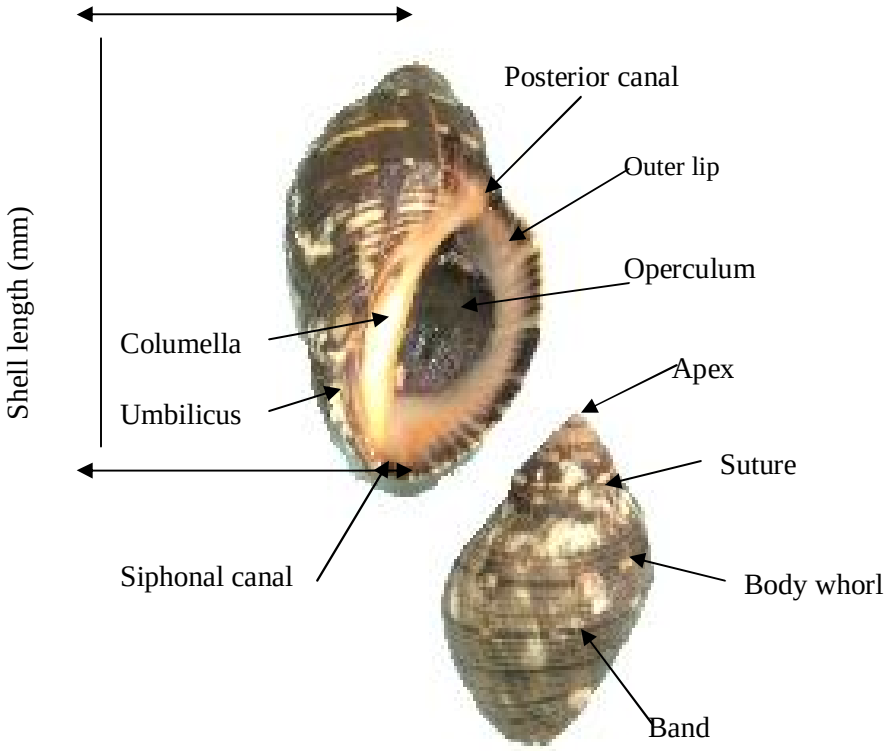

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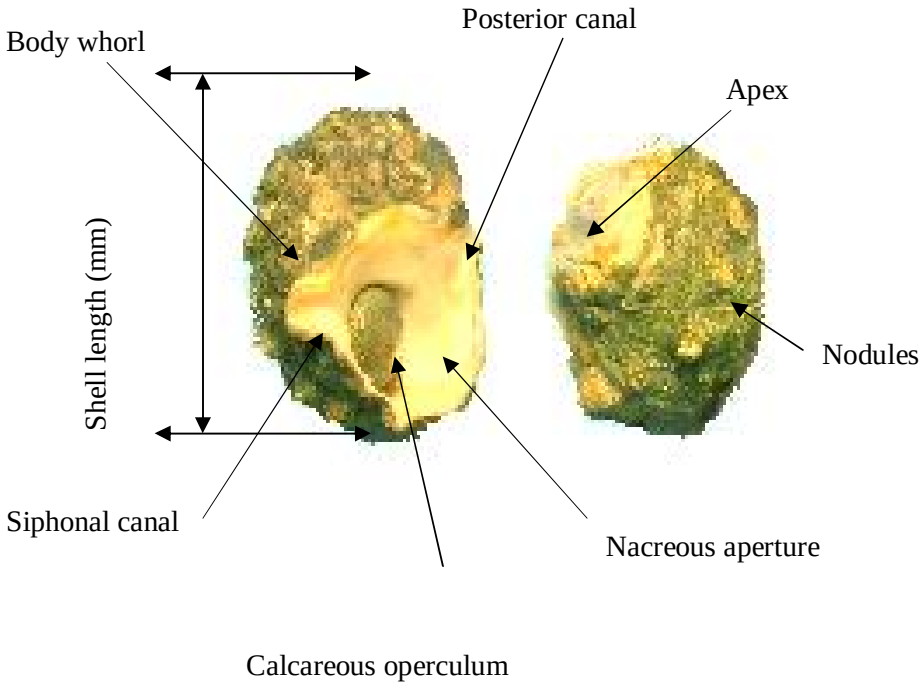


B

Fig. 1. External features of neo- gastropod *Thais rudolphi* (A), and an archaeogastropod *Turbo coronatus* (B).

