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CONTRIBUTIONS TO THE MOLLUSCAN FAUNA— ARCHAEOGASTROPODA

by

A. S. RAJAGOPAL

&

H. P. MOOKHERJEE

Issued by the Director
Zoological Survey of India, Calcutta

**RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA**

MISCELLANEOUS PUBLICATION

OCCASIONAL PAPER NO. 12

**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



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MISCELLANEOUS PUBLICATION
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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. Gravelly'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 upto 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 (Ä.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 Ä. G. K. Menon in 1950, Dr. H. C. Ray in 1955, Dr. Ä. G. K. Menon and Shri G. Ramakrishna in 1957, Dr. Ä. 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., *Ängaria 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 *Liotia varicosa* (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 CALLIOSTOMATINAE

- 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 clanguloides* (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 LIOTIINAE

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* (Bröderip)

 † 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 | 5 |
| 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 tremmata serving as exhalent outlets | <i>Haliotidae</i> |
| Shell conical or cap-shaped | 3 |
| 3. Shell with apex turned backward and near posterior margin, a peritural margin arched. | <i>Phenacolepodidae</i> |
| 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 | <i>Fissurellidae</i> |
| Shell, iridescent to porcelaneous within; protoconch not evident; without perforation marginal notch | <i>Patellidae</i> |
| 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 | <i>Trochidae</i> |

- Operculum calcareous, spiral with central or eccentric nucleus. Shell small to large, few whorled, globose, turbiniform or ovate; peristome continuous 6
6. Shell solid, small to large few whorled with well developed sculpture, umbilicate, aperture nacreous within *Turbinidae*
- Shell few whorled, not nacreous but porcellaneous; generally no umbilicus 7
7. Shell ovate to rounded, without periostracum, smooth to finely spirally sculptured, rarely spirally ribbed. *Phasianellidae*
- 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 *Neritidae*

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

Haliotis varia Linnaeus, 1758, *Syst. Nat.*, Ed. X. : 780, sp.650, (Type-locality : not known); Reeve, 1846, *Conch. Icon.*, 3, *Haliotis*, sp. No.4, pl.2, fig. 4; Pilsbry, 1890, in Tryon's *Man. Conch.*, 12 : 95, pl.17, fig.91; Schepman, 1908, *Siboga Exped. Prosobranchia*, 49a(1): 76-77; Gravely, 1942, *Bull. Madras Govt. Mus. new ser. (Nat. Hist. Sec.)*, 5 (2) : 13, fig. 1b.

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 | <i>Emarginulinae</i> |
| Shell conical, exhalent perforation at or near apex | 2 |
| 2. Apex perforate; perforation truncate posteriorly and bounded by callus within | <i>Diodorinae.</i> |
| Exhalent perforation at or near apex, bordered within by a rounded callus | <i>Fissurellinae.</i> |

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 | <i>Emarginula</i> |
| Conical, surface with fine radiating ribs, apex not recurved; internal groove on anterior slope weak | <i>Clypidina</i> |

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,

Conch. Icon., 19 : *Emarginula*, sp. No. 24, pl. 4, fig. 24; Pilsbry, 1890, in Tryon's *Man. Conch.*, 12 : 267, pl. 28, fig. 11; Satyamurti, 1952, *Bull. Madras Govt. mus. new ser.* (Nat. Hist. Soc), 1 (2), pt. 6 : 33, pl. 1, fig. 12 (diagramatic).

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

Distribution : In India : Pamban & Shingle Is. *Elsewhere* : Philippines : Isle of Samaar : Catbalonga.

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).

Clypidina notata : A. Adams, 1851, *Proc. zool. Soc. Lond.*, pt. 19 : 89 (Type-locality : "West Indies" is erroneous).

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.

Subemarginula (Clypidina) notata : Melvill & Standen, 1898, *J. Conch.*, 9(3) : 79.

Material : 5 ex. (d.), sta. lj—shore colln., N. of Inspection Bungalow. Tuticorin, 24-4-1955 (Coll. H. C. Ray).

Distribution : In India : Bombay, Travancore, Tiruchendur and Madras. *Elsewhere* : Sri Lanka.

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 *Diodora*

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)

Glyphis funiculata : Pilsbry, 1890, in Tryon's *Man. Conch.*, 12 : 218-219, pl. 38, fig. 66.

Diodora funiculata : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1 (2), pt. 6 : 31; pl. I, fig. 8.

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, 13-3-1955 (*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)

Ftssurella ticaonica Reeve, 1850, *Conch. Icon.*, 6 : *Fissurella*, sp. No. 107, pl. 14, fig. 107 [Type-loeality : Island of Ticao, Phi[ippines (under stones at low water)].

Glyphis ticaonica : Pilsbry, 1890, in Tryon's *Man. Conch.*, 12 : 225, pl. 36, fig. 20.

Diodora ticaonica : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Soc.), 1 (2), pt. 6 : 32-33, pl. 1, fig. 11.

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.

Shell ovate light muddy brown in colour. Elevated moderately. Apex, very much inclined forwards. Anterior side short and concave; posterior side long extensive and curved down. Orifice placed at apex, anteriorly. Orifice elongately oblong. Shell reticulated with narrow radiating ridges intersected by raised concentric striae.

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

Macroschisma

Genus *Macroschisma* G. B. Sowerby, 1839

Type-Species : *Patella macroschisma* Solander

6. *Macroschisma canalifera* (G. & H. Nevill, 1869). (Pl. I, Figs. 3 & 3A)

Fissurella canalifera G. & H. Nevill, 1869, *J. Asiat Soc. Beng.*, 38 (2) : 163, pl. 17, fig. 13 (Type-locality : Southern Province of Ceylon).

Glyphis? canalifera : Pilsbry, 1890, in Tryon's *Man. Conch.*, 12: 228, pl. 41, fig. 37.

