Records of the Zoological Survey of India

CONTRIBUTIONS TO THE MOLLUSCAN FAUNA—ARCHAEOGASTROPoda

by

A. S. RAJAGOPAL

&

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Issued by the Director

Zoological Survey of India, Calcutta
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PART I. MARINE MOLLUSCS OF THE COROMANDEL
COAST, PALK STRAIT AND GULF OF MANNAR—
GASTROPODA : ARCHAEOGASTROPODA

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CONTRIBUTIONS TO THE MOLLUSCAN FAUNA OF INDIA PART I. MARINE MOLLUSCS OF THE COROMANDEL COAST, PALK STRAIT AND GULF OF MANNAR—GASTROPODA:
ARCHAEOGASTROPODA

By
A. S. RAJAGOPAL AND H. P. MOOKHERJEE

Zoological Survey of India, Calcutta.

(With one plate)

INTRODUCTION

The Indian freshwater and land molluscs have been the subject of several studies whereby literature on them has grown considerably in bulk and it also includes among others, all the four volumes on mollusca (1908-1921) published in the Fauna of British India series. The marine molluscs, on the other hand, have not received as much attention as they should have though a few categories here and there which are economically important like the sacred chank, pearl oysters, the backwater clam of the genus *Meretrix* etc. have been fairly well studied.

In this paper we have made an attempt to present our study on the systematics of marine molluscs of the order Archaeogastropoda in the collections of the Zoological Survey of India. This is the first in a series in which we propose to bring out our future studies on other groups of molluscs found along the Indian coast.

Among the earlier references on the molluscan fauna of the east coast the works of only five authors are necessary to be mentioned here, specially for their comprehensive treatment of the subject though the materials studied by them came from more or less restricted areas. Melvill and Standen (1898) were the first to make a study on the material dredged from Madras, its neighbourhood and Pamban Passage. Crichton’s (1941) notes on marine shells were concerned with the strip of sea-board in the immediate vicinity of Madras extending from Ennore to about thirty miles (48 kms.) south. Gravely’s (1941 and 1942) two contributions were based on a collection from a short stretch of the shore around Madras. Ray’s (1948) report on a collection from
the Coromandel Coast, though unexceptionable otherwise, is deficient in the data regarding the exact localities etc., of the species dealt with. While all the above references were concerned with Madras and its neighbourhood or Coromandel Coast, Satyamurti's (1952 and 1956) two works were devoted exclusively to the mollusca of Krusadai Island and Pamban area.

So far as the material for our study is concerned, it comes from a more extensive area—a long stretch of the Indian coast extending from Madras, along the Coromandel Coast, Palk Strait and Gulf of Mannar up to Cape Comorin. The bulk of it is chiefly from the collections of two surveys of the Tamil Nadu Coast under the leadership of one of us (A.S.R.) in 1968 and 1975. It is supplemented with the back-log of unnamed collections from the same area lying accumulated for over 60 years in the Zoological Survey of India and brought by earlier surveys such as those of Dr. S. W. Kemp in 1913, Drs. B. N. Chopra and H. S. Rao in 1925, Dr. H. S. Rao in 1926, Dr. S. L. Hora and Shri A. G. K. Menon in 1950, Dr. H. C. Ray in 1955, Dr. A. G. K. Menon and Shri G. Ramakrishna in 1957, Dr. A. Daniel in 1960 and Sarvashri V K. Premkumar and P. K. Chakraborty in 1962 and a small miscellaneous collection, the identity of whose collector(s) is obscure.

Most of the material consists of shells washed ashore or collected during low-tide in shallow waters from intertidal zone. A small portion represents specimens brought to the surface by divers at Pearl Banks, Tuticorin and bottom-trawled material collected on board R. V "Chota Investigator" at Madras and "I.F.S. No. 3" at Pondicherry.

In the course of the present study opportunity was taken to re-examine the named collections and particularly G. & H. Nevill's type-materials of three species in the National Zoological Collections of the Zoological Survey of India and to compare with them the respective material presently under study for confirming the specific determinations. The type-materials of the three species were found to represent syntypes as the designation of Holotype in any of the cases had not been done by the authors. Necessary steps were taken now to designate the Lectotype in each case as laid down under Article 74 of the International Code of Zoological Nomenclature.

Altogether 36 species 1 sub-species and one variety under 24 genera distributed in 8 families are dealt with here. Of these, two species viz., Minolia casta (G. & H. Nevill) and Phenacolepas crenulata (Broderip) are found to be new records for the Indian coast; also the latter one is provided with a redescription here. Four other species viz., Angaria distorta (Linnaeus), Monilea (Monilea) callifera (Lamarck), Turbo spinosus Gmelin and Nerita georgina Recluz are found to be new records for the coast of mainland India.
The species names, *Cellana radiata* (Born), *Angaria distorta* (Linnaeus) *Turbo (Lunatica) brunneus* (Röding) and *Phenacolepas crenulata* (Broderip) are in much confusion, being associated with, and quite often referred to, by several other names. Effort is made here to clarify their correct identity.

A single shell representing the topotype is present in the material for the species *Calliostoma tranquebarica* (Röding) and all the examples of *Liota varicosas* (Reeve) are new acquisitions to the identified collections of the Zoological Survey of India.

The classification adopted in this paper is according to the one given by Knight et al. (1960) and the keys of different categories are also prepared mainly on the basis of shell characters described by them. For the genera, *Neritina* and *Clithon* under Neritidae, van Benthem Jutting (1956) is followed.

**Abbreviations Used**

CMFRI—Central Marine Fisheries Research Institute; Coll.—collector (s); colln.—collection; d.—dry; E.—East; ex.—example(s); Id.—Island; I.F.S.—Inshore Fisheries Survey vessel; Is.—Islands; Km.—Kilometre(s) MBS—Marine Biological Station; N.—North; NZC.—National Zoological Collections; Reg. No.—Register Number; S.—South; S.E. South-east; Sta.—Station; Vill.—village; W.—West; w.—wet; ZSI.—Zoological Survey of India.

**CONSOLIDATED LIST OF MARINE MOLLUSCS REPORTED SO FAR FROM THE EAST COAST OF INDIA BETWEEN MADRAS AND CAPE COMORIN (SPECIES ARRANGED ALPHABETICALLY). TAXA MARKED WITH ASTERISK(*) HAVE BEEN DEALT WITH IN THIS PAPER.**

**Phylum MOLLUSCA**

**Class GASTROPODA**

**Order ARCHAEOGASTROPODA**

**Family HALIOTIDAE**

*Haliotis asinina* Linnaeus  
*Haliotis glabra* Gmelin  
*Haliotis varia* Linnaeus

**Family FISSURELLIDAE**

**Subfamily EMARGINULINAE**

*Emarginula costulata* Deshayes  
*Emarginula incisura* A. Adams
* Emarginula obovata A. Adams.
Emarginula peasei Thiele
* Clypidina (Clypidina) notata (Linnaeus)
Scutus cf. corrugatus (Reeve)
Scutus unguis (Linnaeus)

Subfamily Diodorinae

Diodora bombayana (Sowerby)
* Diodora funiculata (Reeve)
Diodora lima (Sowerby)
Diodora ruppellii (Sowerby)
* Diodora ticaonica (Reeve)
Diodora townsendi (Melvill)

Subfamily Fissurellinae

* Macroschisma canalifera (G. & H. Nevill)

Family Patellidae

Subfamily Nacellinae

Cellana cernica H. Adams (=Cellana livescens (Reeve)
* Cellana radiata subspecies radiata (Born)
Cellana testudinaria (Linnaeus)

Family Trochidae

Subfamily Margaritinae

* Euchelus asper (Gmelin)
* Euchelus asper var. tricarinatus (Lamarck)
* Euchelus atratus (Gmelin)
* Euchelus circulatus (Anton)
Euchelus foveolatus (A. Adams)
* Euchelus horridus (Philippi)
Euchelus scaber (Fischer)

Subfamily Angariinae

Angaria atratus (Gmelin)
* Angaria distorta (Linnaeus)

Subfamily Monodontinae

* Cantharidus interruptus (Wood)
Cantharidus (Thalotia) Kotschyi (Philippi)
Cantharidus tricingulatus A. Adams
Subfamily GIBBULINAE

* Gibbula (Cantharidella) blanfordiana G. & H. Nevill
Gibbula holdsworthana G. & H. Nevill
Gibbula (Enida) nobomii Ray
Gibbula stoliczkana G. & H. Nevill

Subfamily CALLIOSTOMATINAЕ

Calliostoma polychroma (A. Adams)
* Calliostoma tranquebarica (Röding)

Subfamily TROCHINAE

* Trochus pustulosus Philippi
* Trochus (Infundibulum) radiatus Gmelin
* Trochus stellatus Gmelin
* Trochus tentorium Gmelin
  Trochus venetus Reeve
* Clanculus clanguoloides (Wood)
  Clanculus microdon (A. Adams)

Subfamily UMBONIINAE

* Umbonium vestiarium (Linnaeus)
* Monilea (Monilea) callifera (Lamarck)
  Monilea (Rossiteria) nucleus ((Philippi)
  Monilea obscura (Wood)
  Monilea solandri (Philippi)

Subfamily SOLARIELLINAE

Minolia biangulosa (A. Adams)
* Minolia casta (G. & H. Nevill)
Minolia impressa (G. & H. Nevill)
Minolia variabilis (A. Adams)

* Family STOMATELLIDAE

Stomatella elegans Gray

Family TURBINIDAE

Subfamily ASTRAEINAE

*Astraea (Calcar) semicostata (Kiener)
Subfamily LIOTINAE

* Liotia cidaris (Reeve)
  * Liotia varicosa (Reeve)

Subfamily TURBININAE

* Turbo (Lunatica) brunneus (Roding)
  Turbo (Lunatica) marmoratus Linnaeus
* Turbo (Turbo) petholatus Linnaeus
* Turbo spinosus Gmelin

Family CYCLOSTREMATIDAE

Cyclostrema bushi Dautzenberg & Fisher
Cyclostrema eburneum Nevill
Cyclostrema pulchellum Dunker

Family PHASIANELLIDAE

Phasianella indica Winckworth
* Phasianella nivosa Reeve

Family NERITIDAE

Subfamily NERITINAE

* Nerita (Theliostyla) albicilla Linnaeus
* Nerita (Theliostyla) chamaeleon Linnaeus
* Nerita (Amphinerita) georgina Recluz
* Nerita (Amphinerita) polita Linnaeus
† Nerita gemmulata Reeve
Nerita maura Recluz
* Nerita (Ritena) plicata Linnaeus
Nerita (Theliostyla) squamulata Le Guillon
Nerita (Theliostylat) textilis Gmelin (This does not seem to occur on the E. Coast of India)
* Clithon oualaniensis (Lesson)
Neritina aciculata Reeve
Neritina rangiana Recluz
Neritina siquijorensis Reeve
* Neritina (Dostia) violacea (Gmelin)

Family PHENACOLEPADIDAE

* Phenacolepas crenulata (Brödertip)

† Melvill, J. C. & Standen, R., 1898, J. Conch 9:76.
The above list covers 80 species, 1 subspecies, and one variety which have severally been reported by different authors. Of these 36 species, one subspecies, and one variety are dealt in detail in this paper as they are represented by fresh material and taxonomic information on them was found to be inadequate.