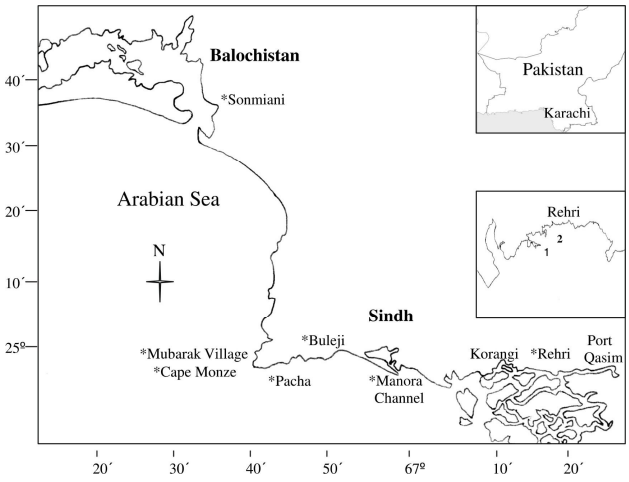


Fig. 2. Map showing collection sites*. 1, Old Korangi Fish Harbour (OKFH); 2, New Korangi Fish Harbour (NKFH).

1000-1200 meters and is directly exposed to open sea. Its high water mark and low water mark range is about 200 m of the rocky stratum. The ledge is fairly rich in molluscan fauna.

Site 3: Old Korangi Fish Harbour (OKFH)

Creek area at a distance of about 12 km from the center of Karachi city This area lies in close proximity to shipping port (Port Mohammad Bin Qasim) and is located at 24° 48′ N, 66° 14′ E in the southeast of Manora Channel.

Site 4: New Korangi Fish Harbour (NKFH)

The new Korangi Fish Harbour is situated at 24° 50′ N, 67° 14′ E in close proximity to old Korangi Fish Harbour in the Korangi Creek System. Mostly large foreign fishing vessels operate from here. The Harbour receives contaminant from the passing shipping traffic. The bottom line here is muddy and the specimens of *Thais carinifera* are found clinging to the jetty poles.

Site 5. Buleji

The Buleji rocky ledge is situated at 24° 50’ N, 66° 48’ E, and southwest of Karachi near fishing village of Buleji. 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 of rather flat rocks and small boulders. The left margin of the ledge has less wave action as compared to right one. Main body of the triangular ledge consists of small and large tide pools, which inhabit different species of gastropods and other benthic life with abundance of algal growth.

Site 6. Cape Monze

Cape Monze is located near Karachi, at an approximate distance of 35km far from Karachi at 24° 50′ N, 66° 39′ E. The rocky shore of Cape Monze is comparatively smaller to other rocky shores and is 150 m long and 40 m wide. The site is clean and small scale boating activity takes place in the nearby area.

Site 7: Pacha

Pacha is a rocky shore, about 390 m long located at 24° 50′ N, 66° 43′ E near Karachi. The exposed rocky ledge is subjected to strong wave action of the Arabian Sea. The site is clean and no boating activity takes place in this area.

Site 8: Mubarak village

It is a small fishermen village situated at 24° 50´ N, 66° 39´ E. The beach here faces the open Arabian Sea and is constituted of rocky stratum, studded with small boulders, cobbles and pebbles. The rocky shelters here at some places form, cave like structures. The very small local fishing trawlers operate from this area. No commercial large scale shipping activity takes place in this area.

Site 9: Sonmiani

The coastal town of Sonmiani lies at 25° 25' N, 66° 35' E in the northwest of Karachi at a distance of about 45 kilometers. The beach at Sonmiani is sandy to sandy-cum-muddy having small rocky platforms facing the strong wave action of open sea. The specimens of *Thais carinifera* are found in muddy substratum and also in holes and crevices of the rocky platforms. Sonmiani Fish Harbour lies in close proximity of coastal town of Sonmiani. It is about 45 kilometers in the northwest of Karachi. Small local fishing trawlers operate from the Fish Harbour.

SYSTEMATICS

Phylum: Mollusca
Class: Gastropoda
Sub-class: Prosobranchia
Order: Archaeogastropoda
Super family: Trochoidea

Family: Turbinidae
Genus: *TURBO* (Linnaeus, 1758)

Shells in Turbinidae are solid and turbinate with rounded whorls and more or less circular aperture (Subrahmanyam *et al.*, 1952; Tirmizi and Zehra, 1982).