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

Material ; 1 ex. (w.), sta. ?—In dead corals, Pamban Beach. Feb. 1925 (coll. *B. Chopra* and *H. S. Rao*) 1 ex. (d.), sta. 2d—Galaxea Reef, Krusadai Id., 4-5-1955 (coll. *H. C. Ray*.)

Distribution : In India : Cape Comorin, Andaman and Nicobar Is. *Elsewhere*: Sri Lanka.

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.) :—	Lectotype (as given by the authors)	A shell from Sta. 2d- Galaxea Reef (as in the Material above)
Height	4.25	3.30
Maximum length	14.00	11.30
Width (Diameter)	7.50	5.65

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

Genus *Cellana* H. Adams, 1869.

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

7. *Cellana radiata radiata* (Born, 1778)

Patella radiata Born, 1778 * *Index Revum Nat. Caes. Vind.* : 443.

Patella radiata Born, 1780, *Test. Mus. Caes. Vindob.* : 425, pl.18, fig.10, (Type-locality : "in Africa, statius Müller; in Indiis, Davila").

Patella rota : Gmelin, 1791. *Syst. Nat.*, Ed. XIII, 1(6) : 3720, sp. 145.

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 : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1(2), pt. 6: 35, pl. 1, figs. 14a &b.

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.

Sta. 14—Shore colln. from a rock, Cape Comorin. 24-2-1968 (Coll. *A. S. Rajagopal*); 12 ex. (w.), Sta. 2—Shore colln., Mahabalipuram, N. of Madras, 26-1-1975; 58 ex. (w.) Sta. 3—Shore colln., Kovelong, N. of Madras, 28-1-1975; 15 ex. (w.) & 10 ex. (d.), Sta. 5—Shore colln., CMFRI. Mandapam Camp to Mandapam, 31-1-1975; 2 ex. (w.) & 2 ex. (d.), Sta. 12—Shore colln., N. of Fort, Tranquebar. 12-2-1975; 32 ex. (w.) Sta. 13—Shore colln. 0.4 km (2 furlongs) N. of Fort, Tranquebar, 13-2-1975; 13 ex. (w.) Sta. 16—Shore colln., N. of jetty upto Solathandakuppam vill., Pondicherry, 17-2-1975 (Coll. *A. S. Rajagopal & H. P. Mookherjee*),

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 subfamiliese :

- | | |
|--|-------------------|
| 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 braching spines; umbilicus wide; aperture nacreous within; operculum horny, thin | <i>Angariinae</i> |
| Shell medium sized, mostly lenticular, umbilicus partly or entirely filled by callus pad | <i>Umboniinae</i> |

- | | |
|--|--------------------------|
| 3. Mostly openly umbilicate shells | 4 |
| Shells narrowly umbilicate or umbilicus lacking | 6 |
| 4. Aperture more or less circular | <i>Solariellinae</i> |
| Peristome interrupted | 5 |
| 5. Outer lip strongly prosocline i.e. growth lines inclined adapically or leaning forward | <i>Gibbulinae</i> |
| Outer lip not strongly prosocline i.e. growth lines not leaning forward | <i>Margaritinae</i> |
| 6. Littoriniform, turbiniform or conical shells of small or medium size, lacking in umbilicus with few exceptions; Oranament predominantly spiral or smooth; Outer lip strongly prosocline i.e. growth lines inclined adapically and columellar lip with one or more teeth in many genera Monodontinae Conical or turbiniform shells, normally umbilicate or umbilicus lacking | 7 |
| 7. Shell mostly medium to large size, many with flattened base; base not excalvated 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 | <i>Calliostomatinae.</i> |
| 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. | <i>Trochinae.</i> |

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

Euchelus.

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.

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

Euchelys proximus : A. Adams, 1854, *Proc. zool. Soc. Lond.*, 22 : 316.

Euchelus indicus : A. Adams, *Proc. zool. Soc. Lond.*, 22 : 316.

Euchelus asper : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 431, pl.38, figs.13-14; Gravely, 1942, *Bull. Madras Govt. Mus. new ser. (Nat. Hist. Sec.)*, 5 (2) : 15 fig. 1f.

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.

Material : 2 ex. (w.), Sta. 13-Madras (Coll.?) 2 ex. (d.), Sta. 1k—Rocky beach of Cape Comorin, 24-5-1955 (Coll. H. C. Ray); 1 ex. (d.), 2—Galaxea reef, Ktusadai Id., 12 kms. E. of Mandapam, 21-2-1962 (Coll. V K. Premkumar and P. K. Chakraborty); 2 ex. (d.), Sta. 4-Bottom trawl, Coastal waters of Madras on board "Chota Investigator" 6-7 fms., 29-1-1975; 1 ex. (d.), Sta. 5—Shore colln. from CMFRI. Mandapam Camp to Mandapam jetty, 31-1-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

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).

Manodonta tricarinate Lamarck, 1822*, *Hist. nat. des Anim. sans vert.* Ed. I, 7:36, sp. No. 16 (Type-Localities : ?); Deshayes, 1843, *Hist. nat. des Anim. sans Vert.*, Ed.2, 9 : 180, sp. No. 16.

* 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.

Euchelus asper var. *tricarinata* : Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 5(2) : 15.

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*.

