

**OCCASIONAL PAPER NO 126**

# **Records of the Zoological Survey of India**

**Land Molluses of Andaman  
and Nicobar Islands.**

**N. V. Subba Rao  
S. C. Mitra**

**Zoological Survey of India**

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*By*

**N. V. SUBBA RAO**

*and*

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**Zoological Survey of India, New Alipur, Calcutta**



**सत्यमेव जयते**

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**CONTENTS**

INTRODUCTION	...	...	1
LIST OF LAND MOLLUSCS OCCURRING IN THE ISLANDS	...	...	3
KEY TO THE FAMILIES	...	...	7
SYSTEMATIC ACCOUNT	...	...	8
ENDEMISM AND SPECIES DIVERSITY	...	...	77
SUMMARY	...	...	78
ACKNOWLEDGEMENTS	...	...	79
NUMBER OF TOTAL ENDEMIC SPECIES	...	...	80
DISTRIBUTION & LATEST YEAR OF COLLECTION	...	...	80
REFERENCES	...	...	84

## INTRODUCTION

The first ever collection of molluscs from Nicobar islands was made by the staff attached to the Danish frigate "Galathea", commanded by H.S. Bille, in 1846 (from 5th January to 25th February). This was the first organised survey which collected specimens from Car Nicobar, Choura, Teressa, Kamorta and Nancouri islands. Stray shell collections were however, made earlier by the 'Moravian Brethren' who were there during 1768-1787 ( e.g. *Turbo foliaceus* Chemnitz, 1786).

In 1789 an old settlement (not penal) was established in the Andamans by Archibald Blair, which was turned into British Penal colony in 1858. With the establishment of this penal colony (New Settlement) by Warneford, many officers were posted at Port Blair. These officers had turned into naturalists and initiated systematic collection of fauna. Persons who paid particular attention to the land shells were mainly Col. J.C. Haughton, F. Stoliczka, and J. Woodmason. H.H. Godwin-Austen, who pioneered the studies on Indian land molluscs received large collections from his brother Mr. Harold Godwin-Austen, who after assuming the charge of Asstt. Commissioner of the islands, had visited many previously unexplored places. Collections made by another Asstt. Commissioner, Mr. F.A. de Roepstorff were also placed at H.H. Godwin-Austen's disposal by the widow of the former. Thus we find that majority of land molluscs were collected during the latter half of the last century.

These collections were identified intermittently by various malacologists of that period. First report of land molluscs of the islands was made by Benson, who in a series of reports (1860, 1861a, b, 1863a, b, c) described 16 new species from the Andaman islands. Tryon (1869) in his brief report published a list of land molluscs from the Andamans. Stolizka (1870), however critically reviewed the report and gave correct identification of the species listed by Tryon. Bill's (1870) account of his short trip of eight days to the New settlement at the Nancowry Harbour and Trinket Island included a brief comment on the collection of molluscs made by him (all marine) which were later studied by G. Nevill. The collections of land molluscs made by 'Galathea in 1846 were deposited in the Copenhagen Museum which were worked out after a long interval by Moerch. His two reports (1872, 1876), contained about 76 species including 15 new (many of which were however, subsequently synonymised). Godwin-Austen and Nevill's (1879) report included 2

species from these islands. In his contribution to Indian malacology Blanford, (1880) while dealing with molluscs from different parts of India, described three species of *Omphalotropis* from Andaman. He observed that the genus was almost totally insular in its known distribution and was especially common in the Mascarene islands and in Polynesia. Nevill (1881), while describing a new species from the Nicobar island, made some important remarks on the general distribution of land molluscs of these islands and its significance. Godwin-Austen's contributions included two short reports (1888 and 1893) with description of four new species and also an excellent assesment of the land molluscs of the Andaman and Nicobar islands in the year 1895. His account provided a complete list of land molluscs of these islands which included more than 150 species, wherein a large number of varieties were also figured. He also gave a critical account of the distribution of land molluscs in the islands. Preston (1908) described a new species of land mollusc.

In addition to the above mentioned specific works on molluscs of the Islands, Godwin-Austen's *Mollusca India* (1899-1910) and the *Fauna British India-Mollusca* series (Blanford & Godwin-Austen, 1908 ; Gude, 1914 and 1921 ) also included the land molluscs of these islands.

Andaman and Nicobar islands have a very distinct fauna of land molluscs which has very little in common with that of the Indian Mainland at the species level. Studies of insular fauna are significant since these always offer unique opportunities to study the conditions leading to species isolation and endemism.

Information on land molluscs of these islands was hitherto available in a scattered state as given above. The present report is in keeping with the longfelt necessity of having a consolidated document of land molluscs of these islands. Besides updating the nomenclature of various species it also provides for the first time a key to the identification of land molluscs of the Andaman and Nicobar islands. Ecological notes have also been added wherever possible.

The land molluscs of Andaman and Nicobar Islands were collected by different persons during different years. These fall under two distinct categories : 1. those collected by the European collectors during the period between 1850 and the early part of 1900, prior to the establishment of Zoological Survey of India. These collections are mostly labelled as 'Andamans' or 'Nicolbars' without further details ; and 2. those collected by the parties from ZSI, after 1916. The list of collectors and the years of collection are as given below :

Novara exped.	1858
J. Anderson	1870
F. Stoliczka	1872
J. Woodmason	1872
F. A. Roepstorff	1876
G. H. Booley	1908
H. S. Rao	1932
K. K. Tiwari	1959
A. Daniel	1966
B.K. Tikader & N.V Subba Rao	1971
A.G. K. Menon & A.S. Rajagopal	1972
K. V. Surya Rao	1974
S. S. Saha	1984

The classification followed here is that of Taylor and Sohl (1962).

### List of land molluscs of Andaman and Nicobar Islands.

Class GASTROPODA

Order ARCHAEOGASTROPODA

Family 1. HYDROCENIDAE

1. *Georissa Pyxis* (Benson, 1856) (A)

Family 2. HELICINIDAE

2. *Pleuropoma andamanica* (Benson, 1860) (A)
3. *P. dunkeri* (Zeilebor, 1847) (N)
4. *P. nicobarica* (Pfeiffer, 1847) (N)
5. *P. scrupula* (Benson, 1863) (A)
- 6\*. *P. rogersi* (Bourne, 1911) (A)
7. *Sulfurina behniana* (Pfeiffer, 1859) (N)
- 8.\* *S. bensoni* (Wagner, 1907) (N)
9. *S. zeilebori* (Pfeiffer, 1867) (N)

Order MESOGASTROPODA

Family 3. CYCLOPHORIDAE

10. *Cyclophorus (Glossostylus) charpentieri* Mousson Sub-sp. *nicobaricus* Moerch, 1872 (N)
11. *C. (Cyclohelix) foliaceus* (Pfeiffer, 1847) (N)

\* Species recorded in literature.

[A] From Andamans

[N] From Nicobars

12. *C. (Cyclohelix) leai* Tryon, 1869 (A)
13. *C. (Cyclohelix) crocatus* (Born, 1778) (N)
- 14.\* *C. (Cyclohelix) denselineatus* (Pfeiffer, 1852)
15. *C. (Cyclohelix) nicobaricus* (Pfeiffer, 1863) (N)
- 16.\* *C. Perdix* var. *roepstorffiana* Godwin-Austen, 1895 (N)
17. *Leptopoma (Trocholeptopoma) immaculata* Pfeiffer, 1847 (A & N)
18. *L. (Trocholeptopoma) roepstorffiana* Nevill, 1878 (A)
19. *Lagochilus galathea* Moerch, 1872 (N)
20. *L. roepstorfi* Moerch, 1876 (N)
- 21.\* *L. wuellerstorffiana* Zelebor, 1867 (N)
22. *L. polynema* (Moerch, 1876) (N)
23. *L. warnefordi* Nevill, 1876 (A)
- 24.\* *Cyathopoma natalicum* Godwin-Austen, 1895 (N)
- 25.\* *Cyathopoma tignarium* (Benson, 1863) (A)
26. *Alycaeus (.A) reinhardti* Moerch, 1872 (A & N)
- 27.\* *Chamalycaeus andamaniae* Benson, 1861 (A & N)
28. *C. busbyi* Godwin-Austen, 1893 (N)

#### Family 4. DIPLOMMATINIDAE

29. *Palaina nicobarica* (Godwin-Austen, 1886) (N)

#### Family 5. PUPINIDAE

30. *Pupina (Tylotoechus) nicobarica* Pfeiffer, 1852 (N)