Turbo coronatus (Gmelin, 1791).

Synonyms:	*Lunella coronata* (Gmelin, 1791).
Specimens examined:	956.
Size:	14-37 mm (min-max); 24 mm mean shell length.
Locality:	Manora Channel and Buleji (Fig. 1).

Description

Shells are of moderate size nearly circular, thick, domed or almost flat topped with more or less rounded body whorl. Spire of the shell is somewhat depressed with nodules. Last whorl of the shell largely and broadly expanded with heavy or light rows of nodules, aperture circular, nacreous, operculum is thick and calcareous. Inner surface like pearl luster, upper dull green, orange-yellow, brown or reddish grey (Fig. 3A). The species recovered are similar to those described by Khan and Dastagir (1970) from Karachi and Bosch *et al.* (1995) from coasts of Eastern Arabia.

Habitat

This species is found in supra littoral zone, on boulders, rocks and sometimes in the crevices between the rocks.

Remarks

Previously reported by Khan and Dastagir (1970) from Manora Island, Buleji, and G. M. Hut, from Karachi. During the present study large numbers of specimens of this species were found at Buleji and Manora Channel. Shells at Manora Channel were mostly eroded and slightly larger than those found at Buleji. There is no previous record available for comparison.

Family: Trochidae
Genus: *MONODONTA* (Lamarck, 1801)

Moderate size with trochiform shell and inflattened body whorl. There is usually a single strong tooth at columella and outer lip is much thickened (Khan and Dastagir, 1970).

Monodonta canalifera (Lamarck, 1801)

Specimens examined:	963.
Size:	8-30 mm (min-max); 22 mm mean shell length.
Locality:	Manora Channel and Buleji (Fig. 1).

Description

The shell is low spired with well rounded whorls, no umbilicus, smooth aperture, base of the columella has strong pointed tooth, brown or green spiral lines and dashes on shell, bright green algae often covers shell, (Khan and Dastagir, 1970) (Fig. 3B).

Habitat

The species is found in supra littoral zone, on rocky platforms. In the littoral zone this species inhabits crevices or rock pools.

Remarks

Earlier *M. canalifera* was reported by Khan and Dastagir (1970) from Buleji. During the present study this species was collected from Buleji as well as from Manora Channel. Slightly larger and older shells were present at Manora Channel as compare to Buleji.

Order: Neogastropoda
Super family: Muricoidea
Family: Thaididae
Genus: *THAIS* (Roding, 1798)

All the species of *Thais* have thick shells with a short spire. Body whorl large and canal short. Aperture wide and columella flattened, whorls variously carinated, and are found at low water