Material : 1 ex. (w.) Sta. 14.—Madras (Coll. ?); 18 ex. (d.), Sta. 2c—Shingle Id., 2 km. E. of Krusadai Id., 3-5-1955; 2 ex. (d.) Sta. 3b—Rocky shore of Gulf of Mannar, S. of Quarantine Camp, Mandapam, 11-5-1955; 6 ex. (d.) Sta. 1k—Rocky beach at Cape Comorin, 24-5-1955 (Coll. *H. C. Ray*); 3 ex. (d.) Sta. 12—Shore colln., Hare Id., off Tuticorin, 22-2-1968; 5 ex. (d.) Sta. 13—Shore coll., Vanthivu Id., off Tuticorin, 23-2-1968 (Coll. *A. S. Rajagopal*); 1 ex. (d.), Sta. 4—Bottom trawl, Coastal waters of Madras N. of Harbour, on board "Chota Investigator", 6-7-fms: 29-1-1975 (Coll. *A.S.Rajagopal & H. P. Mookherjee*).

Distribution : In India : Kutch, Bombay, Bimlipatam. *Elsewhere* : Indian Ocean.

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.

Measurements : (in mm.) Range (14 ex.) : Height 6.65-20.15; Maximum Diameter 8.15-21.10 Minimum Diameter 6.85-17.25.

10. *Euchelus horridus* (Philippi, 1846—1855)

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

Euchelus horridus : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 433, pl.37, fig. 17.; Melvill and Standen, 1898, *J. Conch.*, 9 : 78.

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*).

Distribution : In India : Bombay, Tuticorin, Ganjam (Orissa). *Elsewhere* : Mediterranean; Indo-Pacific.

* 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).

Trochus circulatus : Philippi, 1846 (—1855), *Conchyl. Cab.*, 2 (2 & 3), sp. 342 : 264-265, pl. 39, fig. 4.

Euchelus circulatus : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 432, pl. 37, fig. 16; Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 5(2) : 15 & 16; Satyamurti; 1952, *Bull. Madras. Govt Mus. new Ser.* (Nat. Hist. Sec.), 1 (2), pl. 6 : 39-40.

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

Material : 2 ex. (d.), sta. 6—Shore colln. at low tide, Rameswaram, 1-2-1975, (Coll. A. S. Rajagopal & H. P. Mookherjee).

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.

Masurements : (in mm.) : Range (2 ex.) : Height 8.40—11.35; Maximum Diameter : 8.35-11.15, Minimum Diameter : 7.75-10.00

12. *Euchelus attatus* (Gmelin, 1791)

Turbo atratus Gmelin, 1791. *Syst. Nat.* Ed. XIII 1(6) : 3601, sp. 53 (Type-locality : Nicobar Is.).

Euchelus atratus : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 439-440, pl. 38, fig. 22.; Melvill & Standen, 1898, *J. Conch.*, 9 (3) : 78; Schepman, 1908, *Siboga Exped. Prosobranchia*, 49a (1) : 70.; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.) 1 (2), pt. 6 : 40.

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)

Turbo distortus : Linnaeus, 1758, *Syst. Nat.*, Ed. X : 764, sp. 547 (Type-locality : not known).

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

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

* The date of publication determined according to : Sherborn, C. D. and Woodward, B. B. 1901-*Proc. Malac. Soc. Lond.*, 4 (5) 216-219

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.

Angaria plicata : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 1 (2), pt. 6 : 49, pl. 2, figs. 12a & 12b.

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. (1½ miles) E, of Krusadai, 3-5-1955; 1 ex. (d.), Sta. 2f—Shore of Rameswaram, 6-5-1955 (Coll. H. C. Ray).

Distribution ; In India : Nicobar Is. *Elsewhere* : Sri Lanka, Indian Ocean.

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 they still retain the characteristic crimson red colour.

Shell solid, rugged, heavy, spire depressed-turbinata. 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.

Calliostoma interruptum : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 358, pl. 17, figs. 21, 22; Melvill & Standen, 1898, *J. Conch*, 9 : 77.

Cantharidus (Jujubinus) interruptus : Satyamurti, (in part) 1952, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 1(2), pt. 6 : 42, pl. 2, fig. 3.

Material : 2 ex. (d.), Sta. 1c—Shore about 2.4 kms. (1½ miles) S. of Inspection Bunglow, Tuticorin, 16-4-1955; 7 ex. (d.) Sta. 1j—Shore colln, N. of Inspection Bunglow, Tuticorin, 24-4-1955 (Coll. *H. C. Ray*). 15 ex. (d.), Sta. 11—Shore colln. in front of Circuit House, Tuticorin; 21-2-1968; 5 ex. (d.) Sta. 16—Shore colln. near Madras State Fisheries Extn. Unit, Tuticorin 25-2-1968 (Coll. *A. S. Rajagopal*) 35 ex. (d.), Sta. 6—Shore colln., Rameswaram, 1-2-1975 (Coll. *A. S. Rajagopal & H. P. Mookherjee*).

Distribution : In India : Pamban, Madras. *Elsewhere* : Sri Lanka.

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

low water); Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 218-219, pl. 37, fig. 32., Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 1 (2): pt. 6 : 42, pl. 2, fig. 2.

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

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

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).

Shell tiny, thick, conoidal and narrowly deeply umbilicate. Shell faded pink in colour mottled with radiating brown markings. Spirally strongly lirate. Body-whorl angulate in the middle, a little convex ventrally. Columella oblique, ending in tiny denticle.

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

Calliostoma

Genus *Calliostoma* Swainson, 1840

Type-species : *Trochus conulus* Linnaeus

16. *Calliostoma tranquebarica* (Röding, 1798)

Trochus tranquebaricus Röding, 1798, *Mus. Bolt.* : 83, No. 1084 (Type-locality: Tranquebar); Philippi, 1846 (—1855),* *Conchyl. Cab.*, 2 (2 & 3) sp. 62 : 65-66, pl. 13, fig. 10; Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 308-309, pl. 98, fig. 1.

Calliostoma tranquebaricum : Pilsbry 1889, in Tryon's *Man. Conch.*, 11 : 388, pl. 17, figs. 17, 18.

Calliostoma tranquebarica : Gravely, 1942, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 5(2) : 14, fig. 1 h.