#### Family 6. ASSIMINEIDAE

31. *Omphalotropis andersoni* Blanford, 1880 (A)
- 32.\* *O. brevis* Godwin-Austen, 1895 (N)
33. *O. distermina* Benson, 1168 (A)
- 34.\* *O. sordida* (Frauenfeld, 1863) (N)
35. *O. decussata* (Blanford, 1880) (A)
- 36.\* *Realia Pallida* Blanford, 1880 (A)
- 37.\* *Acmella mellilla* Godwin-Austen, 1895 (A)
38. *A. moreleti* Nevill, 1878 (N)
39. *A. roepstorffi* Nevill, 1878 (N)

### Order STYLOMMATOPHORA

#### Family 7. SUCCINEIDAE

40. *Hyalimax andamanica* Godwin-Austen, 1882 (A)
41. *H. reinhardti* Moerch, 1872 (N)
- 42.\* *Succinea vitrea* Pfeiffer, 1854 (A)

- 43.\* *S. ceylanica* Pfeiffer, 1854 (N)  
44. *Quickia gravelyi* subspecies *andamanensis* (Rao, 1924) (A)

## Family 8. CLAUSILIIDAE

45. *Acrophaedusa wuellerstorffi* (Zeilebor, 1867) (N)  
46. *Phaedusa corticina nicobarica* Gude, 1914 (N)

## Family 9. VALLONIIDAE

- 47.\* *Pupilsoma constrieta* Godwin-Austen, 1895 (A)

## Family 10. ACHATINIDAE

48. *Achatina (Lissachatina) fulica fulica* (Bowdich, 1822 (A & N)

## Family 11. SUBULINIDAE

49. *Lamellaxis gracile* (Hutton, 1894) (A & N)  
50. *Prosopeas haughtoni* Benson, 1863 (A)  
51. *P. roepstorfi* Moersch, 1876 (N)  
52.\* *P. achates* Moersch, 1875 (N)  
53. *P. walkeri* (Benson, 1860) (A)  
54. *Subulina octona* (Bruguiere, 1789) (A & N)

## Family 12. CHAROPIDAE

55. *Philalanka subbillirata* (Godwin-Austen, 1882) (A & N)  
56.\* *P. homfrayi* (Godwin-Austen, 1895) (A)

## Family 13. TROCHOMORPHIDAE

57. *Videna andamanica* Nevill, 1895 (A)  
58. *V. billeana* (Moersch, 1872) (N)  
59. *V. iopharynx* Moersch, 1876 (N)  
60.\* *V. lardea* Martens, 1864 (N)  
61. *V. pseudosanis* Fulton, 1897 (A)  
62. *V. sanis* (Benson, 1861) (A & N)  
63. *V. sulcipes* Moersch, 1872 (N)  
64.\* *V. frauenfeldi* (Zeilebor, 1876) (N)  
65.\* *V. bicolor* Martens, 1864 (N)  
66.\* *V. subniqritella* Beddome, 1891 (A)  
67. *V. trilineata* Moersch, 1876 (N)

## Family 14. ARIOPHANTIDAE

- 68.\* *Kaliella (?) kjellerupi* (Moersch, 1872) (N)  
69. *Macrochlamys aulopis* Benson, 1863 (A & N)

70. *M. choinix* Benson, 1961 (A)  
 71. *M. fordiana* Godwin-Austen, 1888 (A)  
 72. *M. exul* Theobald, 1864 (A)  
 73. *M. indica* Godwin-Austen, 1882 (A)  
 74. *M. Pseudaulopis* Godwin-Austen, 1888 (A)  
 75.\* *M. ? battimalvensis* Godwin-Austen, 1888 (N)  
 76. *M. pungis* Theobald, 1859 (A)  
 77. *M. stephus* Benson, 1861 (A)  
 78. *Rhysstopsis conferta* (pfeiffer, 1856) (A)  
 79. *Sitala attegaia* (Benson, 1859) (A & N)  
 80. *S. haroldi* Godwin-Austen, 1882 (A & N)  
 81. *S. denselirata* Preston, 1908 (A)

Family 15. HELICARIONIDAE

82. *Microcystina rinki* (Moerch, 1872) (N)  
 83. *M. moerchiana* Godwin-Austen, 1882 (N)

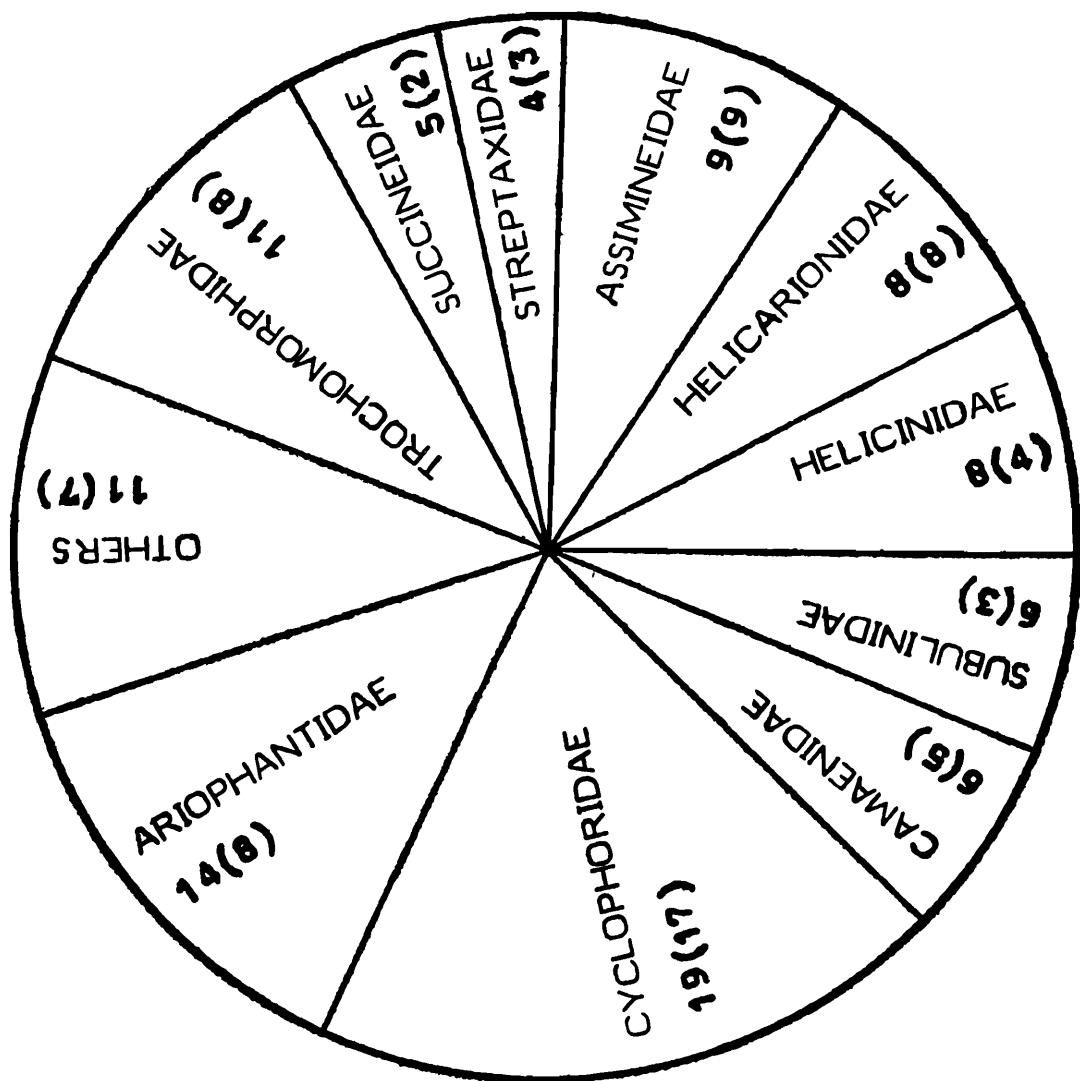


Fig. 1 : Proportionate representation of different families with respective number of species and endemic species (in brackets)

84. *M. warnefordi* Godwin-Austen, 1882 (A)  
 85.\* *M. harrietensis* Godwin-Austen, 1882 (A)  
 86.\* *M. stewarti* Blanford, 1904 (A)  
 87. *M. brunii* Moersch, 1872 (N)  
 88. *Satiella christinae* (Theobald, 1864) (A)  
 89. *Taphrospira bathycharax* (Benson, 1888) (A)

## Family 16. CAMAENIDAE

90. *Chloritis (Trichochloritis) hemiopta* (Benson, 1863) (A)  
 91.\* *C. helferi* (Benson, 1860) (A)  
 92.\* *C. wimberleyi* (Godwin-Austen, 1885) (N)  
 93. *Planispira trochalia* (Benson, 1861) (A)  
 94. *Oreobba codonodes* (Pfeiffer, 1846) (N)  
 95. *Amphidromus furcillatus andamanicus* (Hanley & Theobald, 1876 (A & N)

## Family 17. STREPTAXIDAE

96. *Haploptychius andamanicus* (Benson, 1860) (A)  
 97. *H. pfeifferi* (Zelebor, 1867) (A)  
 98. *Culella (Huttonella) bicolor* (Hutton, 1881) (A & N)  
 99. *Sinoennea moerchiana* (Nevill, 1881) (N)

## Order SOLEOLIFERA

## Family 18. VERONICELLIDAE

100. *Laevicaulis alte* (Ferussac, 1821) (A & N)  
 101.\* *Vaginulus giganteus* (Godwin-Austen, 1895) (A)

Key to the families of land molluscs of Andaman and Nicobar Islands.