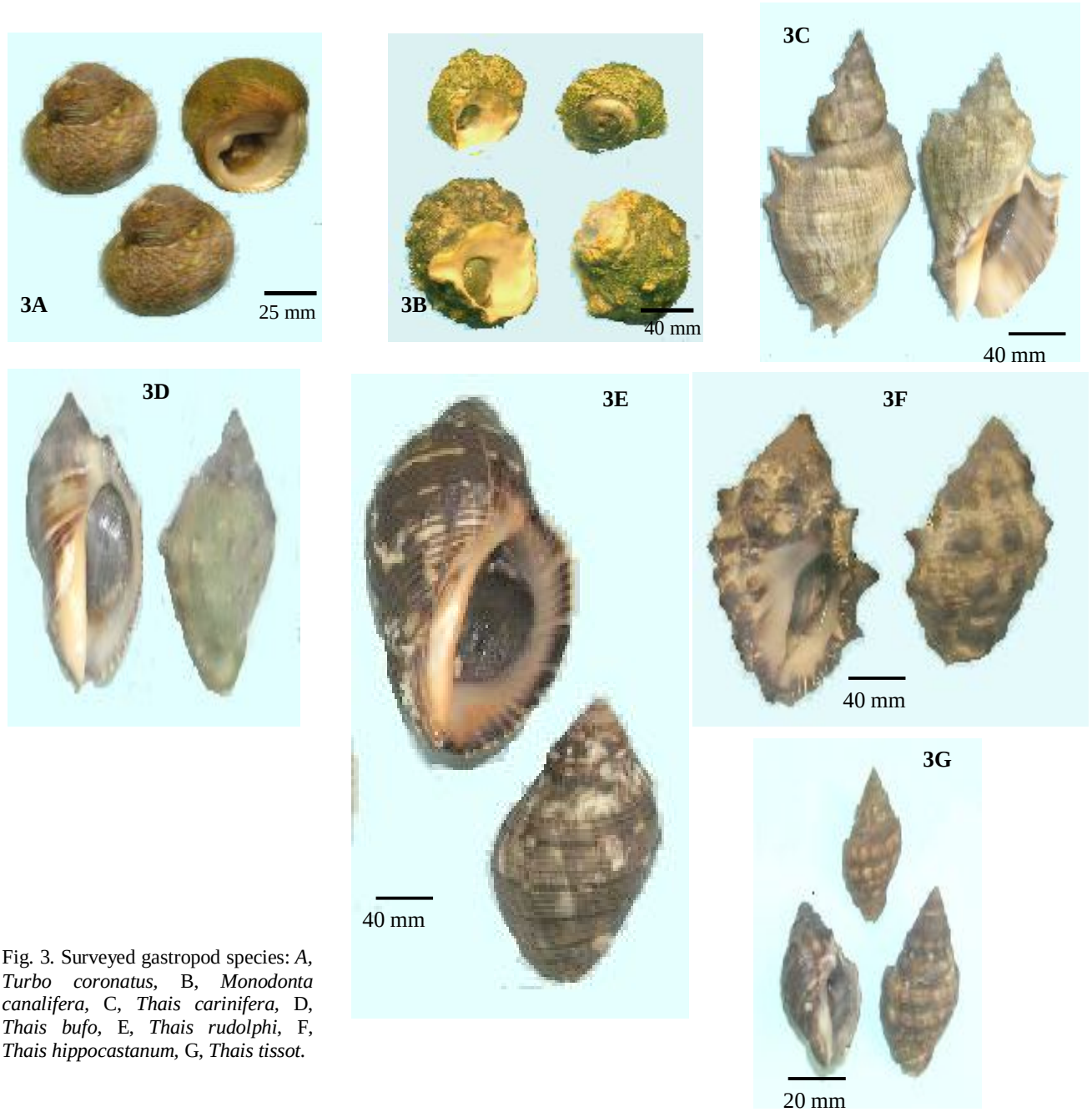


Fig. 3. Surveyed gastropod species: *A, Turbo coronatus,* B, *Monodonta canalifera,* C, *Thais carinifera,* D, *Thais bufo,* E, *Thais rudolphi,* F, *Thais hippocastanum,* G, *Thais tissot.*

mark. This genus exhibit close resembles to the description given by Subrahmanyam *et al.* (1952) for this genus from Bombay, India.

Thais carinifera (Lamarck, 1816).

Synonyms: *Thais* (*Stramonita) carinifera* (Lamarck, 1816)*; Purpura carinifera* (Lamarck, 1816); *Cuma carinifera* (Melvill and Standen, 1901)*; Murex lacera (*Born, 1778)*; Thais lacera* (Born 1778)*; Cuma disjuncta* (Annandale, 1922)*; Cymia carinifera* (Rao and Mukherjee, 1975)*; Thais (Cymia) carinifera* (Ray, 1977).

Specimens examined: 1035

Size: 23-70 mm (min-max); 47mm mean shell length.

Locality: Manora Channel, Cape Monze, Sonmiani, OKFH & NKFH, Mubarak Village and Sonmiani (Fig. 1).

Description

Thick shelled. Whorls strongly shouldered or carinated. Two rows of shoulders are generally present on the body whorl. Columella is smooth, enameled, and flattened at the anterior end. Shell generally whitish, sometimes with shades of brown above and below the shoulders (Subrahmanyam et *al.*, 1952) (Fig. 3C).

Habitat

Marginally sub-tidal, commonly found on muddy to sandy beaches or sometimes on hard substrate on semi-exposed beaches of the coast. This species was also found clinging to artificial seawall and jetty pillars at OKFH and NKFH.

Remarks

Ahmed (1979) reported this species from Manora Jetty at 0.45-0.7 m tidal height and Tirmizi and Zehra (1982) identified this species as *Cymia sp.* from unidentified location. This species has also been reported from Clifton (Ahmed and Hameed, 1999b).

Thais (Stramonita) bufo (Lamarck, 1822).

Synonyms: *Purpura bufo* (Melvill and Abercrombie, 1893)
Specimens examined: 185
Size: 22-66mm (min-max); 45mm mean shell length.
Locality: Manora Channel, Manora rocky ledge, Buleji.