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

Distribution : In India: Pamban, Tranquebar, Pondicherry, Madras, Visakhapatnam, Puri. *Elsewhere* : Sri Lanka, Indian Ocean.

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

Shell conical, with pointed apex, non-umbilicately strong distinct, double spiral ridge present above suture in each whorl. Body-whorl with sharply languated periphery. Base flat, feebly spirally ridged. Columella smooth, arcuate. Aperture rhomboidal, pearly inside.

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 1791

Trochus radiatus Gmelin, 1791, *Syst. Nat.*, Ed. XIII, 1 (6) : 3572, sp. 33 (Type-locality : erroneously stated as "America australi"); Philippi, 1846 (—1855)*, *Conchyl. Cab*, 2 (2 & 3), sp. 43 : 46-47, pl. 10, figs. 5-8; Reeve, 1861, *Conch. Icon.*, 13 : *Trochus*, sp. No. 80, pl. 14, fig. 80.; Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 304-305, pl. 97, fig. 1; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1 (2), pt. 6 : 45, pl. 2, figs. 6a & 6b.

Trochus (Infundibulum) radiatus : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 37, pl. 8, figs. 88-93; Ray, 1948, *Rec. Indian Mus.*, 46 : 90.

Polydonta (Carinidea) radiata : Melvill & Standen, 1898, *J. Conch.*, 9 : 77.

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

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

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. (1½ 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-Glaxea 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. Chakarvorty*); 24 ex. (d.). Sta. 12-Shore colln., 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*).

Distribution : In India : Bombay, Devgarh, Cape Comorin, Tuticorin, Pamban, Krusadai Id., Shingle Id., Laksha Dwip, Andamau and Nicobar Is. *Elsewhere* : Red Sea; Indo-Pacific : Madagascar; Sri Lanka; Singapore.

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.

Trochus stellatus Gmelin (not Reeve, 1861), 1791, *Syst. Nat.*, Ed. XIII, 1 (6) : 3571, sp. 26 (Type-locality : India); Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.*

(Nat. Hist. Sec.), 5 (2) : 15; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1 (2), pt. 6 : 45, pl. 2, figs. 7a & 7b.

Trochus stellaris : Röding, 1798, *Mus. Bolt.*, : 81, No. 1029.

Trochus incrassatus : Reeve, 1861, *Conch. Icon.*, 13 : *Trochus*, sp. No. 77, pl. 13, fig. 77.; Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 113-114, pl. 37, fig. 1, Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 26-27, pl. 6, figs. 48-50.

Material : 1 ex. (d.), Sta. ?—Krusadai Id., Gulf of Mannar, March, 1950 (Coll. S. L. Hora & A. G. K. Menon); 1 ex. (d.), Sta. 1k-Rocky Comorin, 24-5-1955 (Coll. H. C. Ray); 1 ex. (d.), Sta. 13-Shore colln. beach, Cape Vanthivu Id., off Tuticorin, 23-2-1968 (Coll. A. S. Rajagopal); 1 ex. (d.), Sta. 7-Shore colln. Palk Strait, Mandapam Camp, 3-2-1975 (Coll. A. S. Rajagopal and H. P. Mookherjee).

Distribution : In India : S. India, Andamans. *Elsewhere* : Sri Lanka, Maldives, Seychelles.

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 tentorium Gmelin, 1791, *Syst. Nat.*, Ed. XIII, 1(6) : 3571, sp. 24 (Type locality : India); Reeve, 1861, *Conch. Icon.*, 13 : *Trochus* sp. No. 14, pl. 3, fig. 14.; Fischer 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 103, pl. 29, fig. 1b.; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1 (2), pt. 6 : 46, pl. 2, fig. 8.

Trochus tcostatus : Gmelin, 1791, *Syst. Nat.*, Ed. XIII, 1(6) : 3571, sp. 28.

Trochus tentoralis : Röding, 1798, *Mus. Bolt.*, : 81, No. 1055.

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

Polydonta maculata Var.: Melvill & Standen, 1898, *J. Conch.*, 9: 77.

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 pustulosus Philippi, 1849, *Zeitschr. Malak.*, : 188 (Type-locality: Not known; "Vidi in coll. Hanleyana' "); Philippi (not Reeve, 1861), 1846(—1855)*, *Conchyl. Cab.*, 2 (2 & 3), sp. 397 : 305, pl. 44, fig. 6; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 1 (2), pt. 6 : 46, pl. 2, fig. 9.

Trochus crebrigranatus : Reeve, 1861, *Conch. Icon.*, 13 : *Trochus*, sp. No. 89, pl. 15 fig. 89; Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar, Trochus* etc.) : 307, pl. 97, fig. 3; Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 33, pl. 6, figs. 56, 58 & 59.

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

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

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.

Trochus (Clanculus) clanguloides : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11; 65-66, pl.10, figs.10, 11.

Clanculus clanguloides : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec), 1(2) pt.6 : 43 pl.2, figs.4a & 4b (in part).

Satyamurti (1952) has merged *stigmatarius* 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. (1½ miles) E. of Krusadai, 3-5-1955 (coll. H. C. Ray); 3 ex. (d.), Sta. 12—Shore colln.. Haru 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 vestiarius* Linnaeus.

22. *Umbonium vestiarius* (Linnaeus, 1758).

Trochus vestiarius Linnaeus, 1758, *Syst. Nat.*, Ed.X : 758, sp.515 (Type-locality: unspecified).

Umbonium vestiarius : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 450-451' pl.58, figs.1-8; Melvill & Standen, 1898, *J.Conch.*, 9 : 77.; Gravely, 1942, *Bull. Madras Govt, Mus. new Ser.* (Nat. Hist. Sec.), 5(2) : 16-17, fig.li.; Ray, 1948, *Rec. Indian Mus.*, 46 : 91-92, Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser* (Nat.-Hist. Sec.), 1(2), pt.6 :47-48, pl.2, figs.11a - 11e.