- |  |     |                 |
|--|-----|-----------------|
| 1. Animal without a shell (external or internal),<br>tentacles contractile | ... | Veronicellidae  |
| Animal with a shell (external, rarely internal),<br>tentacles retractile   | ... | 2               |
| 2. Shell with an operculum   | ... | 3               |
| Shell without an operculum   | ... | 8               |
| 3. Shell higher than broad   | ... | 4               |
| Shell broader than high  | ... | 7               |
| 4. Shell smooth with peristomal canals                                     | ... | Pupinidae       |
| Shell sculptured, without peristomal canals                                | ... | 5               |
| 5. Shell cylindrical-turreted, with strong costulate<br>ribbings           | ... | Diplommatinidae |
| Shell ovately conical, without costulate ribbings                          | ... | 6               |

6. Shell imperforate, strongly Sculptured, operculum with a peg at the columellar side	...	Hydrocenidae
Shell perforate, weakly sculptured, operculum without any peg	...	Assimineidae
7. Umbilicus closed by a callus, aperture triangularish	...	Helicinidae
Umbilicus open, aperture circular	...	Cyclophoridae
8. Shell with simple peristome	...	9
Shell with strongly reflected peristome	...	15
9. Shell higher than broad, imperforate	...	10
Shell broader than high, perforate	...	12
10. Shell elongately turreted, spire longer than last whorl	...	Subulinidae
Shell oval or ovately conical, spire shorter than last whorl	...	11
11. Shell thick usually coloured, columella truncate below	...	Achatinidae
Shell thin, unicolourous, columella rounded below (except in <i>Hyalimax</i> , which has an interreal, plate-like shell)	...	Succineidae
12. Shell more or less widely umbilicate (except <i>Philalanka homfrayi</i> which is imperforate) animal without a caudal gland at the extremity of foot	...	13
Shell narrowly perforate, animal with a caudal gland at the extremity of foot	...	14
13. Shell with lirations, upto 6 mm. in diameter	...	Charopidae
Shell without lirations, above 6 mm. in diameter	...	Trochomorphidae
14. Shell thicker, peristome often thickened, dart sac large	...	Ariophantidae
Shell thinner, peristome not thickened ; dart sac usually lacking	...	Helicarionidae
15. Shell without apertural process	...	Camaenidae
shell with apertural process	...	16
16. Shell sinistral, with shallow, oblique suture, a clausilium is present	...	Clausiliidae
Shell dextral with impressed and more or less vertical suture, clausilium absent	...	Streptaxidae

### SYSTEMATIC ACCOUNT

Class GASTROPODA

Order ARCHAEOGASTROPODA

Family 1. HYDROCENIDAE

Shell small (not exceeding 25 mm. in height), conoid with spiral lirations, umbilicus obliterated by a smooth callus. Operculum cal-

careous with a basal nucleus and a peg at the columellar side (Bentham Jutting, 1948).

Snout broad and short, eyes on short peduncles. True tentacles absent. Sole of foot oval.

South and east Asia, various Pacific islands.

On ground, at damp situations, between vegetable debris and earth. Some found in caves (Bentham Jutting, 1948).

In India this family is represented by a single species, which is restricted to the Andamans.

### Genus *Georissa* Blanford, 1864

Shell small, thin, imperforate, aperture ovately semicircular, whorls convex, inner lip joined by a parietal callus.

S. E. Asia and Europe (Preston, 1915).

#### 1. *Georissa pyxis* (Benson, 1856) (Pl. I, fig. 1)

*Hydrocena pyxis* Benson, 1856, *Ann. Mag. nat. Hist.*, (2)17 : 232.

*Hydrocena (Georissa) pyxis* : Preston, 1915, *Fauna Brit. India*, Mollusca. Freshwater gastropoda & pelecypoda, p. 3.

*Material examined* : 100 exs., Andamans.

*Distribution* : India : Andamans. Elsewhere : Burma.

For Andamans it is a new record.

*Remarks* : Shell minute, ovately conical, imperforate, with rather strong spiral lirations ; whorls 4, convex. Aperture oblique, subcircular, peristome simple, margins joined by a parietal callus. Operculum with a short peg at the columellar side.

<i>Measurements</i> :	(in mm)	Height	Diameter	Height of aperture
(Average shell)		2.05	1.65	.9

### Family 2. HELICINIDAE

Shell small (not more than 6 mm. in height), lenticular, depressed to conically turbinate, broader than high with a flattened base, umbilicus closed by a callus. Aperture triangular or semioval, peristome usually simple, sometimes reflected or dilated at the base. Operculum calcareous, concentric or paucispiral, with a central or lateral nucleus.

Animal with a short snout. Eyes at the base of long tentacles, sole of foot long, undivided or tripartite.

Tropical Asia and America, New Guinea, Pacific Islands.

Mostly on ground, some found on trees.

In India this family is restricted to the Andaman and Nicobar islands where it is represented by two genera.

#### Key to the genera of Helicinidae

Peristome less reflected, operculum acutely angled above, nucleus lateral	...	<i>Pleuropoma</i>
Peristome more reflected, operculum not angled above, nucleus central	...	<i>Sulfurina</i>

#### Genus 2. *Pleuropoma* Mollendorff, 1893

Shell small (maximum 6 mm in height), depressedly conoid or lenticular, peristome slightly thickened, and a little reflected. Aperture triangular, acutely angled above. Operculum triangular with a lateral nucleus. Though these species were treated under *Aphanoconia* Wagner by Gude (1921) following Solem (1959) we give precedence to *Pleuropoma* Mollendorff.

Burma, India (Andaman and Nicobar Islands), Pacific islands, Malaysia, Philippines, New Guinea, S. China and Japan.

#### Key to the species of *Pleuropoma*

1. Shell with decussating sculpture.	...	2
Shell without decussating sculpture.	...	3
2. Shell without bands, usually exceeding 8 mm. in diameter.	...	<i>P. andamanica</i>
Shell with bands, usually below 8 mm. in diameter.	...	<i>P. nicobarica</i>
3. Shell with keeled periphery, usually exceeding 5 mm. in diameter.	...	<i>P. dunkeri</i>
Shell with rounded periphery, usually upto 5 mm. in diameter.	...	<i>P. scrupula</i>

#### 2. *Pleuropoma andamanica* (Benson, 1860)

(Pl. II, figs. 3 & 4)

*Helicina andamanica* Benson, 1860, *Ann. Mag. Nat. Hist.*, (3) 6 : 194.

*Helicina (Aphanoconia) andamanica* : Gude, 1921, *Fauna Brit. India*, Mollusca III : 366.

*Material examined* : 85 exs., Andaman islands ; 7 exs., Kondul, Nicobars ; 16 exs., Great Nicobar.

*Distribution* : Andaman and Nicobar islands. (Kondul, Gt. Nicobar).

*Remarks* : Shell small, lenticular, spire convexly conoid, with microscopic striae decussated by spiral markings ; yellowish white ; whorls  $4\frac{1}{2}$ , edged at the sutures, periphery strongly keeled. Aperture oblique, triangular, peristome slightly thickened, upper margin a little

curved, reflexed. Operculum thin, triangular with acute upper angle.