Description

The shell is stouter and large with a short spire, well developed body whorls. Aperture large and canaliculated anteriorly and posteriorly. The smooth area of the columella is well developed and extends posteriorly beyond the upper extremity of the outer lip which is thin and serrate. The aperture is ovate and large with an oblique channel at the anterior part. The outer surface possess nodules and the shell is orange in colour, 3-4 inches in length (Subrahmanyam *et al.*, 1952; Khan and Dastagir, 1970) (Fig. 3D).

Habitat

The species is found in the low tidal zone usually among boulders and rocks.

Remarks

Also reported by Khan and Dastagir (1970) from Manora Island, Pasni, Gawadar, and Astola. Ahmed and Hameed (1999a) reported this species from Buleji and Nasreen *et al.* (1999) from Manora rocky ledge.

Thais rudolphi (Lamarck, 1822)

Synonym: *Purpura panama* (Roding, 1798)
Specimens examined: 385
Size: 30-78 mm (min-max); 48 mm mean shell length.
Locality: Manora Channel, Manora rocky ledge, Buleji, Pacha, Cape Monze, Sonmiani (Fig. 1).

Description

Shell is large with conical apex and a large body whorl. Spiral growth lines are well developed. Strong shoulders are absent and body whorl with banded blackish and brown and white alternate bands on it. Aperture large and canaliculated both ways. Columellar margin smooth and enameled, broad and sloping or more or less straight and brownish. Outer lip is serrated and surface color is dark brown (Subrahmanyam *et al.*, 1952) (Fig. 3E).

Habitat

Shells are found abundantly attached to rocks and boulders on the rocky shores along Sindh and Balochistan coasts

Remarks

Khan and Dastagir (1970) have reported this species from Manora Island, Buleji, West Wharf. This species has also been reported by Tirmizi and Zehra (1982) from Pakistan. Ahmed (1979) found this species on Keamari Seawall. Ahmed and Hameed (1999a) reported this species from Buleji and Nasreen *et al.* (1999) from Manora rocky ledge.

T. savignyi (Deshayes, 1844)

Synonyms: *Purpura hippocastanum* (Melvill and Abercrombie, 1893); *Thais*

	hippocastanum (Linnaeus, 1758).
Specimens examined:	57
Size:	20-62 mm (min-max); 40 mm mean shell length
Locality:	Manora Channel, Manora rocky ledge, Cape Monze, Buleji (Fig. 1).

Description

The shell of *T. savignyi* is very thick, heavy and high spired with close pyramid like tubercles on body whorl. Pointed nodules on all whorls. No umbilicus, aperture cream, inner edge dark brown, columella white with dark brown base. Semi-lunar dark brown operculum. Colour ochraceous brown from outside. The inner margin of the outer lip is purplish and 4-5 bifid teeth present inside outer lip (Subrahmanyam *et al.*, 1952; Bosch *et al*., 1995) (Fig. 3F).

Habitat

Found among rocks and boulders at rocky shores.

Remarks

Earlier reported by Tirmizi and Zehra (1982). Shells show close resemblance with *T. savignyi* (Deshayes, 1844-1848). Nasreen *et al.* (1999) from Manora rocky ledge identified and reported as *T. hippocastanum.*

Thais tissoti (Petit, 1853)

Synonyms:	*Purpura tissoti; Thais (Stramonita) tissoti* (Petit, 1852).
Specimens examined:	199
Size:	13-28 mm (min-max); 22 mm mean shell length.
Locality:	Manora Channel, Buleji, Sonmiani.

Description

A small reddish brown shell, whorls spirally ridged that assume the shape of beautiful nodes along 9 or 10 transpiral ribs. Shell high spired. (Subrahmanyam *et al.*, 1952; Bosch *et al*., 1995; Tan and Sigurdsson, 1996) (Fig. 3G)).

Habitat

Commonly found among rocks in the intertidal zone.

Remarks

Ahmed (1979) reported this species from Keamari seawall at 0.1-0.4 m tidal height. Ahmed and Hameed (1999a) reported this species from Buleji.

Super family: Muricoidea
Family: Thaididae
Genus: *MORULA*

Shell solid with five spiral rows and nodules on body whorl. Outer lip thick, teeth internally, more or less of same size (Bosch *et al*., 1995).

Morula granulata (Duclos, 1832)

Synonym:	*Morula* (Schepnan, 1892).
Specimens examined:	167
Size:	12-26 mm (min-max); 20mm mean shell length.
Locality:	Manora Channel, Buleji.