Material : 3 ex. (w.), Sta. 3b—Rocky shore of Gulf of Mannar, S. of Quarantine Camp, Mandapam, 11-5-1955 (Coll. *H. C.Ray*); 6 ex. (d.). Sta. ?—Sea shore 4 km. ($2\frac{1}{2}$ miles) S. E. of MBS. Porto Novo, 25-1-1957; 4 ex. (d.) Sta. ?—Sea coast near the mouth of Araselar, 1.6 km. (1 mile) E. of Madadi, Karaikal 5-2-1957 (Coll. *A.G.K. Menon & Ramkrishna*); 7 ex. (w.), Sta. 2—Pudupettai, 2.4 km. ($1\frac{1}{2}$ miles) N. of MBS. Porto Novo., 6-5-1960; 25 ex. (w.) Sta. 2—Pudupettai, 2.4 km. ($1\frac{1}{2}$ miles) N. of M.B.S., Porto Novo, 7-5-1960; 62 ex. (w.), Sta. 2—Vellangirayan Pettai, 4.8 kms (3 miles) N. of M.B.S., Porto Novo, 7-5-1960; 102 ex. (w.), Sta. 2—Sea shore, Porto Novo, 8-5-1960; 171 ex. (w.), Sta. 2—Pudupettai, 2.4 kms. ($1\frac{1}{2}$ miles) N. of M.B.S., Porto Novo, 13-5-1960 (Coll. *Dr. A. Daniel*); 1 ex. (d.), Sta. 3—Vellar river bank in front of M.B.S., Porto Novo, 11-2-1968; 6 ex. (d.), Sta. 7—Shore colln., Point Calimere, 16-2-1968; 3 ex. (d.), Sta. 8—Shore colln., Agastiampalli, 17-2-1968; 44 ex. (d.), Sta. 11—Shore colln., in front of Circuit House, Tuticorin, 21-2-1968; 7 ex. (d.), Sta. 12—Shore colln., Hare Id., off Tuticorin, 22-2-1968; 17 ex. (d.), Sta. 13—Shore colln., Vanthivu Id., off Tuticorin, 23-2-1968; 37 ex. (d.), Sta. 16—Shore colln., near Madras State Fisheries Extn. Unit., Tuticorin, 25-2-1968; (Coll. *A. S. Rajagopal*); 27 ex. (d.), Sta. 5—Shore colln.. CMFRI. Mandapam Camp to Mandapam, 31-1-1975; 1 ex. (d.), Sta. 6—Shore colln., in low tide, Rameswaram, 1-2-1975 25ex. (d.), Sta. 11—Shore colln., opposite Fort to the mouth of Uppanar, Tranquebar, 11-2-1975 1 ex. (D.), Sta. 14—Shore ecolln., beyond Fishermen's Vill., N. of Fort, Tranquebar, 14-2-1975 1 ex. (d.), Sta. 18—Shore colln., upto Virumpattinam Vill., 4 km. S. of Jetty, Pondicherry, 19-2-1975. (Coll. *A. S. Rajagopal & H. P. Mookherjee*).

Distribution : In India ; Bombay, Bassein, Goa, Tuticorin, Krusadai 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)

Trochus calliferus Lamarck, 1822*, *Hist. nat. des Anim. sans Vert.*, Ed.I, 7 : 27, sp. No.59 (Type-locality : not known); Philippi, 1846(-1855)†, *Conchyl. Cab.*, 2 (2 & 3), sp.255 : 206-207, pl.30, fig.13.; Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 257, pl.86, fig.3.

Trochus callosus : Wood, 1856, *Index Test. Suppl.*, : 221, pl.5, fig.33.

Monilea callifera : Chenu, 1859, *Man. de Conchyl.*, 1 : 362, fig. 2685.; Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 247-248, pl.41, figs.1-5.

Material : 1 ex. (d.), Sta. 7—Shore colln., Palk strait, Mandapam Camp to Mandapam, 3-2-1975 (Coll. *A.S. Rajagopal & H.P. Mookherjee*).

Distribution : In India : Andaman Is. *Elsewhere* : Sri Lanka, Burma:Arakan, Indonesia : Sumatra, Philippines and New Caledonia⁴ Australia.

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 liriate nature prominent on rounded body-whorl, though finely beaded striae appear faded. Aperture rounded-quadrate. 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 SOLARIELLINAЕ

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

Periostracum marked with spots and stripes of color

Minolia.

* Not seen in the original

† Vide *Brit. Mus. Cat.* 3 : 1252.

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.

24. *Minolia casta* (G. & H. Nevill, 1874)

(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).

Minolia casta : Pilsbry, 1889, in Tryon's *Man. Conch.*, 11 : 266-267, pl.60, figs. 21,22.

Material: 6ex. (d.), Sta.1j—(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 (in mm.):	Lectotype (as given by authors), Photographed,	A shell from Tuticorin as in Materail (1) above (Photographed).	Range (12 exs.)
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 *Astracinae*, *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 *Turbininae*.
- Shells relatively small to medium size, operculum oval or chitinous within, not heavy 2
2. Shell conical with more or less carinate periphery; base flattened; operculum most commonly oval *Astracinae*.
- 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 *Liotiinae*.

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

Astraea (Astralium)

Genus *Astraea* (Bolten, Röding, 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,

Calcar semicostatus : Fischer, 1880, in Kiener's *Coq. Viv.*, (Gen. *Calcar*, *Trochus* etc.) : 35-36, pl.38, fig.1.

* The date of publication determined according to : Sherborn, C.D. and Woodward, B. B. 1901. *Proc. malac. Soc. Lond.*, 4(5), pp.216-219.