*Measurements* : (in mm.)    Height    Diameter    Height of aperture  
    2.9-5.86    4.1-9.66            1.86-4.0

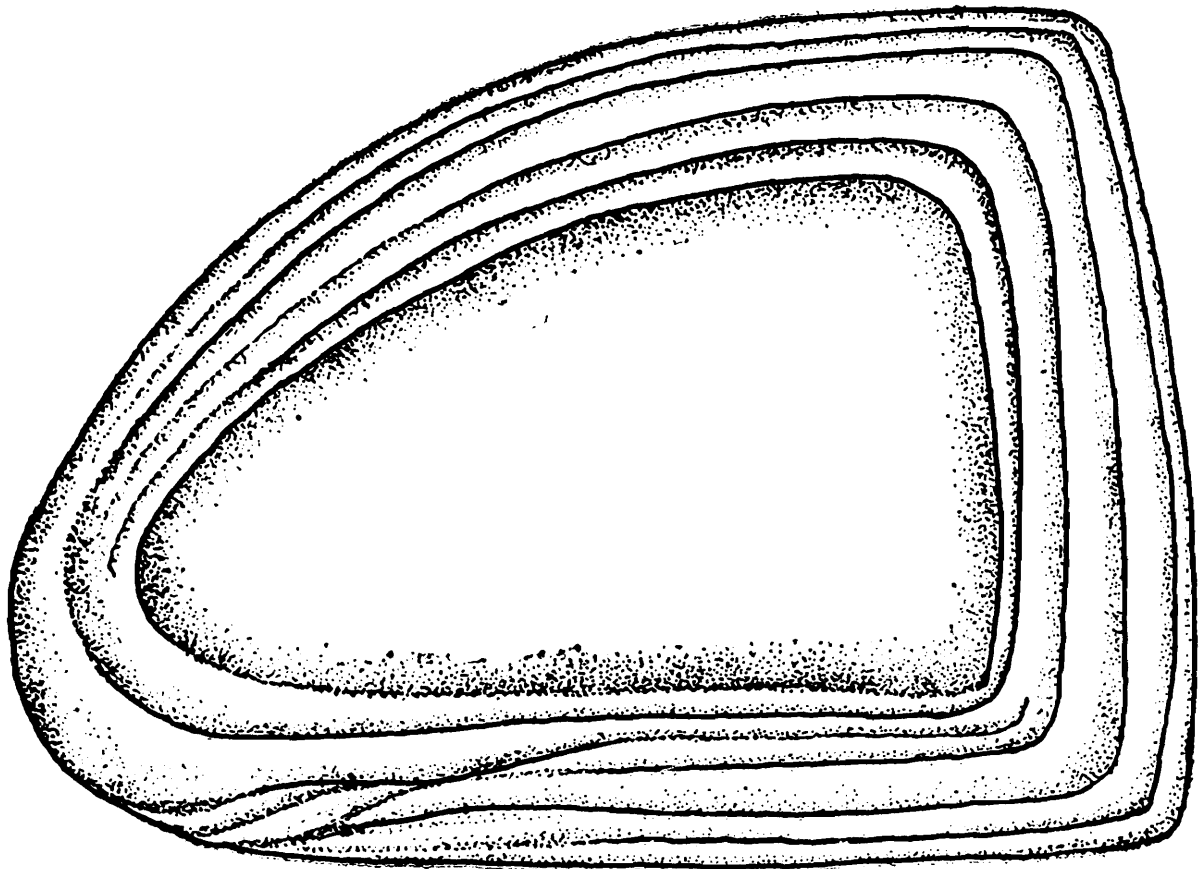


Fig. 2 : Operculum of *Pleuropoma andamanica* (Benson)

### 3. *Pleuropoma dunkeri* (Zelebor, 1867)

(Pl. II, figs. 5 & 6)

*Helicina dunkeri* Zelebor, 1867, *Verh. K. K. Zool. bot. Ges.*, 17 : 808.

*Helicina (Aphanoconia) dunkeri* : Gude 1921, *Fanna Brit. India, Mollusca, III*, 368.

*Material examined* : 3 exs., Katchall, Nicobars ; 15 exs., Camorta, Nicobars ; (Coll. F. Stoliczka).

*Distribution* : Restricted to Nicobar islands.

*Remarks* : Shell very much similar to the preceding species, differs in being a little thinner, lacking the decussating spiral markings, peristome being thin and less reflected and the columellar margin taking a more angular curve at the base.

4. *Pleuropoma nicobarica* (pfeiffer, 1847).

(Pl. II, figs. 1 &amp; 2)

*Helicina nicobarica* (Philippi) pfeiffer, 1847, *Zeits. Malak.* 4 : 149.*Helicina nicobarica* : Reeve, 1873, *Conch. Icon.*, 19, *Helicina* pl. 21, figs. 187 a & b.*Helicina (Aphanoconia) nicobarica* : Gude, 1921, *Fauna Brit. India, Mollusca, III* : 369,*Material examined* : 63 exs., Andamans (Coll. G.H. Booley) ; 10 exs., Andamans, (Coll. ?)*Distribution* : Andaman and Nicobar islands (Car Nicobar, Batti Malve, katchall & Nancowry).*Remarks* : Shell globosely conoid, brownish white, angulate at the periphery with 2-3 light chocolate bands above and also below the periphery ; with fine granular sculpture resulting from microscopic striae and obsolete spiral lines. Aperture slightly oblique, obtusely triangular, peristome thickened and reflected, columellar margin with a small projecting notch at the base.

The lot which includes ten examples from Andamans contains shells which do not bear any bands on the surface or near the periphery.

*Measurements* : (with bands) Length    Diameters    Height of aperture  
3.3-4.88    5.31-7.34    2.05-3.3  
3.2-3.5    4.65-5.4    2.0-2.65. *Pleuropoma scrupula* (Benson. 1863)

(Pl. II, figs. 7&amp;8)

*Helicina scrupulum* Benson, 1863, *Ann. Mag. Nat. Hist.*, (3) 12 : 463.*Helicina (Aphanoconia) scrupulum* : Gude, 1921, *Fauna Brit. India, Mollusca, III*, 370.*Material examined* : i) 72 exs., Mt. Harriet, Andamans (Coll. ?). ii) 11 exs., Daring vill., Camorta island. (Coll. A.S. Rajagopal, 26.3.72).*Distribution* : Andaman (Mt. Harriett) and Nicobar islands (Camorta).*Remarks* : Shell conically globose, pale white usually with narrow rufous bands above, microscopically striate, rounded at the periphery, whorls  $4\frac{1}{2}$ , convex. Aperture triangularly lunate, peristome thickened and reflected.*Measurements* : ( in mm.) Height    Diameter    Height of aperture  
4.36    5.15    2.7Genus 3. *Sulfurina* Mollendorff, 1893

Shell conoid or globose, yellow when fresh, highly polished. Aperture a little oblique, peristome thickened and slightly reflected, rather

angled and dilated at the base on columellar side. Operculum triangular, externally concave with a central nucleus.

Following Benthem Jutting (1948), *Sulfurina* is treated as a separate genus.

India (Andaman and Nicobar islands). Indonesia, Moluccas, The philippines, New Guinea and Pacific islands.

#### Key to the species of *Sulfurina*

Shell angulate at the periphery, peristome thickened and reflected. ...	<i>S. behniana</i>
Shell rounded at the periphery, peristome simple ...	<i>S. zeleborei</i>

#### 6. *Sulfurina behniana* (Pfeiffer, 1859)

(Pl. I, fig. 2)

*Helicina behniana* Pfeiffer, 1859, *Proc. zool. Soc. Lond.*, 1859 : 29.

*Helicina (Sulfurina) behniana* : Gude, 1921, *Fauna Brit. India, Mollusca, III* : 364.

*Material examined* : i) 21 exs., Port Blair, S. Andaman (Coll. K.N. Das), ii) 30 exs., Galathea Bay ; 26 exs., Kondul ; 11 exs., Gt. Nicobar; 20 exs., Car Nicobar (Coll. A.S. Rajagopal, 1972), (iii) 97 exs., Nicobar (Coll. ?).

*Remarks* : Shell conoidly depressed, yellowish, whorls  $4\frac{1}{2}$ , body-whorl angulate at the periphery ; finely striate ; peristome slightly thickened and reflected. Operculum rather triangular, thin.

The species was hitherto collected from Nicobar Islands only. It is a first record for Andaman islands.

<i>Measurements</i> : (in mm)	Height	Diameter	Height of aperture
Largest	5.0	7.25	3.65
Smallest	4.18	5	2.68

*Distribution* : Restricted endemic to Aadamans (Port Blair) and Nicobars (Galathea Bay, Kondul, Gt. Nicobar, Sanbelong).

#### 7. *Sulfurina zeleborei* (Pfeiffer, 1867)

(Pl. I, fig. 3)

*Helicina zeleborei* Pfeiffer, 1867, *Verh. K. K. Zool, bot. Ges.* 17 : 807.