**Systematic Account**

**Phylum Mollusca**  
**Class Gastropoda**  
**Subclass Prosobranchia**  
**Order Archaeogastropoda**

Archaeogastropoda is the first of the three orders into which Prosobranchiate gastropods are divided. As the name suggests it consists of primitive forms. The chief characters in the internal organisation that distinguish the members from others are the possession of one or two bipectinate gills (aspidobranch) in the respiratory system, two auricled heart in most cases and the products of gonads getting discharged through the right kidney directly into the sea. Nervous system is not concentrated; proboscis, siphon and penis are absent.

**Key to the identification of families of order Archaeogastropoda:**

1. Shell with operculum  
   Shell without operculum  
   2

2. Shell auriform, depressed, with spire more or less excentric and scarce protruding; aperture broad occupying most of underside; shell with spiral row of small tentmata serving as exhalent outlets  
   Shell conical or cap-shaped  
   3

3. Shell with apex turned backward and near posterior margin, a pertural margin arched.  
   Shell more regularly shaped, apex central or subcentral  
   4

4. Shell porcellaneous; protoconch spiral; with perforation, slit, notch or emargination for passage of exhalent current  
   Shell, iridescent to porcelaneous within; protoconch not evident; without perforation marginal notch  
   5

5. Operculum corneous circular multispiral, thin, with central nucleus. Shell conical, turbiniform or subglobose; inner shell layer and outer most layer in some genera nacreous; Peristome discontinuous in most genera with columella and outer lips not in the same plane  
   6
Operculum calcareous, spiral with central or eccentric nucleus. Shell small to large, few whorled, globose, turbiniform or ovate; peristome continuous

6. Shell solid, small to large few whorled with well developed sculpture, umbilicate, aperture nacreous within

   Shell few whorled, not nacreous but porcellaneous; generally no umbilicus

7. Shell ovate to rounded, without periostracum, smooth to finely spirally sculptured, rarely spirally ribbed.

   Shell globose, turbiniform, capuliform or patelliform, mostly thickwalled, inner walls of whorls resorbed; inner lip thickened by callus or protruding as septum that narrows aperture

Family HALIOTIDAE

Only one genus, Haliotis Linnaeus is recognised under this family and the genus is represented by a single species in this paper.

Shell elongate and narrow with apex very eccentric, almost marginal

Haliotis

Genus Haliotis Linnaeus, 1758

Type-species: Haliotis midae Linnaeus.

1. Haliotis varia Linnaeus, 1758


Material: 2 ex. (w.), sta.?-Krusadai Id, Gulf of Mannar, 23-3-1950 (Coll. S. L. Hora & A.G.K. Menon); 2 ex. (d.), sta. ?-Krusadai Id., (Coll. S. L. Hora).

Distribution: In India: Andaman & Nicobar Is. Elsewhere: Red sea; Mozambique; Mauritius; Sri Lanka; Burma: Arakan; Malay Archipelago; Australia and Philippines to China.

Remarks: Reeve (1846) and Pilsbry (1890) have given adequate descriptions of the species and the shells under study are in complete agreement with them.
Shell oval, spire low, slightly conoidally raised, surface characterised by spiral closely set unequal cords, crossed by tumid nodules irregularly ranging in oblique waves. Inside of shell silvery iridescent, showing indistinctly furrows and pits corresponding to cords and nodules on outer surface. Holes (tremata) varying from round to oval.

In the wet collection (as above) the holes are four in one and six in the other, and five in each of the dry shells. Encrustation covers the entire surface of two shells, one (w.) and one (d.). Of the other two free from it, the one (w.) has broad white rays on a chocolate brown ground.

Measurements (in mm.): Range (4 ex.) ; Height 19.25—27.85 Maximum length 27.55—38.20; Width (Diameter) 19.40—25.05.

Family FISSURELLIDAE

This is represented here by three subfamilies: Emarginulinae, Diodorinae and Fissurellinae which can be identified by the key below:

Key to the identification of the Indian subfamilis.

1. Apex present in most forms; when wholly removed by perforation, apex replaced by projecting shelf within; slit anterior to apex
   - Shell conical, exhalent perforation at or near apex
   - Emarginulinae
   - 2
   - Diodorinae.
   - Fissurellinae.

Subfamily EMARGINULINAE

Two genera namely, Emarginula Lamarck and Clypidina Gray are dealt with in this paper.

Slit of varying extent; apex varying in position; no septum within
- Emarginula

Conical, surface with fine radiating ribs, apex not recurved; internal groove on anterior slope weak
- Clypidina

Genus Emarginula Lamarck, 1801.

Type-species: Emarginula conica Lamarck

2. Emarginula obovata A. Adams, 1851.

Emarginula obovata A. Adams, 1851, Proc. zool. Soc. Lond., 19 : 83, No. 16, (Type-locality: Catbalonga, Isle of Samaar, on stones, 4 fathoms); Reeve, 1873,

Material: 1 ex (d.); Sta. 2C-Shingle Id., 2.4 km (1½ miles) E. of Krusadai, 3-5-1955 (Coll. H. C. Ray).


Remarks: The solitary shell in the collection is somewhat eroded. Yet the characters are clearly discernible. Shell oval, white. Apex or summit subcentral, inclined backwards. Anterior incision extends about half way towards apex. Surface cancellated by radial and concentric ridges giving shell prominently latticed appearance.

Measurements (in mm.): Height 3.55; Maximum length 12.40; Width (Diameter) 8.95.

Genus Clypidina Gray, 1847
Subgenus Clypidina S. S.

Type-species: Patella notata Linnaeus.

3. Clypidina (Clypidina) notata (Linnaeus, 1758)

Patella notata Linnaeus 1758 Syst. nat., Ed. X: 784, sp. 678, (Type-locality: not known).


Emarginula notata: Reeve, 1873, Conch. Icon., 19: Emarginula, sp. No. 42, pl. 6, figs. 42a & b.

Subemarginula notata: Pilsbry, 1890, in Tryon’s Man. Conch., 12: 282, pl. 63, fig. 34.


Remarks: Reeve (1874), A. Adams (1851) and Pilsbry (1890) have supplemented Linnaeus’ description of the species. Of the five shells in the collection, two are well grown and much eroded. The other three which are in better condition are smaller and of different sizes. In all of them the anal groove, though inconspicuous, is visible. The interior of the shell has a characteristic dark mushroom-shaped scar at the centre.

Measurements (in mm.): Range (5 ex.): Height 4.30—10.00; Maximum length 10.45—23.00; Width (Diameter) 8.05—18.55.
Subfamily Diodorinae

This is represented in the collection by a single genus *Diodora* Gray

Ornament cancellate; Perforation oval; margin crenulate within

Genus *Diodora* Gray, 1821.

Type-species: *Patella apertura* Montagu

4. *Diodora funiculata* (Reeve, 1850)

*Fissuella Funiculata* Reeve, 1850, *Conch. Icon.*, 6: *Fissurella*, sp. No. 65, pl. 9, fig. 65 (Type-locality: Karachi, mouth of Indus)


**Material**: 1 ex. (w.) Sta. ? In dead Corals, Pamban beach, Feb. 1925 (Coll. B. Chopra and H. S. Rao); 2 ex. (w.), Sta. 1: Palk Strait 3.2 km. N. of CMFRI, Mandapam Camp, 13-5-1955 (*M.A.S. Menon*);

7 ex. (d) Sta. 2d: Galaxea reef, Krusadai Id., 4-5-1955; 1 ex. (d), Sta. 1K: Rocky and sandy beach, Cape Comorin, 24-5-1955 (Coll. H. C. Ray); 1 ex. (d), Sta. 2: Shore colln., Mahabalipuram, N. of Madras, 26-1-1975; 1 ex. (d), sta. 5: Shore colln., CMFRI, Mandapam Camp to Mandapam, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mokherjee).

**Distribution**: In India: Kathiawar, Kutch, Kerala (Travancore), Cape Comorin, Gulf of Mannar: Pamban, Galaxea reef & Krusadai. Elsewhere: Persian Gulf; Gwador; Sind (Karachi).

**Remarks**: Reeve (1850) and Pilsbry (1890) have given fairly good descriptions of the species. The examples which number ten dry shells and one with the animal inside, agree well with the description given by the above authors. The shells are shoreworn and in two of them the rim is slightly broken. The smaller shells in the collection have the radiating ribs stronger and more prominent than the larger ones. The species seems to favour coral reefs for its habitat.

**Measurements** (in mm.): Range (10 ex.): Height 3.50—7.25; Maximum length 6.75—17.90; Width (Diameter) 5.15—11.25.

5. *Diodora ticaonica* (Reeve, 1850)

(Pl. I, Figs. 1 & 1A)

*Fissurella ticaonica* Reeve, 1850, *Conch. Icon.*, 6: *Fissurella*, sp. No. 107, pl. 14, fig. 107 [Type-locality: Island of Ticao, Philippines (under stones at low water)].
**Rec. zool. Surv. India, Occ. Paper No. 12**


**Material**: 1 ex. (w), sta.?—Madras coast, shallow water, (coll. ?)

**Distribution**: In India: Krusadai Id. Elsewhere: Philippines.

**Remarks**: Adequate descriptions of the species are given by Reeve (1850) and Satyamurti (1952).

The species is represented in the collection by a single large shell with the animal, preserved in alcohol. The date of collection and the collector’s name are not mentioned but the collection doubtless appears to be very old.


**Measurements** (in mm.): Height 9.50; Maximum length 25.50; Width (Diameter) 15.60.

**Subfamily Fissurellinae**

A single genus *Macroschisma* G. B. Sowerby represents this in the collection.