Description

Description of the shell closely resembles the characteristics described by Bosch *et al.* (1995). Shell is heavy, somewhat elongate and ovate or barrel shaped. Columella has 2 to 4 week folds. Outer lip with 4 or 5 strong teeth and large rounded nodules on surface of the shell. No umbilicus, grayish white with dark brown nodules. Edge of outer lip dark brown, operculum kidney shaped, teeth and columella pale (Fig. 4A).

Habitat

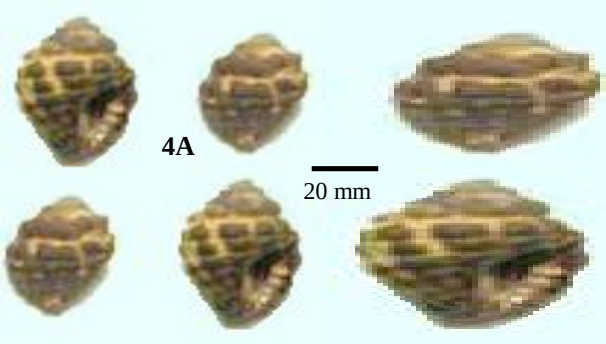
Found under rocks in the intertidal region as well as often on exposed rocks.

Remarks

Tirmizi and Zehra (1982) have illustrated the specimen up to genus only. Burney and Barkati (1995) have reported this species from Buleji rocky ledge.

Super family: Conoidea
Family: Turridae
Genus: *TURRICULA*

Small shells but highly ornate, fusiform with a notch on outer lip (Khan and Dastagir, 1970).



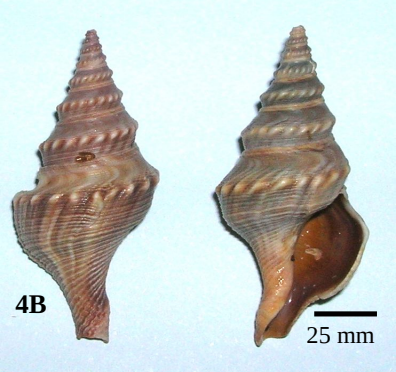


Fig. 4. Surveyed gastropod species: A, *Morula granulate;* B, *Babylonia spirata;* C, *Turricula javana.*

Turricula javana (Linnaeus, 1767)

Synonyms:	*Murex turris* (Gmelin, 1791); *Pleurotoma javana* (Lamarck, 1816); *P. nodifera* (Lamarck, 1822); *P. contorta* (Perry, 1811); *P. spuria* (Link, 1807).
Specimen examined:	1
Size:	56mm mean shell length.
Locality:	Manora Channel

Description

Shell fusiform in shape, with elevated spire. Whorls of the shell large and a deep slit near the suture. The aperture is oval and anterior siphonal canal long and straight. Columella smooth and the outer lip detached in the hind portion from the body whorl and forms a sinus (Khan and Dastagir, 1970) (Fig. 4B).

Habitat

Found among rocks and boulders in low tidal zone.

Remarks

This species was reported from Bangladesh (then East Pakistan) by Khan and Dastagir (1970).

Super family: Buccinoidea
Family: Buccinidae
Genus: *BABYLONIA*

Small to large gastropod shells with usually short and open siphonal canal. Occasionally the color pattern of the shell is striking but usually subdued and may be hidden under the thick periostracum. Shells are more or less fusiform or ovate, with orange, brown patches on surface. Aperture oval and channeled interiorly. Columellar region smooth. Outer lip simple and thickened (Bosch *et al.*, 1995; Subrahmanyam *et al.*, 1952).

Species: *Babylonia spirata*
(Linnaeus, 1758; Swainson, 1822)

Synonyms:	*Eburna chrysostoma* (Sowerby, 1866); *B. valentina* (Shikama and Horikoshi, 1963).
Specimens examined:	277
Size:	34-72mm (min-max); 42 mm mean shell length.
Locality:	Manora Channel, Buleji and Sonmiani.

Description

Shell large, heavy, ovate with smooth and inflated body whorl. Last whorl inflated, protoconch pointed. Suture sunk in a broad groove or deeply channeled. Aperture wide and external border thin. Operculum semi lunar and brown in colour. Whorls white with broad patches of orange brown. Surface covered with periostracum in fresh specimens. In young ones umbilicus is open (Bosch *et al.*, 1995; Subrahmanyam *et al.*, 1952) (Fig. 4C).