*Helicina (Pachystoma) zeleborei* : Moersch, 1876, *J. Conch. Paris.* 24 : 364.

*Helicina (Sulfurina) zeleborei* : Gude, 1921, *Fauna Brit. India, Mollusca, III* : 365.

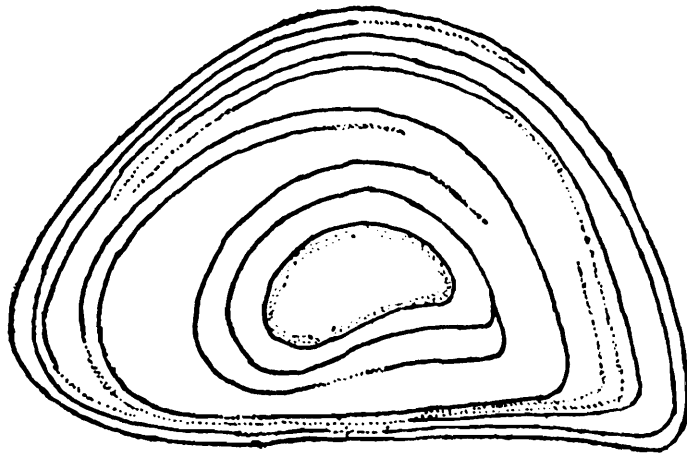
*Material examined* : i) 4 exs., Gt. Nicobar ; 49 exs., Camorta ; 8 exs., Nancowry ; 92 exs., Trinket island, (Coll. ?). ii) 4 exs., Car Nicobar (Coll. A.S. Rajagopal, 1972).

*Distribution* : Restricted endemic to the Nicobar islands (Car Nicobar, Nancowry, Trinket, Camorta, Gt. Nicobar).

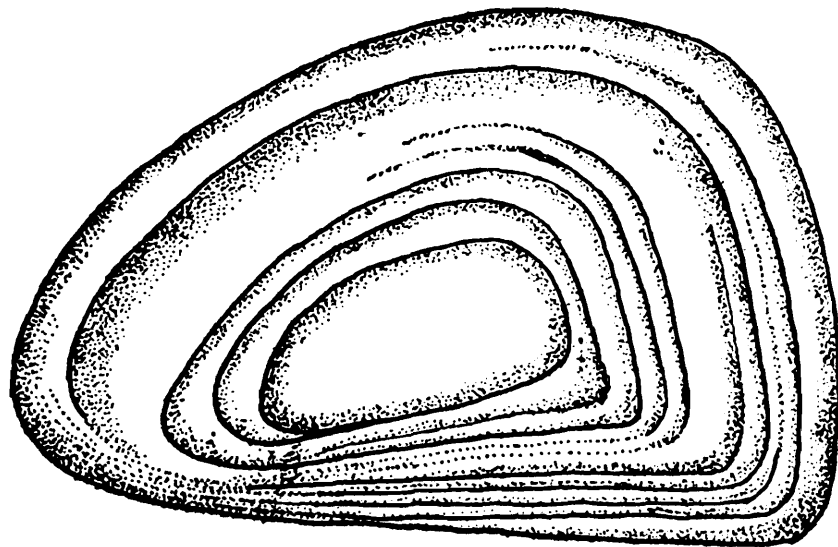
*Remarks* : Shell conoid, solid, apex obtuse, whorls 4, moderately

convex ; body whorl depressedly rounded. Aperture oblique, semioval ; peristome simple, the basal margin forming an obtuse angle with the columellar margin.

Some of the shells possess one band on the body whorl.



1 mm



1 mm

Fig. 3 : Operculum of *Sulfurina Zelebori* (Pfeiffer) (Top)

Fig. 4 : Operculum of *Sulfurina behniana* (Pfeiffer) (Below)

Measurements :	(in mm.)	Height	Diameter	Height of aperture
		1.68-4.76	2.75-5	1.15-2.84

## Order MESOGASTROPODA

## Family III. CYCLOPHORIDAE

Shells depressed or conically globose. Small to moderately large. Usually openly umbilicate. Aperture more or less circular, often variously modified. Operculum horny or calcareous.

South and east Asia, Philippines, various pacific islands and Australia.

Mostly on ground, in vegetable gardens or among low vegetations.

## Key to the genera of Cyclophoridae

- |   |     |                     |
|---|-----|---------------------|
| 1. Shell with a small incision at upper margin of peristome.                  | ... | <i>Lagochilus</i>   |
| Shell without incision at upper margin.                                       | ... | 2                   |
| 2. Shell with a sutural tube and a constriction in front of aperture.         | ... | 3                   |
| Shell without a sutural tube or constriction in front of aperture.            | ... | 4                   |
| 3. Shell depressed and broad (nearly twice as broad as high), umbilicus wide. | ... | <i>Chamalycaeus</i> |
| Shell more conoid (slightly broader than high), umbilicus narrow.             | ... | <i>Alycaeus</i>     |
| 4. Shell large, solid with continuous peristome.                              | ... | <i>Cyclophorus</i>  |
| Shell small, thin with discontinuous peristome.                               | ... | <i>Leptopoma</i>    |

Genus 4. *Cyclophorus* Montfort, 1810

Shell thick and solid, globosely turbinate, usually broader than high, peristome continuous thickened or expanded but without modifications. Operculum thin, horny, multispiral with a central nucleus, externally concave.

South and east Asia, Malay archipelago, Philippines.

In Andaman and Nicobar islands this genus is represented by 2 subgenera, *Cyclohelix* Moersch and *Glossostylus* Kobelt & Mollendorff. While *Glossostylus* is represented by a single species, *Cyclohelix* with its 5 species is distributed in both Andaman and Nicobar islands, a single species being subsequently recorded from W. Java by Benthem Jutting (1948). Perhaps it deserves a generic status for its long isolation. This extension of distribution of *Cyclohelix* south-east wards to Nias in Java is interesting and is fully justified in the light of the observations made by Godwin-Austen (1895).

Key to the species of *Cyclophorus*

- |   |     |   |
|---|-----|---|
| 1. Umbilical opening narrow but deep, body whorl rounded at base. | ... | 2 |
|---|-----|---|

- |   |     |                                     |
|---|-----|-------------------------------------|
| Umbilicus usually closed by a callus, body whorl flattened at base. | ... | 4                                   |
| 2. Shell with varicose lamellas Chocolate band on periphery absent. | ... | 3                                   |
| Shell without varicose lamella chocolate band on periphery present. | ... | <i>C. charpentieri nicobaricus.</i> |
| 3. Shell more conoid, varicose lamellae near aperture less than 3.  | ... | <i>C. leai</i>                      |
| Shell more depressed, varicose lamellae near aperture more than 3.  | ... | <i>C. foliaceus</i>                 |
| 4. Columellar margin vertical and notched on outside edge.          | ... | <i>C. crocatus</i>                  |
| Columellar margin oblique and notched on inside edge.               | ... | <i>C. nicobaricus</i>               |