Shell long and narrow anteriorly; perforation long triangular, wide end at posterior

**Genus Macrochisma** G. B. Sowerby, 1839

Type-Species: *Patella macroschisma* Solander


(Pl. I, Figs. 3 & 3A)


Pilsbry (1890) has included this among species of doubtful position without ascribing any reason.


Remarks: The original collection of three shells with the label "Type" on which G. & H. Nevill (1869) based their description of Fissurella canalifera is present in the N.Z.C. of Z.S.I., bearing the Reg. No. M 1648/1. Without designation of any shell as a Holotype, they have figured one of them (op. cit., pl. 17, fig. 13). We take this opportunity to select the shell which has been figured and designate it as the Lectotype (Reg. No. M 20364/3) of the species (vide Pl. I. figs. 2 & 2A) under Article 74 (Recommendation 74B) of the International Code of Zoological Nomenclature. The remaining two Syntypes are duly labelled as "Paralectotypes" bearing the original registration number.

The description given by G. & H. Nevill (op. cit.) is adequate for the species and the specimens under study agree well with it. They have also been compared with the above type-collection with which they agree. The dry shell is well preserved. The smaller example in alcohol possesses the animal which extends beyond the shell posteriorly.

Shell ovate-elongate, slightly compressed laterally. Radiating striae and roughened concentric lamellae present on it. Apical foramen elongate and oval. Front margin narrower, turned up a little. Two black stripes on each side radiating from anterior end of foramen prominent in dry shell while similar stripes from posterior end, less distinct. In the other specimen all stripes indistinct.

Measurements (in mm.): —

<table>
<thead>
<tr>
<th></th>
<th>Lectotype (as given by the authors)</th>
<th>A shell from Sta. 2d-Galaxea Reef (as in the Material above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>4.25</td>
<td>3.30</td>
</tr>
<tr>
<td>Maximum length</td>
<td>14.00</td>
<td>11.30</td>
</tr>
<tr>
<td>Width (Diameter)</td>
<td>7.50</td>
<td>5.65</td>
</tr>
</tbody>
</table>

Family Patellidae

This is represented here by a single subfamily namely, Nacellinae.

Shell solid in some species, in others thin-shelled to transparent, interior with metallic glaze . . . Nacellinae

Subfamily Nacellinae

A single genus viz., Cellana H. Adams is dealt with in this paper.

Shell fairly solid, apex subcentral: radial ribs strong, interior brilliantly glazed Cellana
Rec. zool. Surv. India, Occ. Paper No. 12

Genus Cellana H. Adams, 1869.

Type-species: *Nacella cernica* (Barclay) H. Adams.

7. Cellana radiata radiata (Born, 1778)


*Patella petalata*: Reeve, 1854, *Conch. Icon.*, 8 : *Patella*, sp. No. 54, pl. 22, figs. 54a, b & c.

*Patella luzonica* Reeve, 1855, *Conch. Icon.*, 8 : *Patella*, sp. No.86, pl.31, figs. 86a & b.

*Patella scalata*: Reeve, 1855, *Conch. Icon.*, 8, *Patella*, sp. No. 89, pl. 31 figs. 89a & b.

*Patella frauenfeldi*: Frauenfeld, 1867, *Reise Novara Moll.* : 15 pl. 2, figs. 26 a & b

*Helcioniscus rota* var. rota : Pilsbry, 1891, in Tryon’s *Man. Conch.*, 13 : 145, pl. 72, figs. 65-75.


*Cellana radiata* subspecies *radiata*: Powell, *Indo-pacific Mollusca*, 3(15) : 149, pl. 67, figs. 8,9; pl. 120.

Pilsbry (1891) while including Born’s *radiata*, without any explanation, in a long list of species grouped under the heading “Spurious unidentified and unfigured limpets” has rightly considered Reeve’s *petalata*, *luzonica* and *scalata* as identical with *rota*. Satyamurti (1952) is right in placing *P. frauenfeldi* and Preston’s *Acmaea travancorica* as synonyms of this species. Powell (1973) has recognised four subspecies under *radiata* as per their characters and range of distribution.

**Material**: 23 ex. (d.), sta. 1J-Shore colln. N. of Inspection Bungalow, Tuticorin, 24-4-1955; 22 ex. (w.). Sta. 3b—Rocky Shore of Gulf of Mannar, Quarantine Camp, Mandapam, 11-5-1955 (Coll. H. C.Ray); 7 ex. (w.) Sta. 2—Boulders at the shore of Gulf of Mannar, near CMFRI Mandapam Camp, 15-2-1962; 34 ex. (w.), Sta. 2—From a rock, Vedali Coast, 4.8 km. (3 miles), W. of Mandapam Camp, 16-2-1962; 12 ex. (w.), Sta. 2—Sea shore, 1.6 km. E. of Mandapam, 22-2-1962; 27 ex. (w.), Sta. 2—From boulders near Subramania temple, Tiruchendur, 28-2-1962 (Coll. V K. Premkumar & P. K. Chakraborti); 13 ex. (w.), Sta. 12—Mandapam Camp, 17-9-1965; 12 ex. (w.) Sta. 15-Mandapam, 28-9-1965 (Coll. A. Daniel & M. Babu Rao & Party); 1 ex. (d.), Sta. 9—Royapuram Coast, 7-3-1966 (Coll. M. S. Mani & Party); 12 ex. (w.)

*Not seen in the Original.*

Distribution: In India: Bombay, Varkalay, Mandapam, Madras, Waltair, Bimlipatam, Andamans. Elsewhere: Seychelles; Mare; Burma: Mergui Archipelago, West Irian and Philippine Is.

Remarks: An excellent description of the subspecies is found in Powell (1973) though adequate descriptions for the species can be had from some of the earlier authors including Satyamurti (1952). In the opinion of authors this is an excessively variable species.

In the collection, a large number of shells possesses the animal intact.

The dark rays on shell in almost all cases eleven in number, either forked or split into irregular patches. When distinct, rays visible also from inside shell. Interior iridescent yellow or silvery white. Central area within shell marked out by red-chestnut patch, very different in shape from mushroom shaped scar characteristic of Clypidina (C. notata) (Linnaeus).

According to Powell (op. cit.) the colouration which is exceedingly variable is of no diagnostic significance.

Measurements (in mm.): Range (110 exs.): Height 1.60—19.20; Maximum length 4.45—29.20; Width (Diameter) 7.25—34.60.

Family Trochidae

Under this family eight subfamilies are dealt with here. They are Margaritinae, Angariinae, Monodontinae, Gibbulinae, Calliostomatinae, Trochinae, Umboniinae and Solariellinae.

Key to the identification of the Indian subfamilies:

1. Shell low-spired or lenticular 2
   Shell conical, turbiniform, littoriniform or sub-lenticular 3
2. Shell small to moderately large; surface with rows of nodes or branching spines; umbilicus wide; aperture nacreous within; operculum horny, thin
   Shell medium sized, mostly lenticular, umbilicus partly or entirely filled by callus pad

Angariinae

Umboniinae
3. Mostly openly umbilicate shells
   Shells narrowly umbilicate or umbilicus lacking
4. Aperture more or less circular
   Peristome interrupted
5. Outer lip strongly proscline i.e. growth lines
   inclined adapically or leaning forward
   Outer lip not strongly proscline i.e. growth lines
   not leaning forward
6. Littoriniform, turbiniform or conical shells of
   small or medium size, lacking in umbilicus with
   few exceptions; Ornament predominantly spiral
   or smooth; Outer lip strongly proscline i.e.
   growth lines inclined adapically and columellar
   lip with one or more teeth in many genera Mono-
   dontinae Conical or turbiniform shells, normally
   umbilicate or umbilicus lacking
7. Shell mostly medium to large size, many with
   flattened base; base not excavated in middle;
   aperture quadrangular; peristome discontinuous,
   parietal region without callus in most genera;
   collumellar lip straight, vertical or inclined,
   meeting parietal lip in abrupt angle, and smooth
   or with denticle at lower end
8. Nodosely ornamented shells with considerable
   range of size; base excavated in middle, aperture
   quadrangular with strongly discordant lips; outer
   lip sharp, columellar lip straight, emerging from
   umbilicus or basal excavation, smooth, undulating
   or toothed, commonly forming marked angle with
   basal margin.

Subfamily Margaritinae

This is represented by a single genus, Euchelus Philippi

Ovate-conical, aperture rounded, outer lip thickened
lirate within; inner lip usually with tooth below

Genus Euchelus Philippi, 1847

Type-species: Trochus quadricarinatus Holten [ (? = Trochus asper
(Gmelin) ]

8. Euchelus asper (Gmelin, 1791)

Trochus asper Gmelin, 1791, Syst. Nat., Ed. XIII, 1(6) : 3583, sp. 105 (Type-locality
not known); Philippi, 1846 (—1855),* Conchyl. Cab., 2 (2 &3), sp. 206 : 172,
pl.27, fig.11; Fischer, 1880, in Kiener’s Cog. Viv., (Gen : Calcar, Trochus etc.): 291, p. 94, fig.1.


Pilsbry (1889) has placed Adams’ *proximus* in the synonymy of this species while Gravely (1942) has included Adams’ *indicus* also in it. Probably, Melvill and Standens’ (1898) *indicus* and *proximus* may also be identical with it. Satyamurti (1952) without having any say on Pilsbry’s *asper* has treated the latter’s *principalis* only as a synonymy of this species. It is not clear how far this is justified.


**Distribution**: In India: Kutch, Bombay, Malabar Coast, Madras, Visakhapatnam, Bimlipatam, Andamans. Elsewhere: Indian Ocean; Sri Lanka, Moluccas.

**Remarks**: Philippi (1846—1855), Fischer (1880), Pilsbry (1889) and Satyamurti (1952) have given adequate descriptions of this species and the examples in the collection agree well with them. Shell thick, solid, conoidal and dull ash-grey coloured.

The examples in alcohol are fresh but in the larger one the peristome is imperfect. The interior is shining with pearly iridescence. Among the dry shells in the two large ones the body-whorl shows a tendency to become detached from the spire. They and a small shell are in a good state of preservation. The others are eroded and dull within. Smaller shells are non-umbilicate.

**Measurements** (in mm.) Range (8 ex.): Height 5.20—28.05; Maximum Diameter 5.95—26.35; Minimum Diameter 5.40—22.70.

9. **Euchelus asper** var. *tricarinatus* (Lamarck, 1822).


* Not seen in the original.
Trochus tricarinatus: Philippi, 1846(-1855)*, Conchyl. Cab., 2 (2 & 3), sp.205: 171-172, pl.27, fig.8; Fischer, 1880, in Kiener's Coq. Viv., (Gen. Calcar, Trochus etc.): 287, pl.93, fig.1.