Habitat

Individuals live buried in sand and mud by the side of the rocks.

Remarks

Khan and Dastagir (1970) reported this species from Bhit Island and Manora Island. Tirmizi and Zehra (1982) illustrated the genus only. Ahmed (1979) has reported this species from beach near Manora jetty at 0.0-0.3 m tidal height. During the present study individuals were collected from Manora Channel and Sonmiani.

CONCLUSIONS

Ten species of gastropods have been described from the only available records of provided by the Zoological Survey of Pakistan (Khan and Dastagir, 1970). No update of records is available after that. However, in the light of data collected during surveys it appears that the number of specimens of *Babylonia spirata*, *Thais bufo*, *Thais savignyi* and *T. rudolphi* have decreased markedly at Manora Channel. Prosobranch gastropod species *Monodonta canalifera*, *Morula granulata* and *Turricula javana* previously not investigated from Manora Channel. Common intertidal species *Turbo coronatus* found globally in rocky shores, also abundantly found at all rocky shores of Sindh and Balochistan coasts.

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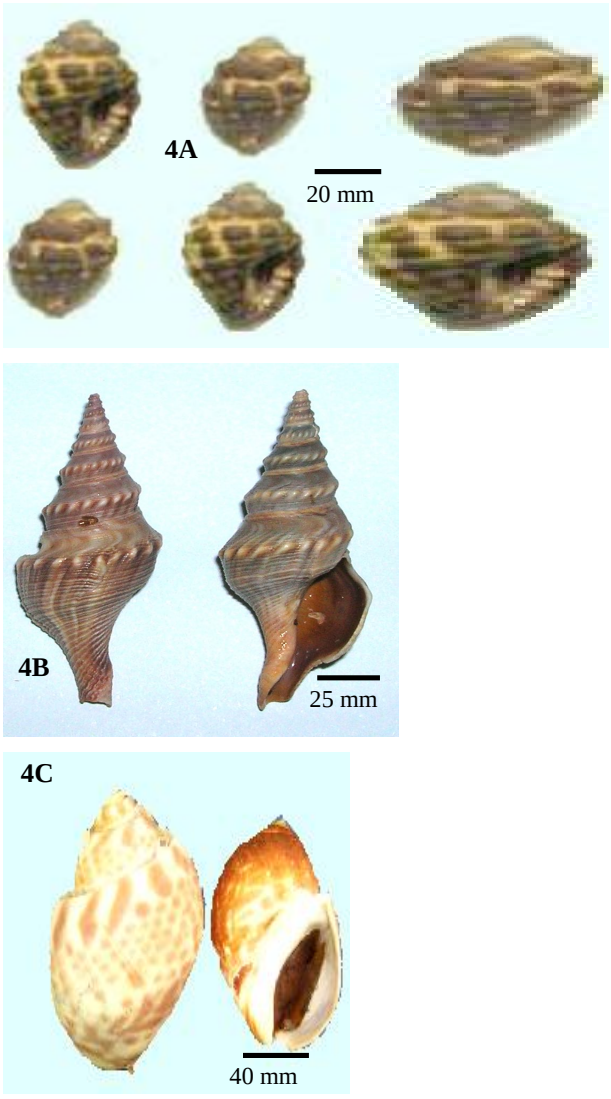


Fig. 4. Surveyed gastropod species: A- *Morula granulata*, B- *Babylonia spirata*, C-*Turricula javana.*