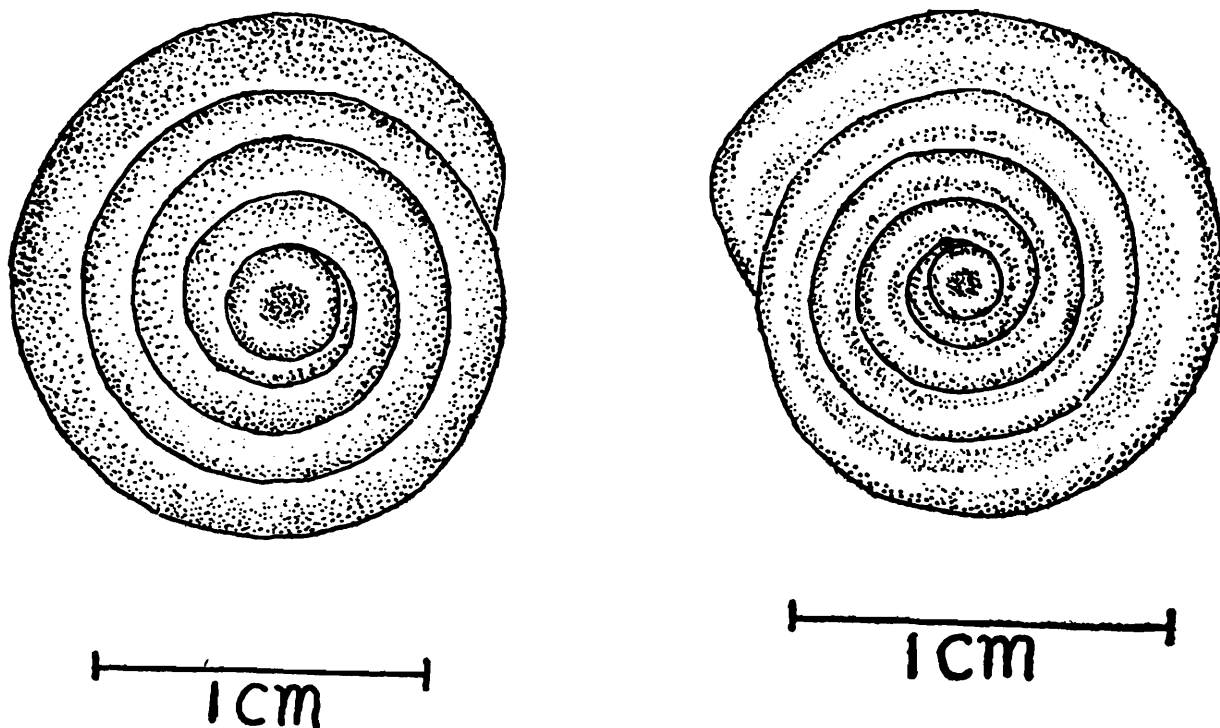


Fig. 5 : Operculum of *Leptopoma immaculata* Pfeiffer

Fig. 6 : Operculum of *Cyclophorus leai* (Tryon)

Subgenus (*Cyclohelix*) Morech, 1852

8. *Cyclophorus Cyclohelix foliaceus* Pfeiffer, 1847

(Pl. I, fig. 4)

*Cyclostoma foliaceum* Pfeiffer, 1847, *Conch. Cab.* (Cyclostomaceen) p. 36, pl. 4. figs. 10-11.

*Cyclophorus foliaceus* : Benson, 1860, *Ann. Mag. nat. Hist.* (3) 5 : 97.

*Cyclophorus (Cyclohelix) foliaceus* : Gude, 1921, *Fauna Brit. India, Mollusca* (land operculates) : 92

*Material examined* : 2 exs., Nicobar islands (Coll. F. Stoliczka & F.A. de Roepstorff).

<i>Measurements</i> (in mm) :	Height	Diameter	Height of aperture
	24.4-26.35	27.68-30.0	15-15.5

*Distribution* : Restricted endemic to the Nicobar islands (Camorta).

*Remarks* : Shell rather depressedly turbinate, narrowly but deeply umbilicate, pinkish with a white peripheral zone, apical whorls with chocolate markings ; spirally striate decussated by fine growth lines ; whorls  $5\frac{1}{2}$ , convex, body whorl indistinctly angulate at the periphery and with a number of varicose lamellae, appearing as a series of reflected peristome. Peristome much thickened, a little reflected and joined by a callus ; aperture subcircular, columella dilated ; umbilicus obstructed by the entering lamellae.

### 9. *Cyclophorus (Cyclohelix) leai* (Tryon, 1869) (Pl. 1, fig. 5 )

*Cyclophorus foliaceus* (non *Turbo foliaceus* Chemnitz) Benson, 1861, *Ann. Mag. nat. Hist.*, (3) 7 : 29.

*Cyclostoma leai* Tryon ; *Amer. Journ. Conch.*, 5 : 111.

*Cyclophorus (Cyclohelix) leai* : Kobelt & Mollendorff, 1897, *Nachr. Deuts. Malak. Ges.*, 29 : 111

*Cyclophorus (Cyclohelix) leai* : Gude, 1921, *Fauna Brit. India, Mollusca* (land operculates) : 93.

*Material examined* : (i) 125 exs. Andamans (Coll. J. Anderson), (ii) 51 exs. Andamans (Coll. ?), (iii) 4 exs., Andamans (Coll. M.R.E. Khamy), (iv) 15 exs. S. Andamans (Coll. B.K. Tikader), (v) 7 exs., Elphin-stone harbour, M. Andamans (Coll. K.K. Tiwari), (vi) 1 ex. Aberdeen bay (Coll. K.K. Tiwari).

<i>Measurements</i> (in mm) :	Height	Diameter	Height of aperture
	16.0-19.35	15.9-17.8	8.4-9.95

*Distribution* : Restricted endemic to the Andaman islands (South & Middle Andaman, Aberdeen bay).

*Remarks* : Shell globosely conical, thick, narrowly umbilicate, whorls 5, convex, rather loosely wound, last whorl obsoletely subangulate at the periphery ; closely spirally striate ; shell whitish with a pinkish brown epidermis and zig-zag chocolate streaks ; aperture rather oval, peristome thickened, reflected and slightly dilated near the columella obstructing the umilicus. Last whorl descending in front, with a number of (usually not more than 3) varicose lamellae near the aperture ;

immature shells without lamellae.

This species differs from the preceding one in being smaller, and distinctly angulate the periphery and also in possessing less number of lamellae.

Considerable confusion exists regarding the identity and position of these two allied species, namely, *C. foliaceus* and *C. leai*. Benson (1860) while making a passing remark referred to a small variety of shells from the Andamans as *Cyclophorus foliaceus*. In a later report (1861) he again referred to larger shells of the same species. The larger shells according to him differed in being 'more lengthened and having rounded periphery'. Subsequently the smaller shells from the Andaman islands were described as *Cyclophorus leai* by Tryon and the larger shells were retained as *C. foliaceus* (Gude, 1921).

As stated, the two species are very closely related but differ chiefly in shell size and the number of varicose lamellae behind the aperture. Since it has not been possible for us to examine more number of shells of *C. foliaceus* at present we are inclined to keep the two species separately.

10. *Cyclophorus (Cyclohelix) crocatus* (Born, 1778)  
(Pl. I, fig. 6)

*Turbo crocatus* BORN, 1778, *Index Mus. Vindob.*, : 343.

*Cyclophorus (Cyclohelix) crocatus* : Moersch, 1872, *J. Conch. Paris*, 20 : 316.

*Cyclophorus (Cyclohelix) crocatus* : Godwin-Austen, 1897. *Land and Freshwater Moll. India*, 2 : 24, pl. 68, figs. 5-8.

*Cyclophorus (Cyclohelix) crocatus* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) ; 91.

*Material examined* : (i) 19 exs., Camorta, Nicobar islands ; (ii) 4 exs., Coconut grove, Ramjao, Camorta, Nicobar (Coll. A.G.K. Menon, 19.3.72).

<i>Measurements</i> (in mm) :	Height	Diameter	Height of aperture
	16.8-22.0	19.0-23.9	9.2-13.5

*Distribution* : Restricted endemic to the Nicobar islands (Galathea bay, Kondul, Camorta).

*Remarks* : Shell conically turbinated, solid, whitish with chocolate markings throughout ; finely spirally striate ; whorls  $5\frac{1}{2}$ , convex, last whorl subcarinate rather flattened at base ; umbilicus closed by a thickened columellar callus, aperture subcircular, columella angulate and notched below, peristome thickened and expanded. Operculum thin and flat.

11. *Cyclophorus* (*Cyclohelix*) *nicobaricus* Pfeiffer, 1865

(Pl. I, fig. 7)

*Cyclophorus nicobaricus* (Behn) Pfeiffer, 1863, *Mon. Pneum. Suppl.* 2 : 68.*Cyclophorus* (*Cyclohelix*) *nicobaricus* : Moersch, 1872, *J. Conch. Paris*, 20 : 317.*Cyclophorus* (*Cyclohelix*) *nicobaricus* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) 93 fig. 16.

*Material examined* : 1 ex., Leola nullah, Gt. Nicobar (25.7.84), 1 ex., South bay, Gt. Nicobar (16.7.84), 4 exs., Army land, 5 km. west of Campbell Bay, Gt. Nicobar (20.6.84), Coll. S.S. Saha.

*Measurements* (in mm) : Height      Diameter      Height of aperture  
16.85-17.0      18.35-19.35      8.9-9.1

*Distribution* : Restricted endemic to Great Nicobar island.

*Remarks* : Shell conoid, solid whitish with chocolate marking ; umbilical opening very narrow or completely closed ; sculptured with oblique transpiral markings decusated by fine wavy spiral striae ; whorls 5, moderately convex, lower margin subcarinate and flattened at base. Aperture ovate, peristome thickened and expanded ; columellar margin with a blunt tooth like projection. Operculum corneous.