Pilsbry (1889) has merged this with Chemnitz's quadricarinatus considering the latter as a distinct species, whereas Melvill and Standen (1898) have regarded this as an independent species, Gravely (1942) and Satyamurti (1952) have rightly made it a variety of E. asper.


Remarks: In the collection under study, the shells, as the name of the variety suggests, have generally three prominently beaded spiral ridges or lamellae on the body whorl, while in a few cases there may be two but rarely four. Spire appears somewhat suppressed in younger shells and in the adults it is less elevated than in the var. asper (S. S.) while umbilicus is clearly open in earlier stages, it is closed in adults.


10. Euchelus horridus (Philippi, 1846—1855)

Trohus horridus Philippi, 1846(-1855)*, Conchyl. Cab., 2 (2 & 3), sp. 207:172-173, pl.27, fig.12 (Type-locality: Pacific Ocean).


Material: 2 ex. (w.), Sta. 2G.—Pulli Id., about 8 kms (5 miles) from Krusadai Id., 7-5-1955 (Coll. H. C. Ray); 1 ex. (d.), Sta. 12,—Shore colln., Hare Id., off Tuticorin, 22-2-1968 (Coll. A. S. Rajagopal).


* Vide Brit Mus Cat. 3 : 1252.
Remarks: Adequate descriptions of the species are given by Philippi (1846—1855) and Pilsbry (1889). The collection under study agrees well with the descriptions given by them.

Shell small, globosely conoid, Umbilicus open, Body-whorl having three prominent spiral, granose keels. Columellar edge bearing a small denticle. Interior of aperture iridescent silvery white.

Shells in the collection are in good condition. They do not seem to attain the normal size of E. asper. The dry shell is with encrustation whereas those in alcohol are in a better condition with a redish colour maculated with brown and white.

Measurements (in mm.): Range (3 ex.): Height 11.20—12.75; Maximum Diameter 10.95—12.20; Minimum Diameter 9.30—10.25.

11. Euchelus Circulatus (Anton, 1848)

(Pl. I, Figs. 4 & 4A)

Trochus (Euchele) circulatus Anton, 1848, Zeitschr. f. Malak., 5:103 (Type-locality: not known) (1849).


Euchelus proximus A. Adams is considered a variety of this species by Gravely (1942) and Satyamurti (1952).


Distribution: In India: Pamban & Krusadai Id.

Elsewhere: Not known.

Remarks: The best description of the species is the one given by Pilsbry (1889). The species is represented in the collection by two exquisitely sculptured shells which agree well with the description. Both the shells are white but the larger one is in a better state of preservation.

Shell umbilicate, ovate, conoidal, with 3 prominent, spiral, elevated, distantly-placed ridges or cinguli on the penultimate whorl and 9 on body-whorl. Ridges obliquely, transpirally grained and bear distant brownish markings alternating with white. Interstices also transpirally, minutely granulated. Suture canaliculate. Aperture semicircular. Columella with a denticle at base. Interior pearly-white and furrowed.

Measurements (in mm.): Range (2 ex.): Height 8.40—11.35; Maximum Diameter: 8.35-11.15, Minimum Diameter: 7.75-10.00
12. Euchelus atratus (Gmelin, 1791)

Turbo atratus Gmelin, 1791. Syst. Nat. Ed. XIII : 3601, sp. 53 (Type-locality: Nicobar Is.).


Material: 1 ex. (w.) and 1 ex. (d.) sta. 17-Coastal waters from Pondicherry upto Nallavarukuppam on board I.F.S. No. 3, Bottom trawl, 5-7 fms. 18-2-1975 (Coll. A. S. Rajagopal and H. P. Mookherjee)

Distribution: In India: Pamban, Nicobar Is.

Elsewhere: Singapore, Moluccas, Indonesia (many localities), West Irian: Sorong, Vanikoro, Philippine Is. Fiji (Viti).

Remarks: Shell globose-conic, umbilicate, resembling in a general way E. circulatus especially in deeply canaliculate character of suture. Whorls with densely beaded spiral ribs, body-whorl having 12 ribs and penultimate: 5. Aperture circular, columella bearing a tooth at base.

The dry shell is tessellated with black spots and the wet one is unicoloured.

In all other respects, the collection agrees with the description given by Pilsbry (1889).

Measurements: (in mm.) Range (2 ex.): Height 15.40—17.20; Maximum Diameter 15.60—16.00 Minimum Diameter 9.05—13.95.

Subfamily ANGARIINAE.

This is represented in the collection by a single genus Angaria Röding.

Moderately large, spire depressed or flattened, sculpture of strong nodes and recurved to branching spines Angaria.

Genus Angaria (Bolten) Röding, 1798

Type-species: Turbo delphinus Linnaeus

13. Angaria distorta (Linnaeus, 1758)


Angaria distorta: Röding, 1798, Mus Bolt. : 71, sp. 910.

Delphinula distorta: Kiener, 1839* Coq. Viv., 10, livr. 27-34: Delphinula, 4-5, pl.

3, figs. 4 (The title *D. rugosa* given erroneously in the plate was subsequently abandoned in the text); Reeve, 1843, *Conch Icon.*, 1: *Delphinula*, sp. No 7, pl. 2, fig. 7.; Tryon, 1888, *Man. Conch.*, 10: 268, pl. 65, fig. 8; pl. 68, figs. 12 & 13.


Satyamurti (1952) has attributed the name "*plicata*" to Kiener and has stated, "...Kiener's name *plicata*, has priority over the others" On a perusal of the literature it is found that the name was neither coined nor given to this species by Kiener.

*Material*: 4 ex. (d.), Sta. 2c—Shingle Id., 2.4 kms. (1 ½ miles) E, of Krusadai, 3-5-1955; 1 ex. (d.), Sta. 2f—Shore of Rameswaram, 6-5-1955 (Coll. H. C. Ray).


*Remarks*: The collection under study agrees well with the description given by Reeve (1843) and Tryon (1888).

Though the shells are shore worn and bleached to some extent—thry still retain the characteristic crimson red colour.

Shell solid, rugged, heavy, spire depressed-turbinate. Dorsal surface of whorl conspicuously plicate. Umbilicus wide open and sculpture of outside of whorl continued inside it.

This appears to be the first record of the species from the coast of mainland India.

*Measurements* (in mm.): Range (5 ex.): Height 27.20—29.40; Maximum Diameter 23.40—39.20; Minimum Diameter 28.30—28.50.

Subfamily *Monodontinae*

A single genus *Cantharidus* Montfort represents this family in the collection.

Spire tapering, surface nearly smooth; columella with fold but tooth obscure, *Cantharidus*

**Genus Cantharidus** Montfort, 1810.

Type-species: *Trochus iris* Gmelin

14. *Cantharidus interruptus* (Wood, 1856)

*Trochus interruptus* Wood, 1856, *Index Test. Suppl.*, :221, pl. 6, fig. 42 (Type locality: erroneously stated as Ireland).
Zizyphinus interruptus: Reeve, 1863, *Conch. Icon.*, 14 : Zizyphinus, sp. No. 64, pl. 8, fig. 64.


**Remarks**: A large number of small trochiform shells in different sizes represents this species in the collection. Some of the shells are fresh while others are eroded. In general they agree with the descriptions given by Pilsbry (1889) and Satyamurti (1952). In a few shells the umbilicus is very shallow while in most cases it is obliterated by the deposition of callus. In only one example it appears deep.

Shell erectly conical, whorls finely, spirally ridged, ridge above the suture being strongest. Shell tessellated with pink, brown or blue-black markings.

When the superficial layer of the shell is lost, the beautifully iridescent nacreous layer lying underneath is exposed.

**Measurements** (in mm.): Range (20 ex.): Height 5.10—8.90; Maximum Diameter 4.20—7.15. Minimum Diameter 3.60—6.75.

**Subfamily Gibbulinae**

A single subgenus *Cantharidella* Pilsbry under *Gibbula* Risso represents this in this study.

Small, polished, umbilicus narrow or wanting

*Gibbula (Cantharidella)*

**Genus Gibbula** Risso, 1826

**Type-species**: *Trochus magus* Linnaeus.

**Subgenus Cantharidella** Pilsbry, 1889

15. *Gibbula (Cantharidella) blanfordiana* G. H. Nevill.  
(Pl. I, Figs. 6 & 6A)

*Gibbula blanfordiana* G. & H. Nevill, 1869, *J. Asiat. Soc. Beng.*, 38 (2); 158, pl. 17, fig. 9 (Type-locality: S. Prov., Ceylon; found on sea-weed at

*Material*: 1 ex. (d.), Sta. 2c.—Shingle Id., 2.4 km (1½ miles) E. of Krusadai Id., 3-5-1955 (Coll. H. C. Ray).


*Remarks*: This species is represented in the collection by a single slightly shore-worn shell in which the penultimate and the body-whorl are well preserved but the rest of the spire is eroded. It conforms to the descriptions given by G. & H. Nevill (*op. cit.*) and Pilsbry in (1889).


*Measurements* (in mm.): Height 5.00; Maximum Diameter 5.95; Minimum Diameter 5.30.

**Subfamily CALLIOSTOMATINAE**

This is represented by a single genus *Calliostoma* Swainson here.

*Without umbilicus*  

**Genus Calliostoma** Swainson, 1840

Type-species: *Trochus eonusus* Linnaeus

16. *Calliostoma tranquebarica* (Röding, 1798)


*Material*: 1 ex. (d.) Sta.?—Sea shore, about 3.2 km (2 miles) N. of Tranquebar, 1-2-1957. (Coll. Menon & Ramakrishna); 1 ex. (d.) St. 1-Bottom trawl, Coastal waters of Madras off Tondiarpet on board “Chota Investigator”, 25-1-1975; 1 ex. (d.), sta.4-Bottom trawl Coastal waters of Madras N. of Harbour on board “Chota Investigator” 6-7 29-1-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

* Vide *Brit. Mus. Cat.*, **3**: 1252

Remarks: Three dead shells represent this species in the collection and they agree well with the descriptions given by Pilsbry (1889) and Satyamurti (1952).


Two shells are fresh and bear tessellated brown markings on the surface. The third one is pale yellowish in colour.

The shell from Tranquebar represents the “Topotype” of the species.

Measurements (in mm.) Range (3 ex.): Height 15.10—15.95; Maximum Diameter 17.15—19.80; Minimum Diameter 16.05—17.55.