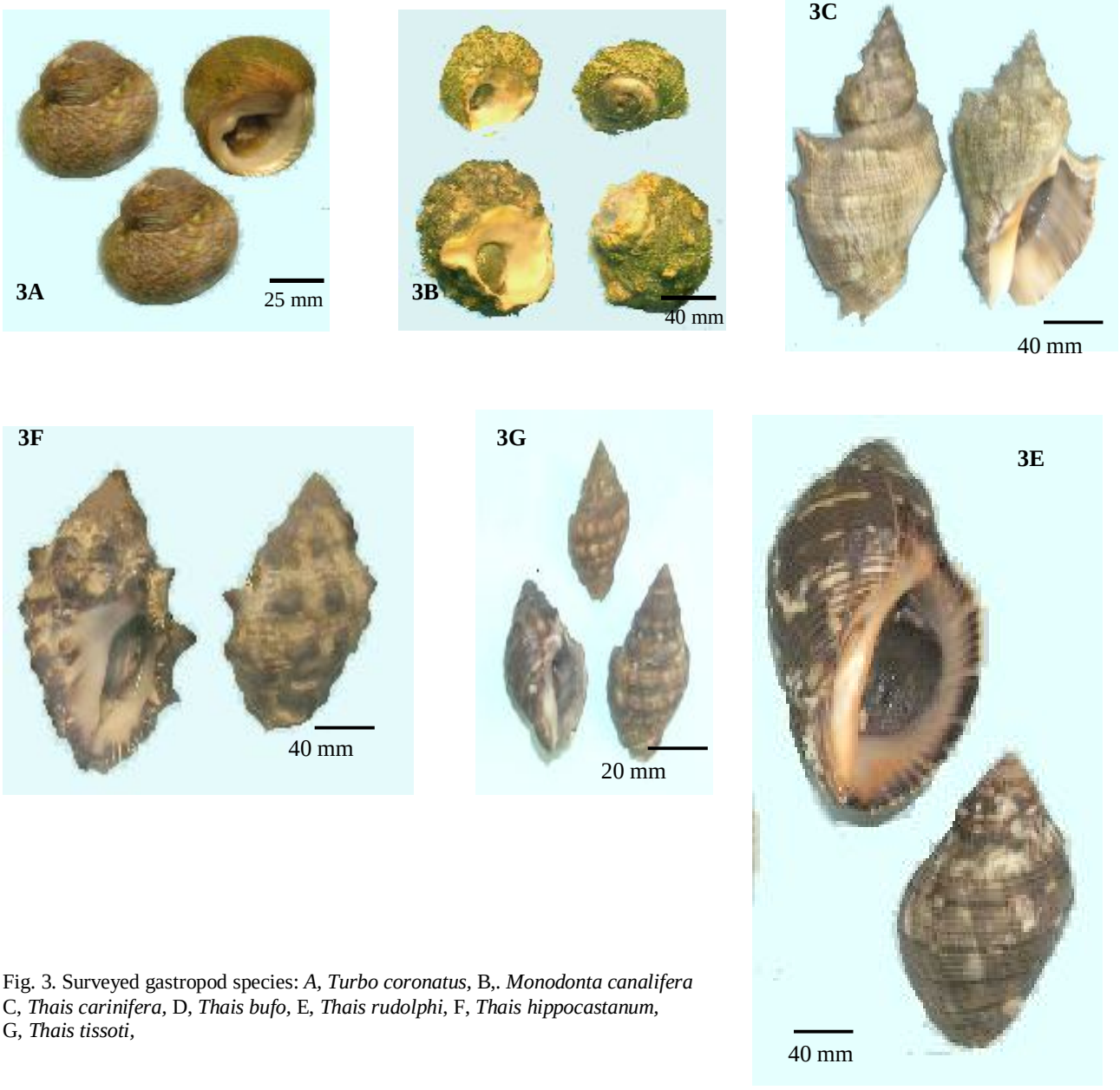
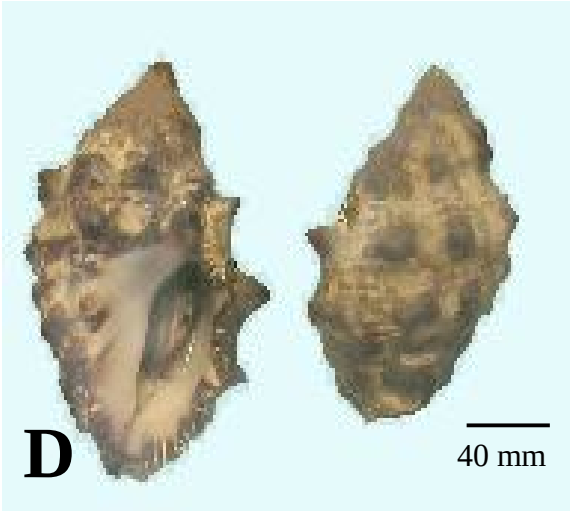


Fig. 3. Surveyed gastropod species: *A, Turbo coronatus,* B,. *Monodonta canalifera* C, *Thais carinifera,* D, *Thais bufo,* E, *Thais rudolphi,* F, *Thais hippocastanum,* G, *Thais tissoti*,


A
40 mm


B
40 mm


C
40 mm


D
40 mm


E
20 mm