Subgenus *Glossostylus* Kobelt & Mollendorff, 189912. *Cyclophorus* (*Glossostylus*) *charpentieri* Moussonsubspecies *nicobaricus* Moersch, 1872

(Pl. I, fig. 8)

*Cyclophorus charpentieri* var. *nicobarica* Moersch, 1872, *J. Conch. Paris*, 20 : 316,*Cyclophorus* (*Glossostylus*) *charpentieri* var. *nicobarica* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) : 58.

*Material examined* : (i) 4 exs., Batti Malve, Nicobars ; 5 exs., Car Nicobar (Coll. F. Stoliczka), (ii) 25 exs., Coconut Grove in Kimios, S. W of Malacca, Car Nicobar ; 10 exs., S. W of I. A. F. Camp, Car Nicobar (Coll. A. G. K. Menon, 1972) ; (iii) 8 exs., Nicobars ; 3 exs., Underneath dead leaves in a shady place, Car Nicobar (Coll. ?).

*Measurements* (in mm) : Height      Diameter      Height of aperture  
14.8-23.5      15.1-23.5      8.3-12.75

*Distribution* : Restricted endemic to Nicobars (Pulo Panjang, Car Nicobar, Batti Malve).

*Remarks* : Shell depressedly conical, solid, rather narrowly umbilicate, whitish with fine wavy chocolate markings throughout, closer on apical whorls, whorls 5, with close spiral raised ridges ; last whorl with a chocolate band along the periphery. Aperture circular, peristome continuous, slightly thickened and reflected. Operculum thin, multi-

spiral and slightly concave externally.

The typical form of this species, which is darker, broader and more depressed occurs in Java.

#### SHELL PARAMETERS OF SPECIES OF CYCLOPHORUS

	Diameter	Colour	Sculpture etc.	Distribution
<i>C. (Glossostylus) charpentieri nicobaricus</i>	15-23.5	Whitish with chocolate markings and a band round the periphery	With spiral lirae	Nicobars
<i>C. (Cyclohelix) foliaceus</i>	27-30	Pinkish with a white periphery	With decussating sculpture and varicose lamellae, narrowly umbilicate	Nicobars
<i>C. (C.) leai</i>	15-17.8	Brownish white with chocolate streaks	Spirally striate, narrowly umbilicate, varicose lamellae present	Andamans
<i>C. (C.) crocatus</i>	19-23.9	Whitish with chocolate markings throughout	Spirally striate, umbilicus closed, body whorl flattened at base	Nicobars
<i>C. (C.) nicobaricus</i>	18 19.35	Whitish with chocolate markings	With decussating sculpture, very narrowly umbilicate, body whorl flat at base	Nicobars

#### Genus 10. *Lagochilus* Blanford, 1854

Shell conically turbinate, deeply umbilicate, usually with spiral lirae and a hairy epidermis. Peristome continuous with a small incision above adjacent to the suture. Operculum thin, horny, multispiral and flat with a central nucleus.

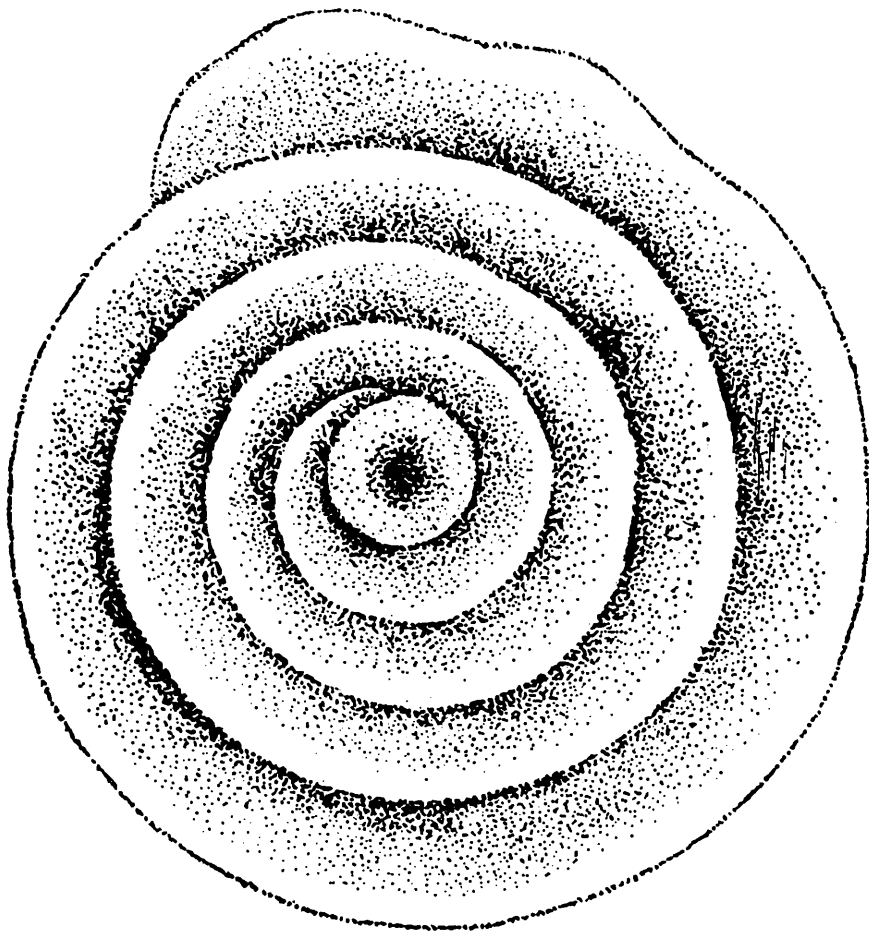
Japan, South and east China, India, Sri Lanka, Burma, Indochina, Thailand, Malay Archipelago, Philippines, New Guinea and

Fiji islands.

Though *Lagochilus* was treated as subgenus of *Japonia* by Gude (1921) and Thiele (1931), following Benthem Jutting (1948) we have treated it as a genus.

Key to the species of *Lagochilus*

- |   |                         |
|---|-------------------------|
| 1. Shell higher than broad with weak sculpture. ...                   | <i>L. warnefordiana</i> |
| Shell broader than high, with strong sculpture. ...                   | 2                       |
| 2. Shell with close spiral lirae, more than 15 on the last whorl. ... | <i>L. galathea</i>      |
| Shell with distant spiral lirae, upto 15 on the last whorl. ...       | 3                       |
| 3. Shell with very prominent transpiral striae. ...                   | <i>L. roepstorfi</i>    |
| Shell with prominent spiral striae. ...                               | <i>L. polynema</i>      |



1 mm

Fig. 7 : Operculum of *Lagochilus galathea* Moerch

13. *Lagochilus galathea* Moerch, 1872

(Pl. I, fig. 9)

*Cyclophorus (Craspedotropis) galathea* Moerch, 1872, *J. Conch. Paris*, 20 : 315.

*Lagochilus (Lagochilus) galathea* : Kobelt & Mollendorff, 1877, *Nachr. Deuts. Malak.*

*Ges.* 24 : 83.

*Japonia (Lagochilus) galathea* : Gude, 1921, *Fauna Brit. India*, Mollusca, (land operculates) : 7.

*Material examined* : (i) 20 exs., Nicobar islands ; 10 exs., Katchall ; 2 exs., Camorta (Coll. ?), (ii) 1 ex., Ramjao, Camorta ; 18 exs., from a jungle, at Car Nicobar (Coll. A. G. K. Menon, 1972).

*Measurements* (in mm) : 

Height	Diameter	Height of aperture
4.6-5.4	4.7-5.7	2.15-3.0

*Distribution* : Restricted endemic to the Nicobar islands (Katchal, Camorta, Car Nicobar).

*Remarks* : Shell small, depressedly conical, rather narrowly umbilicate, streaked with brown flames at regular distances ; sculptured with faint transpiral growth markings and spiral ridges, last whorl with about 10-12 prominent ridges and a few finer intermediate ones (about 20 in all) ; apical whorl rather smooth ; whorls 5-6, moderately convex. Aperture circular, peristome double, outer slightly reflected, with an incision at the upper angle.

#### 14. *Lagochilus polynema* (Moerch, 1876).

(Pl. I, fig. 10)

*Cyclophorus (Craspedotropis) polynema* Moerch, 1876, *J. Conch. Paris*, 24 : 361.

*Lagochilus (Lagochilus) polynema* : Kobelt & Mollendorff, 1897, *Nachr. Deuts. Malak. Ges.*, 29 : 84.

*Japonia (Lagochilus) polynema* : Gude 1921, *Fauna Brit. India*, Mollusca (land Operculates) : 10, fig. 2.

*Material examined* : 5 exs., Nicobars (Coll. ?).