Subfamily Trochinae

Under this Subfamily, two genera i.e. Trochus Linnaeus and Clanculus Montfort are dealt with, the former under a subgenus namely Infundibulum Montfort.

Conical, base more or less flattened, surface with axial folds, base spirally ribbed; columella with single fold. Trochus (Infundibulum)

Rather small, rounded-conical, surface most commonly beaded; columella with tooth; umbilical pit bordered with crenulate ridge. Clanculus

Genus Trochus Linnaeus, 1758.

Subgenus Infundibulum Montfort, 1810.

Type-species: Trochus concavus Gmelin.

17. Trochus (Infundibulum) radiatus Gmelin 1971


Material: 11 ex. (w.), Sta.?—Tuticorin Harbour, Feb.-Mar. 1926 (coll. H. S. Rao); 1 ex. (w.) Sta.?—Krusadai Id., Gulf of Mannar,

Indian Archaeogastropoda is /20-3-1950 (Coll. S. L. Hora & A. G. K. Menon); 1 ex. (w.), Sta. 1D-In front of P.W.D. Inspection Bungalow, Tuticorin, 17-4-1955; 10 ex. (w.) Sta.?—Galaxea reef, Krusadai Id., 2-5-1955; 14 ex. (d.), Sta. 2c-Shingle Id., 2.4 km. (1\frac{1}{2} miles) E. of Krusadai, 3-5-1955; 4 ex. (w.), Sta. 2b-Pulli Id., about 8 km. (5 miles) from Krusadai Id., 7-5-1955; 1 ex. (d.), Sta. 1k.—Rocky beach of Cape Comorin, 24-5-1955 (Coll. H. C. Ray), 1 ex. (w.) Sta. 2 : Sl. No. 128-Pillars of CMFRI. Jetty on Gulf of Mannar shore of Mandapam Camp, 15-2-1962; 14 ex. (w.) Sta. 2-Galaxea reef, Krusadai Id., 12 kms. E. of Mandapam, 21-2-1962; 65 ex. (w.) Sta. 2-From rocky shore of Mandapam, 1.6 km (1 mile) E. of Mandapam Camp, 22-2-1962; 2 ex. (d.) Sta. 3 : No. 336, Bank of backwater canal to N. of Subramania Temple. Tiruchendur, 27-2-1962; 1 ex. (d.), Sta. 3 : Sl. No. 347-Sandy shore of Virapandianpatnam, 1.6 km. (1 miles) N. of Tiruchendur Subramania Temple 28-2-1962 (Coll. V K. Premkumar & P. K. Chakravorty); 24 ex. (d.) Sta. 12-Shore olin., Hare Id., off Tuticorin, 22-2-1968;17 ex. (d.), Sta. 13-Shore colln., Vanthivu Id., off Tuticorin, 23-2-1968; 5 ex. (d.), Sta. 15-Shore colln., Cape Comorin, 24-2-1968; 15 ex. (d.), Sta. 5-Shore colln. from CMFRI., Mandapam Camp to Mandapam, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).


Remarks: Of the descriptions of the species given by several authors which we have gone through the one by Pilsbry (1889) is the best and the collection under study agrees well with it.

Examples with or without the soft parts and of various sizes are present in the collection. Some of them are covered with a thick velvety encrustation of weeds. In the younger ones the whorls are concave in the middle and the shell as a whole appears more broad than conical.

Body-whorl with sharply angulated periphery. Surface of shell bearing irregular bands of crimson red transpirally. When the shell loses the superficial layer, it exposes the underlying nacreous layer which is silvery white.

Measurements (in mm.) Range (50 ex.): Height 7.85—25.10; Maximum Diameter 11.40—29.70; Minimum Diameter 10.55—27.75)

18. Trochus (Infundibulum) stellatus Gmelin, 1791.


Remarks: Shell solid, more thick and massive than in radiatus. Coarsely granular, more conical than broad. Body-whorl somewhat deflected giving a convex outline to spire, Periphery rounded. Spire traversed by broad purplish red bands.

Measurements (in mm.) Range (4 exs.): Height 23.90—27.55; Maximum Diameter 24.45—28.15; Minimum Diameter 22.35—25.70.

19. Trochus (Infundibulum) tentorium Gmelin, 1791


Trochus maculatus var. tentorium : Pilsbry, 1889, in Tryon’s Man. Conch., 11 : 25, pl. 7, fig. 66, 73


Material; 1 ex. (d.), Sta.?—Krusadai Id., Gulf of Mannar, March, 1950 (Coll. S. L. Hora & A. G. K. Menon); 5 ex. (d.), Sta. 2c—Shingle Id., 2.4 kms (1½ miles) of Krusadai, 3-5-1955 (Coll. H. C. Ray); 2ex. (w.) Sta. 2G—Pulli Id. about 8 kms. (5 miles)from Krusadai, 7-5-1955 1 ex. (d.), Sta. 3b—Rocky shore of Gulf of Mannar S. of Quarantine Camp, Tamil Nadu, 11-5-1955 (coll. H. C. Ray); 1 ex. (d.), Sta. 7—Shore colln., in Palk Strait, Mandapam Camp to Mandapam 3-2-1975 (Coll. A. S. Rajagopal and H. P. Mookherjee).
**Distribution**: In India: Andamans. Elsewhere: Indian Ocean: Zanzibar, Mergui Archipelago, Singapore, Java to Philippines, Fiji Is., Kingsmill Id.

**Remarks**: The examples representing this species in the collection are of various sizes. All of them, however, possess the characteristic transpiral plication especially at the lower part of each whorl.

Shell conical, solid, heavy and falsely umbilicate. Body-whorl tending to deflect as in previous species. Columella subvertical or oblique and denticulate. Margin of aperture nearly smooth.

**Measurements**: (in mm.) Range (9 ex.): Height 10.70—29.70; Maximum Diameter 13.90—30.00; Minimum Diameter 13.40—28.20.

**20. Trochus (Infundibulum) pustulosus** Philippi, 1849


*Trochus calcaratus* : Fischer, 1880, in Kiener’s *Coq. Viv.*, (Gen. *Calcar, Trochus* etc.) : 347, pl. 109, fig. 2 (three views).

**Material**: 21 ex. (d.), Sta. 2c—Shingle Id. 2.4 km (1½ miles) E. of Krusadai Id., 3-5-1955 (Coll. H. C. Ray); 4 ex. (d.), Sta. 12—Hare Id., off Tuticorin, Tamil Nadu, 23-2-1968; 3 ex.(d.), Sta. 13.—Vanthivu Id., off Tuticorin, Tamil Nadu, 24-2-1968 (Coll. A. S. Rajagopal).

**Distribution**: In India : Krusadai Id. Elsewhere : Unrecorded.

**Remarks**: Pilsbry (1889) and Satyamurti (1952) have given adequate descriptions of this species.

Shell narrow, umbilicate, conical, slightly smaller in average size and more elevated than in any of the preceding species namely *radiatus*, *stellatus* and *tentorium*. Roseus to dull brick red in colour, interspersed with white transpiral streaks. Whorls spirally closely beset with round nodules. Columella oblique, basal margin crenulate.

Some of the shells in the collection are somewhat shoreworn.

**Measurements** (in mm.) Range (18 exs.): Height 11.60—27.15; Maximum Diameter 10.40—24.15; Minimum Diameter 9.90—22.20.

**Genus Clanculus** Montfort, 1810.

**Type-species**: *Trochus pharaonius* Linnaeus

21. **Clanculus clanguloides** (Wood, 1856)

*Trochus clanguloides* Wood, 1856, *Index Test. Suppl.*, 221, pl. 6, fig. 39 (Type-locality: not known) Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar, Trochus* etc.): 369-370, pl. 113, fig. 2.


Satyamurti (1952) has merged *stignatarius* A. Adams with this species. We are, however, of the view that the two are distinctly separate.

**Material**: 17 exs. (d.), Sta. 2c—Shingle Id., 3.4 km. (1 1/2 miles) E. of Krusadai, 3-5-1955 (coll. H. C. Ray); 3 ex. (d.), Sta. 12—Shore colln.. Hari Id. off Tuticorin, Tamil Nadu, 22-2-1968 (Coll. A. S. Rajagopal),

**Distribution**: In India: Pamban, Krusadai & Shingle Is., Andamans. Elsewhere: Sri Lanka; Australia: Port Jackson; Watson's Bay: New Caledonia; Fiji Is.

**Remarks**: The collection before us representing this species consists of both eroded and good shells. They agree well with the descriptions given by Pilsbry (1889) and Satyamurti (1952).

Shell, small, solid, globose-conic, narrowly deeply false-umbilicated (*i.e.* the umbilicus surrounding the columella), generally light pinkish or greyish in colour. Surface of whorls having characteristically close set and spirally beaded ribs, with every second, third or fourth rib articulated with white and black dots, arranged in twos or threes. Body-whorl showing a tendency to deflect, rounded at the periphery. Aperture oblique, outer lip bearing within, a strong tooth above. Basal part of lip expanded, feebly denticulate. Columella oblique, plicate and ending in a strong plicated tooth at the base.

In one or two shells in the collection representing younger stages, the deflection of the body whorl has not taken place.

**Measurements** (in mm.) Range (20 ex.): Height 6.05—11.30, Maximum Diameter 7.30—11.40; Minimum Diameter 6.90—9.85.

**Subfamily UMBONIINAE**

Two genera namely *Umbonium* Link and *Monilea* Swainson represent this here.

Solid, glossy, smooth or spirally striated **Umbonium**

Elevated, spirally ribbed **Monilea**

**Genus Umbonium** Link 1807.

**Type-species**: *Trochus vestiarus* Linnaeus.
22. *Umbonium vestiarium* (Linnaeus, 1758).


**Distribution :** In India ; Bombay, Bassein, Goa, Tuticorin, Kru sadai Id., Tranquebar, Madras, Pulicat Lake. *Elsewhere :* Persian Gulf, Mekran Coast, Karachi, Indian Ocean, Sri Lanka to Java, Singapore, New Ireland, Philippines and Japan.

**Remarks :** This is the commonest Trochid found along the Indian Coast. Pilsbry (1889) and Satyamurti (1952) have dealt in considerable detail with the variations in colour patterns etc. met with in this species.
Measurements (in mm.): Range (180 'ex.): Height 2.75-8.10; Maximum Diameter 4.55-13.55; Minimum Diameter 4.05-11.10.

Genus **Monilea** Swainson 1840

Subgenus **Monilea** S. S.

Type-species: *Trochus calliferus* Lamarck

23. **Monilea** (**Monilea**) callifera (Lamarck, 1822)


Remarks: Pilsbry, (1889) has given an adequate description of the species with which the solitary example represented in the collection, agrees.