Astrallium semicostatum : Tryon, 1888, *Man. Conch.*, 10 : 237-238, pl.63, fig.15-18

Astraea semicostata : Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1(2), pt.6 : 53 pl3, fig.4a & 4b.

Material : 3 ex. (d.), Sta. ?—Krusadai Id., Gulf of Mannar, March, 1950 (coll. S. L. Hora & A.G.K. Menon); 1 ex. (d.), Sta. 1c—Shore about 2.4 kms. (1½ miles) S. of Inspection Bungalow, Tuticorin, 16-4-1955; 4 ex. (d.), Sta. 2c—Shingle Id., 2.4 kms. (1½ miles) E. of Krusadai Id., 3-5-1955; 1 ex. (d.) Sta. 2d—Galaxea reef, 4-5-1955 (Coll. H.C. H. C. Ray); 3 ex. (d.), Sta. 12—Shore colln. Hare Id., off Tuticorin, 22-2-1968; 4 ex. (d.), Sta. 13—Shore colln., Vanthivu Id., off Tuticorin, 23-2-1968 (coll. A. S. Rajagopal).

Distribution : In India : Kathiawar, Bombay, Andamans. *Elsewhere* : Indian Ocean.

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

Liotia.

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 Corriegedor, Philippines), Reeve, 1843, *Conch. Icon.*, 1 : *Delphinula*, sp. No.12, pl.3, figs.12a & b.

Liotia varicosa : Melvill & Standen, 1898, *J. Conch.* 9 : 78; Schepman, 1908 *Siboga Exped. Prosobranchia*, 49a (1) : 33-34.

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* : Corriegedor 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*).

Distribution: In India : Andaman and Nicobar Is. *Elsewhere* : Tonga Tabu, Vinikoro and New Caledonia.

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 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

Turbo petholatus Linnaeus, 1758, *Syst. Nat.*, Ed.X: 762, sp. 533 (Type-locality, erroneously stated as Barbados); Reeve, 1848, *Conch. Icon.*, 4 : *Turbo*, sp. No. 12: pl.3, fig 12; Tryon, 1888, *Man. Conch.*, 10 : 193, pl.40, fig.14.; Schepman, 1908, *Siboga Exped. Prosobranchiä*, 49a (1) : 23; Satyamurti, 1952, *Bull. Madras Govt. Mus. new ser.* (Nat. Hist. Sec), 1(2); pt.6 : 52-53, pl.3, fig 3.

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

Distribution: In India : Krusadai and Shingle Is., Andaman Is. *Elsewhere* : Red Sea, Indian Ocean to Philippines etc., and New Caledonia

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 shoreworn 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)

Lunatica brunea Röding, 1798, *Mus Bolt* : 102, No. 1315 (Type-locality : not known).

Turbo (*Senectus*) *intercostalis* : Schepman, 1908, *Siboga Exped. Prosobranchia*, 49a (1) : 24

Turbo (*Marmarostma*) *brunneus*: Adams & Leloup, 1938*, *Mem. Mus. r. Hist. nat. Belg.*, 2,(19) : 34-37, pl.3, figs.4a & b (shell).

Turbo brunneus : Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.) 5(2) : 17-18, fig. 2c; Ray, 1948, *Rec. Indian Mus.*, 46 : 92-93.

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*).

Distribution : In India : Bombay, Goa, Panjim, Andamans & Nicobars. *Elsewhere* : Gulf of Suez, Red Sea, Persian Gulf, Mekran Coast, Karachi, Mauritius, Madagascar, Sandwich Is. Maldives, Sri Lanka Akyab, Arakan, Maungmagan, Singapore, Indonesia, Australia, New Caledonia, Loyalty Is. Gulf of Siam, Annam, Philippines.

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, *concinus* 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. argyrostoma* Linnaeus, which is probably erroneous. (It may also be mentioned here that *T. margaritaceus* which is closely allied to *argyrostoma* 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; npn-umbilicate

Phasianella.

Genus *Phasianella* Lamarck, 1804Type-species : *Buccinum australe* Gmelin.30. *Phasianella nivosa* Reeve, 1862

Phasianella nivosa Reeve, 1862, *Conch. Icon.*, 13 : *Phasianella*, sp. No 8, pl.4, figs. 8a, b & c (Type-locality : ; Sri Lanka Satyamurti, 1952, *Bull. Madras Govt. Mus new Ser.* (Nat. Hist. Sec.), 1(2), pt.6 : 54, pl.3, fig. 5.

Phasianella (Orthomesus) variegata : Mevill & Standen, 1898, *J. Conch.*, 9 : 77.

We consider this to be distinct from *P. variegata* and Lamarck 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 (1½ 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, its 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 sub-sutural row of spines Umbilicus closed. Labial area smooth

Clithon.

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

Neritina.

Genus *Nerita* Adanson, 1757

Subgenus *Theliostyla* Mörch, 1852

Type-species : *Nerita albicilla* Linnaeus.

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

Nerita albicilla Linnaeus, 1758, *Syst. Nat.*, Ed.X : 778, sp.640 (Type-locality : "ad Hitoe"); Reeve, 1855, *Conch. Icon.*, 9 : *Nerita*, sp.No.64, pl.15, figs.64 (a to d) (nicely figured); Tryon, 1888, *Man. Conch.*, 10 : 19, pl.2, figs.21-26.; Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 5(2) : 18, fig.1j.; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), (12), pt.6 : 58, pl.3, fig.6.

Nerita (*Theliostyla*) *albicilla* : Schepman, 1908, *Siboga Exped. Prosobranchia*, 49a (1) : 3 - 4.