Shell conoidal, depressed, umbilicate narrowly. Densely finely lirate nature prominent on rounded body-whorl, though finely beaded striae appear faded. Aperture rounded-square. Shining nacreous layer within, layer undulating and corresponding with inner lirae. Columella bearing a denticle below. Shell somewhat eroded, more so at apex.

This appears to be the first record of the species from the coast of mainland India.

Measurements (in mm.): Height 12.70; Maximum Diameter 17.50; Minimum Diameter 15.10.

Subfamily **Solarieillinae**

A single genus *Minolia* A. Adams is represented in the collection.

Periostracum marked with spots and stripes of color *Minolia*.

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* Not seen in the original
Genus *Minolia* A. Adams, 1860

Type-species: *Minolia punctata* A. Adams Thiele (1931) has treated this as a subgenus of *Isanda* Adams while Knight et al (1960) have considered it as a genus. We have followed the latter.

(Pl. I.-figs. 8 & 8A)

*Trochus (Solariella) castus* G. & H. Nevill, 1874, *J. Asiat. Soc. Beng.*, 43(2): 27, pl.1, fig.4,(Type-locality, Ceylon).


**Material**: 6ex. (d.), Sta.Ij—(1) Shore colln., N. of Inspection Bungalow, Tuticorin, 24-1-1955 (Coll. H. C. Ray); (2) 2 ex. (d.), Sta. 11-Shore colln. in front of the Circuit House, Tuticorin, 21-2-1968; (3) 6 ex. (d.) Sta. 16-Shore colln. near Madras State Fisheries Extension Unit, Tuticorin, 25-2-1968 (Coll. A. S. Rajagopal).

**Distribution**: In India: Tuticorin. Elsewhere: Sri Lanka.

**Remarks**: The original collection consisting of two examples and labelled "Type" based on which G. & H Nevill (1874) gave their description under the name *Trochus (Solariella) castus* is present in the N.Z.C. of Z.S.I. It bears the Reg. No. M 2300/1 Zool. Surv. India. Since the Nevills had not formally designated either of them as the "Holotype", we take this opportunity to select the shell which the authors had figured and to designate it as the "Lectotype", (Reg. No. M 20365/3) (Vide Pl. I. figs. 7 & 7A) as laid down under Article 74 (Recommendation 74B) of the International Code of Zoological Nomenclature. The remaining Syntype bearing the original registration number is duly labelled as the "Paralectotype".

We have compared the material under study with the "Type" and found the former identical with the latter. The material contains shells of different stages of growth though some of them are eroded. In the lot (1) above all the shells are in a good state of preservation while in (2) and (3) the peristome is imperfect in some shells.

Narrow spiral platform adjoining suture gives spire pagoda-like contour. Umbilicus open and deep. Some shells glabrous and with dark brown blotches on dorsum.

This appears to be the first record of the species from the Indian Coast.
Measurements

Lectotype (as given by authors), Photographed, A shell from Tuticorin as in Material (1) above (Photographed).

Height : 7.50 8.40 3.50—8.50
Max. Diameter 7.00 9.80 4.40—9.80
Min. Diameter : — 8.25 3.90—8.25

Family TURBINIDAE

Three subfamilies included in this are represented in this paper. They are Astraeinae, Liotiinae, Turbininae.

Key to the identification of the Indian subfamilies:

1. Shells generally large, whorls rounded, base convex; aperture round; operculum thick and heavy, nearly circular, convex outward

   Shells relatively small to medium size, operculum oval or chitinous within, not heavy

   2. Shell conical with more or less carinate periphery; base flattened; operculum most commonly oval

   Shell relatively small, with both axial and spiral sculpture spire low to flattened; operculum chitinous within but with outer surface calcareous or at least with calcareous granules; aperture nacreous

Subfamily ASTRACINAE

A single genus Astraea Röding under its subgenus Astralium Link, represents this in the collection.

Periphery variously ornamented with spines, moderately large not umbilicate

Genus Astraea (Bolten, Roding, 1798)

Subgenus Astralium Link, 1807

Type-species: Turbo calcar Linnaeus.

25. Astraea (Astralium) semicostata (Kiener, 1838)

Trochus semicostatus Kiener, 1839* Coq. Viv.,: Trochus, pl.38, fig.1 (Type-locality: not known.


Remarks: A number of dry shells of different sizes represents this species in the collection. Some of them are eroded to a varying extent while others are preserved in good condition.

Shell trochiform in shape, pale yellowish brown in colour, with closed umbilicus. Characteristic short nodes (projections) present at periphery of lower half of whorls, prominently scalloping suture below.

In other respects the shells conform to the descriptions given by Tryon (1888) and Satyamurti (1952).

Measurements (in mm.) Range (15 ex.): Height 7.75—24.00; Maximum Diameter 11.10—26.85; Minimum Diameter 9.75—25.70.

Subfamily LIOTIINAE

This is represented here by a single genus Liotia Gray.

Axial and spiral ribs well developed, forming latticed surface; umbilicus funnel—shaped, bounded by beaded cord; operculum concave, of many narrow whorls

Genus Liotia Gray, 1847

Type-species: Delphinula cancellata Gray.

26. Liotia varicosa (Reeve, 1843)

Delphinula varicosa Reeve, 1843, Proc. zool. Soc. Lond., pt. 11: 142 (Type locality: Id. of Corregedor, Philippines), Reeve, 1843, Conch. Icon., 1 : Delphinula, sp. No.12, pl.3, figs.12a & b.


Material: 1 ex. (d.), Sta. 2d—Galaxea reef, 4-5-1955; 1 ex. (d.), Sta. 2G—Submerged coral reefs near Pulli Id. about 8 km (5 miles) from
Krusadai Id., 7-5-1955; 3 ex. (d.), Sta. 3b—Rocky shore of Gulf of Mannar near Quarantine Camp, Mandapam, 11-5-1955 (Coll. H. C. Ray); 1 ex. (d.), Sta. 12—Shore colln. Hare Id., off Tuticorin, 22-2-1768 (Coll. A. S. Rajagopal); 3 ex. (d.), Sta. 5—Shore Coll., CMFRI., Mandapam Camp to Mandapam, 31-1-1975; 2 ex. (d.) Sta. 6—Shore colln. at low tide, Rameswaram, 1-2-1975 (A. S. Rajagopal & H. P. Mookherjee.)

**Distribution:** In India: Madras, Andamans. Elsewhere: Corriegeor Id., Philippines, Japan and Loyalty Is.

**Remarks:** The shells before us which are slightly shoreworn agree well with Reeve's (1843) description of the species.

Shell white, solid and with characteristic transpiral varicose ribs, giving it prominently angulate or polygonal shape. Spiral ridges meeting varices lend latticed sculpture to shell. Ventrally a row of small pits which once were holes now blocked probably by extraneous matter—Umbilicus widely open and deep.

This appears to be the second record of the species from the Indian coast, the first one being that of Melvill and Standen (1898).

**Measurements** (in mm.) Range (8 ex.) : Height 4.90—15.85; Maximum Diameter 6.70—17.40; Minimum Diameter 5.70—14.10.

**Subfamily TURBININAE**

A single genus *Turbo* Linnaeus and the subgenera *Turbo* S. S. and *Lunatica* Röding represent this here.

- Smooth to strongly sculptured; inner lip mostly widen-ed or callused. *Turbo.*
- Smooth, rounded, last whorl large; inner face of operculum flat. *Turbo S. S.*
- Very large, heavy, spiral ribs few; Umbilicate; pillar with a basal expansion; operculum semi-granular. *Lunatica.*

**Genus Turbo Linnaeus, 1758**

Type-species: *Turbo petholatus* Linnaeus.

**27. Turbo spinosus* Gmelin.**

(Pl. I, Figs. 9 & 9A)

*Turbo spinosus* Gmelin, 1791, *Syst. Nat.*, Ed. XIII, 1(6) : 3574, sp. 24 (Type-locality: India); Fischer, 1873, in Kiener's *Coq. Viv.*, 12 (Genus Turbo) : 17, pl.3, figs.2.; Reeve, 1848, *Conch. Icon.*, 4 : Turbo, sp. No. 47, pl. 10, fig.47; pl.13, figs.47b & 47c (fig. 74c error for 47c).

We are treating this species directly under the genus *Turbo* without assigning it to any subgenus.
Material: 3 ex. (d.), Sta.?—Pearl bank, 16 km (10 miles) from the shore of Tuticorin, 10 fms. February-March, 1926 (Coll. H. S. Rao).


Remarks:—The species is represented in the collection by three specimens with the operculum intact. Though small in size, the characters as described by Reeve (1848) are clearly discernible in them.

Shell non-umbilicate pyramidally turbinate. Whorls having spiral ridges. Scales on some ridges of s whorls become prominent and prickly presenting to whorls, especially to body-whorl, an angular contour.

This appears to be the first record of the species from the coast of mainland India.

Measurements (in mm.) Range (3 ex.): Height 17.95—21.70; Maximum Diameter 16.85—19.60; Minimum Diameter 15.05—17.40.

Subgenus Turbo S. S.

Type-species: Turbo petholatus Linnaeus, 1758

28. Turbo (Turbo) petholatus Linnaeus, 1758


Material: 1 ex. (d.) Sta. 2c—Shingle Id., 2.4 km (1½ miles) E. of Krusadai Id., 3-5-1955 (Coll. H. C. Ray).


Remarks: A detailed historical review of this species is included by Henry Dodge (1959) in his mollusks of Linnaeus.

The species is represented in the collection by a single shell which is shorreworn to some extent. It conforms to the description given by Tryon (1888).

Schepman (1908) has observed in the very young “Siboga” specimens two characters which are often lost or wanting in museum specimens and therefore they are not recorded by authors. They are, “1° the whole shell is covered by microscopic striae, running nearly spirally, but in an oblique direction from behind and above towards the aperture, 2° the embryonic whorls are quite different from the rest of the shell, showing at the suture short projections which render it angular,
as if the embryonic shell should have been spined; moreover these whorls are plicated, and have near the middle of their upper surface, a kind of keel, which is elegantly beaded, the uppermost whorl is slightly immersed”

_Measurements_ (in mm.): Height 48.30; Maximum Diameter 48.00; Minimum Diameter 37.85.