Material ; 1 ex. (w.), Sta.?—N. of Pamban, March, 1926 (coll. H. S. Rao); 1 ex. (w.), Sta.?—Krusadai Id., March, 1950 (coll. S. L. Hora & A. G. K. Menon); 3 ex. (w.), Sta.?—Galaxea reef, Krusadai Id., 2-5-1955; 3 ex. (d.), Sta. 2c—Shingle Id. 2.4 Km. (1½ miles) E. of Krusadai, 3-5-1955; 2ex. (w.); Sta. 29—Pulli Id., about 8 Km. (5 miles) from Krusadai, Id., 7-5-1955 (Coll. H. C. Roy); 15 ex. (d.), Sta. 12—Shore colln. Hare Id. off Tuticorin, 22-2-1968; 7 ex. (d.), Sta. 13—Shore colln., Vanthivus Id off Tuticorin, 23-2-1968; 8 ex. (w.), Sta. 14—From a rock of Cape Comorin, 24-2-1968 (Coll. A. S. Rajagopal); 4 ex. (d.), Sta. 7—Shore colln., Palk Strait, Mandapam Camp, 3-2-1975 3 ex. (w.), Sta. 12—Shore colln., N. of Fort, Tranquebar, 12-2-1975 (Coll. A. S. Rajagopal & H. P. Mookherjee).

Distribution : In India : Madras, Tranquebar, Porto Novo, Krusadai Id., Pamban, Tuticorin, Cape Comorin. *Elsewhere* : Red Sea, Indian Ocean : Natal, Mauritius, Sri. Lanka, Burma : Akyab; Maungmagan, Singapore; Indonesia (several localities) to Philippines; Loyalty & Fiji Is.

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 chamaeleon Linnaeus, 1758, *Syst. Nat.* Ed. X : 779, sp. 644 (Type locality: "in Asiae ad Bandam"); Tryon, 1888, *Man. Conch.*, 10: 20, pl. 2, figs. 31-36, Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1(2), pt. 6:58, pl. 3, figs. 7a & 7b.

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

Nerita (Theliostyla) chamaeleon: Schepman., 1908, *Siboga Exped. Prosobranchia* 49a (1) : 4.

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.

Nerita polita Linnaeus, 1758, *Syst. Nat.*, Ed.X: 778, sp. 638 (Type-locality: "in Asiae"); Reeve, 1855, *Conch. Icon.*, 9: *Nerita*, sp. No. 2, pl. 1, figs. 2(a to d); Tryon, 1888, *Man. Conch.*, 10: 30, pl. 6 figs. 7-11; Melvill & Standen, 1898; *J. Conch.* 9:76; Schepman., 1908, *Siboga Exped. Prosobranchia*, 49a (1) : 7; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser. (Nat. Hist. Sec.)*, 1(2), pt.,6 : 59, pl.3, figs. 8a & 8b.

Material : 2 ex. (d.) Sta. 12—Shore colln. Hare Id., off Tuticorin 22-2-1968, (coll. A. S. Rajagopal).

Distribution : In India : Madras, Porto Novo, Pulli Reef, Krusadai & Shingle Is. Andaman & Nicobar Is. *Elsewhere* : Red Sea, Indian Ocean, Mauritius, Burma : Maungmagan and Mergui Archipelago, Indonesia to Philippines, Loyalty Is.; Polynesia.

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 flush 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

Nerita georgina Recluz 1841, *Revue zool. Soc. Cuvier*: 180 (Type-locality : New Holland: Port of King George); Reeve, 1855, *Conch. Icon.*, 9:*Nerita* sp.No.74,pl.17, figs.74 a & b. Tryon, 1888, *Man. Conch.*, 10 : 33, pl.7, fig.31.

Material : 1 ex. (w.), Sta. 3b—Rocky shore of Gulf of Mannar, S. of Quarantine Camp, Mandapam, 11-5-1955, (Coll. H. C. Ray); 1 ex. (w.), Sta. 12—Shore colln.. N. of the Fort, Tranquebar, 12-2-1975 (Coll. A.S. Rajagopal and H.P. Mookherjee).

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. Interstices 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

Nerita plicata Linnaeus, 1758, *Syst. Nat.*, Ed.X : 779, sp. 642 (Type-locality : not known); Reeve, 1855, *Conch. Icon.*, 9 : *Nerita*, sp. No. 42, pl. 9, figs. 42(a, b, c & d); Tryon, 1888, *Man. Conch.*, 10 : 27, pl. 5, figs. 81-83; Satyamurti, 1952, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 1(2), pt.6 : 59-60, pl.3, figs.9a & 9b.

Nerita (Peloroŋta) plicata: Schepman, 1908, *Siboga Exped. Prosobranchia*, 49a(1) : 6-7.

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 exerted. 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.

36. *Clithon oualaniensis* (Lesson, 1831).

Neritina oualaniensis Lesson, 1831*, *Voy. Coquillez ool.*, 2 : 379 (Type-locality Oulay ? in Sandwich Islands).

Neritina oualanensis : Reeve, 1856, *Conch. Icon.*, 9 : *Neritina*, sp. No.168, pl.3b, fig.168.

Neritina ualanensis : Tryon, 1888, *Man. Conch.* 10 : 41, pl.13, figs. 56-58.

Neritina mertoniana : Melvill & Standen, 1898, *J. Conch.*, 9 : 77.

Neritina (Smaragdia) oualaniensis : Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.), 5(2) : 18-19.

Clithon oualaniensis : Van Benthem Jutting, 1956, *Treubia*, 23(2) : 285-287.

Material : 36 ex. (w.), Sta. ?—Pamban backwater, 18-9-1925. (Coll. S. L. Hora); 750 ex. (w.), Sta. 3—Vellar river bank in front of MBS., Porto Novo, 11-2-1968 (Coll. A. S. Rajagopal); 2 ex. (d.), Sta. 6—Shore colln., at low tide, Rameswaram, 1-2-1975 ; 47 ex. (w.), Sta. 7—Shore colln., Palk Strait, Mandapam Camp, 3-2-1975 (coll. A. S. Rajagopal & H. P. Mookherjee).