Subgenus _Lunatica_ Röding, 1798

_Type-species:_ _Turbo marmoratus_ Linnaeus

29. _Turbo (Lunatica) brunneus_ (Röding, 1798)


_Material:_ 2 ex. (w.), Sta.?—On rocks under bridge, Ramand Dist., Tamil Nadu, Feb. 1925 (Coll. B. N. Chopra & H. S. Rao); 4 ex. (w.), Sta.?—Krusadai Id., Gulf of Mannar, March, 1950 (Coll. S. L. Hora & A. G. K. Menon); 6 ex. (d.), Sta.? Galaxea reef, Krusadai Id., 2-5-1955; 11 ex. (d.) Sta. 2c-Shingle Id., 2.4 kms (1½ miles) E. of Krusadai Id., 3-5-1955; 4 ex. (d.), Sta. 2d—Galaxea reef, 4-5-1955; 5 ex. (d.), Sta. 2G—Pulli Id., about 8 kms. (5 miles) from Krusadai Id., 7-5-1955; 1 ex. (d.), Sta. 3b—Rocky shore of Gulf of Mannar, Quarantine Camp, Mandapam, 11-5-1955 (Coll. H. C. Ray); 2 ex. (w.), Sta. 2—Galaxea reef, Krusadai Id., 12 km E. of Mandapam Camp, 21-2-1962; 2 ex. (w.) Sta.?—On rocky shore of Mandapam 1.6 km. (1 mile) E. of Mandapam Camp, 22-2-1962 (Coll. V. K. Premkumar & P. K. Chakraborti); 2 ex. (w.), & 1 ex. (d.), Sta. 5—Shore colln., CMFRI. Mandapam Camp to Mandapam, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).


_Remarks_: This is the commonest species of _Turbo_ that is found along the Indian coast.

* Not seen in the original.
In the identification of this species authors appear to have experienced great deal of difficulty. This can be better illustrated by taking into consideration the case of an earlier author, namely, Schepman (1908), who while identifying *T. intercostalis* in the “Siboga” collection remarked, “The identification of this species is difficult. Authors don’t agree about its specific value.”

That he followed Tryon (1888) closely is clear by the use of the same list of synonyms as the latter’s for his species. The synonyms are: *disjunctus* Reeve, *concinnus* Philippi, *articulatus* Reeve, *elegans* Philippi, and *radiatus* Reeve. Added to them was *T. winteri* Philippi which was communicated to him to be identical with *intercostalis*, by von Martens. Further, in quoting in the synonymy for the species the figures which Tryon (op. cit.) used for his *ticaonicus*, he is justified.

From the above list of names it becomes obvious that the name of the species went on changing from time to time as different authors handled it and gave it different names according to their fancy since the correct name somehow remained unknown all along. This was the underlying reason for the confusion that prevailed on it in the literature.

The credit for removing this confusion and establishing, by quoting the proper source, the correct name applicable to this species as *Lunatica brunea* goes to Tomlin (1936, p. 138).

Also on the question of priority between *ticaonicus* Reeve and *intercostalis* Menke, he showed how Reeve’s name would take the precedence.

Even after Tomlin’s clarification, however, some of the later authors like Crichton (1941, p. 337) did not take the benefit. He identified the Madras shell as *T. argyrostroma* Linnaeus, which is probably erroneous. (It may also be mentioned here that *T. margaritaceus* which is closely allied to *argyrostroma* is considered a variety of it by most authors). Gravely (1942) and later Ray (1948) who made a study of this species applied the correct name to it whereas Satyamurti (1952) reverted to the use of *intercostalis* for his material.

In the collection under study specimens of various sizes and stages of growth are present. They are in agreement with the description given by Tryon (op. cit.) for his *intercostalis*.

**Measurements** (in mm.): Range (30 ex.) : Height 9.60—57.20; Maximum Diameter 9.20—49.35; Minimum Diameter 7.60—42.60.

**Family Phasianellidae**

This is represented by a single genus *Phasianella* Lamarck in the collection.

Medium sized to large, smooth, long-ovate; non-umbilicate

*Phasianella.*
Genus *Phasianella* Lamarck, 1804

Type-species: *Buccinum australe* Gmelin.

30. *Phasianella nivosa* Reeve, 1862


We consider this to be distinct from *P. variegata* and Lamorck disagree in merging it with the latter as has been done by Tryon (1888, p. 179), along with several other species.

**Material:** 1 ex. (w.), Sta.?—Pamban, Ramnad Dist., D net in 2 ft. through zostera 22-2-1913. (coll. S. W Kemp); 2 ex. (d.) Sta. lj—Shore colln., N. of Inspection Bungalow, Tuticorin, 24-4-1955; 2 ex. (d.), Sta. 2c., —Shingle Id., 2.4 kms (1 ½ miles) E. of Krusadai 3-5-1955 (coll. H. C. Ray); 1 ex. (d.) Sta. 5—Shore colln. CMFRI., Mandapam Camp to Mandapam, 31-1-1975; 5 ex. (d.), Sta. 6—Shore colln. at low tide Rameswaram, 1-2-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

**Distribution:** In India: Krusadai & Shingle Is. Elsewhere: Mauritius, Sri Lanka and Id. of Mindanao, Philippines.

**Remarks:** The specimens under study are in complete agreement with Reeve’s (1862) description of the species.

Shell flesh-tinted, small and somewhat *Littorina*-like in general shape. Evenly spaced, fine, discontinuous white lines alternating with brown ones present circumspirally on whorls.

A single live specimen with the operculum intact is also present in the collection.

**Measurements** (in mm.). Range (9 ex.) : Height 8.00—19.40; Maximum Diameter 6.65—12.95; Minimum Diameter 4.60—10.15.

Family *Neritidae*

A single subfamily Neritinae represents this family in the collections dealt with here.

Subfamily *Neritinae*

This is represented here by three genera namely *Nerita* Linnaeus, *Clithon* Moutfort and *Neritina* Lamarck.

Sturdy shells, smooth to spirally ribbed; inner lip septum well developed, it. surface (labial area) commonly pustulose or irregularly ribbed. *Neritas.*
Shell with small spire and large body whorl. Surface moderately or closely striated. Several species with substructural row of spines Umbilicus closed. Labial area smooth

Relatively large, low-spired, Outer lip overriding the last whorl in a projecting point; labial area broad, flat

**Genus Nerita Adanson, 1757**

**Subgenus Theliostyla Mörch, 1852**

Type-species: *Nerita albicilla* Linnaeus.

31. Nerita (*Theliostyla albicilla* Linnaeus, 1758)


**Remarks**: This is a widely distributed species.

The collection under study consists of specimens of different sizes and stages of growth. Besides the dry shells, there are also a few live specimens preserved in alcohol. All of them agree well with the descriptions given by Reeve (1855) and Tryon (1888).

Shell triangularly ovate, with depressed spine. Shell in good condi-
tion provided with flatly convex spiral ribs alternating with narrow sulci. Columella tuberculated, minutely toothed.

In most cases the shells, even those with animal inside, are found to be considerably eroded. All are marked with irregular blotches, spots or clouds of purple-black.

**Measurements**: (in mm.): Range (20 ex.): Height 4.75—14.95; Maximum Diameter 4.80—26.25; Minimum Diameter 8.05—21.05.

32. **Nerita (Theliostyla) chamaeleon** Linnaeus, 1758


*Nerita stella*: Reeve, 1855, *Conch. Icon.* 9, : *Nerita* sp. No .60, pl.13, figs. 60 (a, b, c& d).


**Material**: 3 ex. (w.), Sta. 1-Palk bay, about 3.2 km (2 miles) N. of CMFRI, Manda pam Camp, Ramnad Dt., Tamil Nadu, 13-3-1955 (Coll. M.A.S. Menon); 3 ex. (w.) Sta. II from a rock at Vedali coast, 4.8 km (3 miles) West of Mandapam Camp, 16-2-1962 (Coll. V K., Premkumar & P. K. Chakraborti); 3 ex. (d.), Sta. 12—Shore colln, Hare Id. off Tuticorin, 22-2-1968 (Coll. A. S. Rajagopal); 38 ex. (w.) Sta. 7—Shore colln. Palk Strait, Mandapam Camp, 3-2-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

**Distribution**: In India: Devagad on West Coast, Pamban, Madras, Andamans & Nicobars. Elsewhere: East Africa, Akyab, Mergui Archipelago, Singapore, Indonesia to Polynesia.

**Remarks**: This species is represented in the collection by large number of specimens of different sizes. They agree well with the descriptions of the species by Tryon (1888) and Satyamurti (1952).

Shell subglobose, spire slightly elevated above the body-whorl. Shell with many rugose spiral ribs not formed uniformly as also interspaces. Dark coloured (black) markings or maculations present in three indistinct interrupted bands. Columellar surface with some transverse plications at outer and inner margins. A few tubercles present at centre of columella. Aperture white, inside of outer lip toothed.

**Measurements** (in mm.): Range (26 ex.): Height 14.90—27.00; Maximum Diameter 16.30—28.50; Minimum Diameter 12.20—21.90.

Subgenus *Amphinerita* von Martens, 1889

Type-species: *Nerita umlaussiana* Krauss
33. **Nerita (Amphinerita) polita** Linnaeus, 1758.


**Remarks**: Only two shoreworn shells represent this species in the collection. Though they are almost polished and smooth they reveal, on a closer look, the transpiral striation over the shell.

Shell obliquely ovate, spire so depressed as to appear plush with body-whorl.

The faded patches and markings on the shells indicate that they were of bright colour and that they have been partially removed by erosion. The shells agree well in all other respects with the descriptions given by Reeve (1855), Tryon (1888) and Satyamurti (1952).

**Measurements** (in mm.): Range (2 exs.): Height 23.30—23.50; Maximum Diameter 28.65—29.30; Minimum Diameter 16.05—16.85.

34. **Nerita (Amphinerita) georgina** Recluz, 1841


**Distribution**: In India: Nicobar Is.

**Elsewhere**: King George’s Id.

**Remarks**: This species is represented by two specimens preserved in alcohol in the collection. They agree well with the descriptions given by Reeve (1855) and Tryon (1888).

Shell depressed, ovate and spirally ribbed. Ribs bearing irregular black marks, distantly placed, so as to make interstices broad. Intestices latticed closely with cross transpiral striae. Body-whorl elongated
transversely. Columellar area smooth and shining with margin having three feeble denticles. Outer lip shining within, margin thin and slightly wavy.

This appears to be the first record of the species from the coast of mainland India.

**Measurements** (in mm.): Range (2 ex): Height 14.10—15.50; Maximum Diameter 17.75—17.80; Minimum Diameter 9.25—9.80.

**Subgenus** *Ritena* Gray, 1858

Type-species: *Nerita plicata* Linnaeus

35. *Nerita (Ritena) plicata* Linnaeus, 1758


**Material:** 3 ex. (w.), Sta. 3b—Rocky shore of Gulf of Mannar near Quarantine Camp, Mandapam, 11-5-1955 (Coll. H. C. Ray); 1 ex. (w.), Sta. 14-from a rock of Cape Comorin, 24-2-1968 (Coll. A. S. Rajagopal); 2 ex. (w.), Sta. 5-Shore colln., Mandapam Camp, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

**Distribution:** In India: Lakshadwip Is., Kerala: Varkalay, Krusadai & Shingle Is., Andamans. **Elsewhere:** Sri Lanka, Indo-Pacific: Formosa, Polynesia, Sandwich Is.

**Remarks:** All the specimens in the collection are live ones with the respective operculum intact.

Shell white, globose, spire exserted. Spiral ribs and excavated interstices on shell prominent. Lip crenated and inwardly thickened. Columellar region with callus, rugosely wrinkled, margin ending with four strong teeth.

**Measurements** (in mm.): Range (5 exs.): Height 11.15—19.70; Maximum Diameter 11.25—20.10; Minimum Diameter 8.15—15.30,

**Genus** *Clithon* Montfort, 1810

Type-species: *Nerita corona* Linnaeus

Thiele (1931') has subordinated this genus to *Theodoxus* Montfort, 1810. We have followed van Benthem Jutting (1956) in treating it as a genus.


**Distribution**: In India: Pamban, Krusadai Id., Andamans. Elsewhere: Van Benthem Jutting (1956) states, “Very common in the entire East Asian tropical region, from India and Sri Lanka to Polynesia, and from southern Japan to northern Australia. Also found in the islands of Madura and Verlaten Id. close to the coast of Java”.

**Remarks**: A large number of specimens of different sizes represents this species in the collection.

Shell generally small and rotundately ovate, smooth, polished, olive green and marked finely in black and crimson lines in various patterns irregularly or in spiral bands.

Based on the colour patterns Satyamurti (1952) recognised six different groups but according to van Benthem Jutting (1956) the patterns are so variable that the number could be easily doubled. Grüneberg (1976) has recently made a study of shell colour and pattern of this species based on extensive collections in the Indo-Pacific region and has done laboratory breeding & experiments.

Satyamurti (*op. cit.*) has remarked that this species favours localities far removed from the open sea. The majority of specimens examined for the present study were collected in brackish water in Vellar estuary.

**Measurements** (in mm.): Range (230 ex.): Height 3.45—9.25; Maximum Diameter 3.70—9.20; Minimum Diameter 2.80—6.00.

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* Not seen in the original.
Genus *Neritina* Lamarck, 1816  
Subgenus *Dostia* Gray, 1847

Type-species: *Neritina crepidularia* Lamarck (= *Nerita violacea* Gmelin).

37. *Neritina (Dostia) violacea* (Gmelin, 1791)

*Nerita violacea* Gmelin, *Syst. Nat.* 1791, Ed.XIII: 3686, sp. 68 (Type-locality: not known)


**Material**: 3 ex. (w.), Sta. 2-Bank of Vellar R. near M.B.S., Porto Novo, 5-5-1960, 3 ex. (w.), Sta. 2-Bank of Vellar R. near the jetty, Porto Novo, 6-5-1960. (Coll. A. Daniel); 5 ex. (w.) & 2 ex. (d.), Sta. 4-Killai R. estuary, 3 km E. of Killai village, 12-2-1968 (Coll. A. S. Rajagopal).

**Distribution**: In India: Ratnagiri, Goa; Marmagao Bay, Cochin backwaters, Mahanadi, Godavary and Krishna estuaries, Calcutta, Port Canning. Elsewhere : Burma : Mergui Archipelago, Indian Ocean, Malaysia, the four Greater Sunda Is., Bali and Timor, Philippines, China, Southern Japan, New Caledonia, Not in the Moluccas.

**Remarks**: This is represented in the collection by specimens of different sizes.

Shell ovate, thick, *Crepidula*-shaped. Dorsal surface bearing irregular bands, spots or patches of light colour on a dark-coloured background.

In all other characters they agree well with the descriptions of the species by Tryon (1888) and van Benthem jutting (1956).

**Measurements** (in mm.): Range (10 ex): Height 4.80—9.75; Maximum Diameter 10.05—19.25; Minimum Diameter 9.70—18.00.

**Family Phenacolepadidae**

This is represented by a single genus *Phenacolepas* Pilsbry in the collection.

With rugose radial ribs, apertural margin arched, not in one plane

*Phenacolepas*,
Genus *Phenacolepas* Pilsbry, 1891

Type-species: *Scutella crenulata* Broderip.

38. *Phenacolepas crenulata* (Broderip, 1834)


*Material:* 2 ex. (d.), Sta. 3b—Rocky shore of Gulf of Mannar near Quarantine Camp, Mandapam, 11-5-1955; 2 ex. (d.), Sta. 3c—Single Id., 2.4 kms. (1 1/2 miles) E. of Krusadai, 3-5-1955 (Coll. H. C. Ray); 10 ex. (d.), Sta. 12—Shore colln. Hare Id. off Tuticorin, 22-2-1968; 16 ex. (d.), Sta. 13—Shore colln., Vanthivu Id., off Tuticorin, 23-2-1968 (Coll. A. S. Rajagopal); 1 ex. (d.), Sta. 5—Shore colln., from CMFRI, Mandapam Camp to Mandapam, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mukherjee)

*Distribution:* Sri Lanka, Chain Id., S. Pacific, Formosa.

*Remarks:* Since the description of the species by Broderip (1834, p. 48) is brief and inadequate, a more detailed one is felt desirable and given here.

Shell small, white, thin, fragile and patelloid in shape, anteriorly arched convexly and posteriorly slightly concave. Apex obtuse, pointed backwards and almost above posterior margin. Surface of shell radially strongly ribbed, ribs reaching margin of shell and transversely minutely striated. Ribs more pronounced, closely set and shorter at posterior concave portion. Interstices between ribs smooth, bearing here and there short weaker ribs which rising from margin of shell never reach upto apex. Margin of aperture uneven and broadly ovate. Interior of shell smooth, translucent and glossy with the scar of attachment of nuscle to shell present around region of apex. Shell when at rest on a flat surface, only its anterior and posterior ends touching surface, margin at sides being slightly arched.

The shells in the collection representing this species, do not seem to be fully adults as they do not possess the strongly developed marginal ring mentioned by Broderip (*loc. cit.*).

The name *Ph. asperulata* (A. Adams) applied by Satyamurti (1952) to his collection is a *nomen nudum* (vide Pilsbry, 1900, p. 61) and hence invalid. Schepman (1908, p. 15) also refers to it as not having been described. The description given by Satyamurti, however, agrees completely with the present species.

This appears to be the first record of the species from the Indian Coast.

*Measurements* (in mm.): Range (20 ex.): Height 3.95—6.20; Maximum Diameter 9.75—12.95; Minimum Diameter 8.25—10.70.
Acknowledgements

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Summary

In this paper a systematic study of the marine molluscs of the Order Archaeogastropoda found along the Coromandel Coast, Palk Strait and Gulf of Mannar upto Cape Comorin is presented.

The material used for the study comprises the two survey collections of Tamil Nadu Coast made in 1968 and 1975 and the entire unnamed collections from the same area in the Zoological Survey of India accumulated for over 60 years, from 1913 to 1966.

A total of 36 species, one subspecies and one variety under 24 genera spread over 8 families are dealt with.

Necessary keys to the identification of families, subfamilies and genera have been provided.

While the synonymy is made brief confining to only important references, the distribution is given as completely as possible for each species. Diagnostic shell characters for species are included whenever considered necessary.

Among the species dealt with, one is provided with a redescription, two are recorded for the first time from the Indian coast and four others are new records to the coast of mainland India. Correct identity is clarified by removing the prevailing confusion in respect of four species.

References


Knight, J. B., Cox, L.R., Myrakeen, A., Smith, A. G., Batten, R. L., Yochelson, E. L., Luddbrook, N. H., Yonge, C. M. and Moore, R. C. 1960, Treatise on Invertebrate Paleontology, Pt. 1, Mollusca 1: xiii+351 pp., 216 figs.—Lawrence, Kansas (Geological Society of America and the University of Kansas Press).


Pilsbry, H. A. 1889 in Tryon’s *Man. Conch.*, 11, 519 pp+67 pls. Philadelphia (Published by the Conchological Section).

Pilsbry, H. A. 1890 in Tryon’s *Man. Conch.*, 12, 324 pp+65 pls.—Philadelphia (Published by the Conchological Section).

Pilsbry, H. A. 1891 in Tryon’s *Man. Conch.*, 13, 195 pp+74 pls.—Philadelphia (Published by the Conchological Section).


SCHEPMAN, M. M. 1908. Siboga Exped., Prosobranchia, Leyden, 49a, (1) : 1—107, 9 pls., 3 text figs.


Explanation for plate

Fig. 1 & 1A *Diodora ticaonica* (Reeve), 1. Abapertural view of shell; 1A. Lateral view (showing part of the shell margin lost).

Fig. 2 & 2A. *Macrochisma canalisfera* (G. & H. Nevill) 2. Abapertural view of the Lectotype; 2A. Lateral view.

Fig. 3 & 3A. *Macrochisma canalisfera* (G. & H. Nevill), 3. Abapertural view of a shell from Galaxea Reef, Krusadai Id.; 3A. Lateral view.

Fig. 4 & 4A. *Euchelus circulatus* (Anton), 4. Abapertural view of a shell from Rameswaram; 4A. Apertural view.

Fig. 5 & 5A. *Gibbula (Cantharidella) blanfordiana* G. & H. Nevill, 5. Abapertural view of the type; 5A. Apertural view.

Fig. 6 & 6A. *Gibbula (Cantharidella) blanfordiana* G. & H. Nevill, 6. Abapertural view of the shell from near Krusadai Id.; 6A. Apertural view.

Fig. 7 & 7A. *Minolia casta* (G. & H. Nevill), 7. Abapertural view of the Lectotype; 7A. Apertural view.

Fig. 8 & 8A. *Minolia casta* (G. & H. Nevill), 8. Abapertural view of a shell from Tuticorin (Sta. 1j); 8A. Apertural view.

Fig. 9 & 9A. *Turbo spinosus* Gmelin 9. Abapertural view of a shell from Pearl Bank, Tuticorin; 9A. Apertural view.