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.

* Not seen in the original.

Genus *Neritina* Lamarck, 1816Subgenus *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)

Neritina crepidularia : Lamarck, 1822*, *Hist. Nat. Anim. s. Vert.*, 6(2) : 186; Reeve 1855, *Conch. Icon.*, 9 : *Neritina*, sp. No. 38, pl. 8, figs. 38a & b.; Tryon, 1888, *Man. Conch.* 10 : 77, pl. 23, figs. 95-99.; Gravely, 1942, *Bull. Madras Govt. Mus. new Ser.* (Nat. Hist. Sec.) 5(2) : 18-19.

Neritina cornucopia : Benson, 1836*, *J. Asiat. Soc. Beng.* 5 : 748.

Neritina exiltata : Recluz, 1850, *Journ. Conchyl.*, 1 : 65, pl. 3, fig. 3.

Neritina viloocea : Van Benthem Jutting, 1956, *Treubia*, 23(2) : 300-302.

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, 1891Type-species : *Scutella crenulata* Broderip.38. **Phenacolepas crenulata** (Broderip, 1834)

Scutella crenulata Broderip, 1834, *Proc. Zool. Soc. Lond.*, pt.2:48 (Type-locality: "ad isulam Anaan (Chain Island), S. Pacific.); Pilsbry, 1900, *Nautilus*, 14(6) : 61.

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. (1½ 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 muscle 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.

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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.

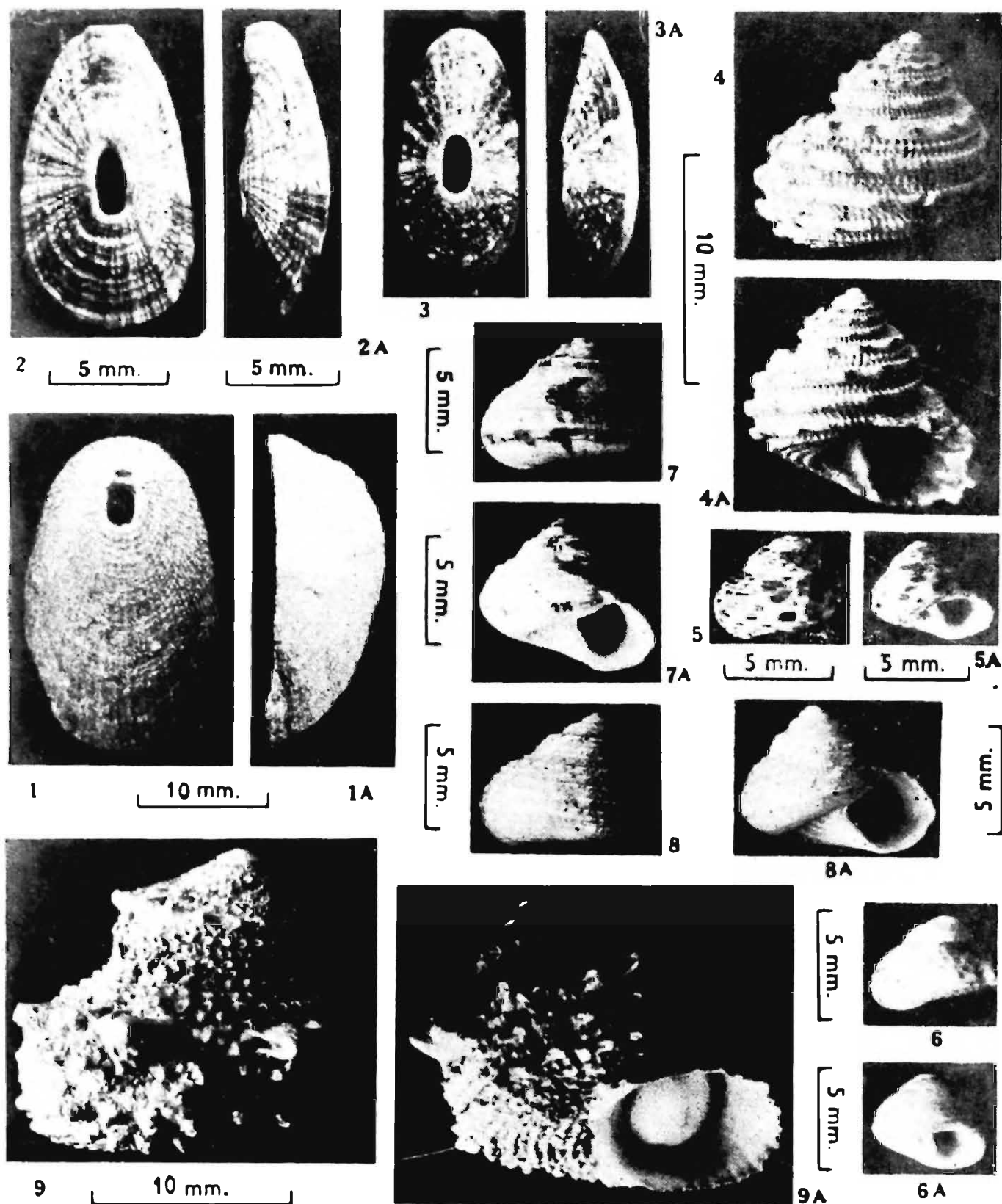
Among the species dealt with, one is provided with a redescription, two are recorded for the first time from the Indian coast and four others are new records to the coast of mainland India. Correct identity is clarified by removing the prevailing confusion in respect of four species.

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Explanation on the reverse

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

Fig. 3 & 3A. —*Macrochisma canalifera* (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. —*Mirolia 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.