*Measurements* (in mm) : 

Height	Diameter	Height of aperture
4.3	5.4	2.5

*Distribution* : Restricted endemic to Nicobar islands.

*Remarks* : Shell small, slightly more depressed and a little broader, thicker with rather prominent oblique transpiral markings, spiral lirae on the last whorl are more or less uniform and about 15 in number the brown flammules are narrower and rather irregular.

#### 15. *Lagochilus roepstorfi* (Moerch, 1876).

(Pl. I. Fig. 11)

*Cyclophorus (Craspedoyropis) roepstorfi* Moerch, 1876, *J. Conch. Paris*, 24 : 361.

*Lagochilus (Lagochilus) roepstorfi* : Kobelt & Mollendorff, 1897, *Nachr. Deuts. Malak. Ges.*, 24 : 84.

*Japonia (Lagochilus) roepstorfi* : Gude, 1921, *Fauna Brit. India* Mollusca (land operculates) ; 11, fig. 3.

*Material examined* : (i) 11 exs., Camorta, Nicobar islands ; 43

exs., Nicobar islands (Coll. ?). (ii) 7 exs., Coconut garden, Tapang village, Nancowry (Coll. A. G. K. Menon, 13. 3. 72).

*Measurements* (in mm) : Height      Diameter      Height of aperture  
3.45-5.6      4.6-7.0      2.55-3.33

*Distribution* : Restricted endemic to Nicobar islands (Camorta, Nancouri).

*Remarks* : This species is allied to *L. polynema* but differs in being distinctly transpirally striate and the spiral lirae being more distant.

#### 16. *Lagochilus warnefordi* Nevill, 1878

(Pl. III, fig. 2)

*Lagochilus warnefordianus* Nevill, 1878, *Hand List Mollusca Indian Mus.*, 1 : 282.

*Japonia (Lagochilus) warnefordiana* : Gude, 1921, *Fauna Brit. India, Mollusca* (land operculates) ; 13.

*Material examined* : (i) 1 ex., On the top of Mt. Harriet Andaman Island (Holotype, Reg. No. M 16873/2). (ii) 5 exs., Mt. Harriet, Andaman islands (Coll. G. Nevill).

*Measurements* (in mm) : Height      Diameter      Height of aperture  
6.85-7.1      5.9-6.15      3.45-3.7

*Distribution* : Restricted endemic to Andaman islands (Mt. Harriet).

*Remarks* : Shell conically ovate, whorls 5-6, convex, last whorl tumid ; sculpture consists of a few very faint spiral lines, with regular dark brown markings arranged transpirally. Umbilical opening narrow ; outer peristome fairly reflected.

This species is readily distinguished from the others by being higher than broad and very narrowly umbilicate and also by the absence of distinct spiral sculpture. Incidentally it is the only species of *Lagochilus* which occurs in the Andaman islands. Though Nevill (1878) included Nicobar islands within its range of distribution with a question mark, its occurrence in these islands is yet to be established.

#### Genus 11. *Leptopoma* Pfeiffer, 1847

Shell globose turbinate or conoid, narrowly umbilicate, thin, often translucent, peristome simple, rarely double, reflected, usually discontinuous. Operculum thin, horny, flat, multispiral.

Formosa, S. E. China, Indo-China, Malay Archipelago, New Guinea, the Philippines, Melanesia.

## SHELL PARAMETERS OF SPECIES OF LAGOCHILUS

Name of the species	Diameter	Colour	Sculpture etc.	Distribution
L. galathea	4-5.7	Pale white with brown flammules	Body whorl with about 20 close spiral ridges of varying thickness; transpiral markings fine.	Nicobars
L. polynema	4-5.3	Pale white with narrower brown flammules	Body whorl with about 15 distant spiral ridges.	Nicobars
L. roepstor	4-7.0	Dark brown with irregular brown flammules	Body whorls with 12-14 spiral ridges, transpiral markings more distinct.	Nicobars
L. warnefordiana	5-6.15	Brownish with regular darker oblique markings	With faint spiral striae. Very narrowly umbilicate.	Andamans

Key to the species of *Leptopoma*

Shell without coloured markings, more globose. ...

...*L. immaculata*

Shell with coloured markings, more conical. ...

...*L. roepstorffianum*

Subgenus *Trocholeptopoma*17. *Leptopoma (Trocholeptopoma) immaculata* Pfeiffer, 1847  
(Pl. III, fig. 1)

*Leptopoma immaculatum* : Pfeiffer, 1847, *Zeits. Malak.*, 4 : 108.

*Leptopoma (Trocholeptopoma) immaculatum* : Kobelt & Mollendorff, 1897, *Nachr. Deuts. Malak. Ges.*, 29 : 81.

*Cyclostoma maculata* : Lea, 1838, *Trans. Amer. Philos. Soc.*, 6 : 68, pl. 23, fig. 87.

*Leptopoma (Trocholeptopoma) immaculatum* : Gude, 1921, *Fauna Brit. India, Mollusca* (land operculates) : 4.

*Material examined* : (i) 9 exs., Katchall (Coll. F. Stoliczka), (ii) 11 exs., Kondul, Gt. Nicobar ; 7 exs., Nicobars ; 3 exs., Camorta ; (iii) 2 exs., Coconut grove, West of I. A. F. Camp, Nicobars ; 2 exs., Nancoury (Coll. A. G. K. Menon, March, 1971), (iv) 39 exs., Andamans (Coll. ?).

*Measurements* (in mm) : Height      Diameter      Height of aperture  
7.45-17.35      7.1-16.6      4.25-9.75

*Distribution* : Andamans (new record) ; Nicobars (Katchal, Kondul, Camorta, Nancoury).

Elsewhere : Philippines.

*Remarks* : Shell white, globosely conical, narrowly but deeply umbilicate, thin, translucent, rather faintly spirally striate ; whorls  $5\frac{1}{2}$ , convex, last whorl broad and large, faintly angulate at the periphery ; aperture oblique, subcircular ; peristome simple, reflected, discontinuous, columellar margin reflected. Operculum thin, multispiral with a central nucleus.

### 18. *Leptopoma (Trocholeptopoma) roepstorffianum* Nevill, 1878

(Pl. I, fig. 12)

*Leptopoma roepstorffianum* Nevill, 1878, *Hand List Moll. Indian Mus.*, 1 : 280.

*Leptopoma (Trocholeptopoma) roepstorffianum* : Gude, 1931, *Fauna Brit. India Mollusca* (land operculates) : 5, fig. 3.

*Material examined* : 1 ex., Andamans ; M 22682/4, Holotype : 9 exs., Andamans, M 22681/4, Paratype (Coll. E. A. Roepstorff) ; 26 exs., Andamans (Coll. ?).

*Measurements* (in mm) : Height      Diameter      Height of aperture  
11.05-13.75      9.75-12.86      6.2-7.0

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* ; Shell thin, more conical than in the preceding species with fine spiral striations, narrowly umbilicate, whitish, usually elegantly decorated with brown oblique markings in a zebra-like fashion ; whorls  $5\frac{1}{2}$ , convex, aperture subcircular, peristome simple and reflected but not as much as in the preceding species.

Nevill (1878) mentioned about uniformly white shells. He also referred to variety *nicobarica* Martens, of this species without giving any characters or any other data. But as Gude pointed out there is no record of this species from Nicobars.

### Genus 12. *Alycaeus* Gray, 1850

Shell conoid, rather narrowly umbilicate, whorls moderately con-



*Alycaeus (Chamalycaeus) busbyi* : Gude, *Fauna Brit, India*, Mollusca (land operculates) : 225.

*Material examined* : 13 exs., Nicobars, (Coll. ?).

*Measurements* (in mm) :    Height    Diameter    Height of aperture  
   5.45-6.8    9.75-11.7            3.3-4

*Distribution* : Restricted endemic to Nicobar islands.

*Remarks* : Shell depressedly turbinate, widely umbilicate, whorls finely ribbed, rounded, last whorl tumidly inflated, rather compressed, swollen and then constricted near the aperture ; ribs less distinct on constricted part, sutural tube rather long, thick, aperture circular, oblique, peristome double, outer lip expanded, and distinctly reflected. Operculum calcareous, externally concave, convex on internal side with a central point of elevation, multispiral.

#### Family 4. PUPINIDAE

Shell ovate or conoid, calcareous, usually glossy, porcellaneous, polished. Aperture circular, peristome thickened, often with canals. Operculum multispiral, horny or calcareous, nucleus central.

Asia and Australia.

On grounds, in low vegetations, decaying wood etc.

#### Genus 14. *Pupina* Vignard, 1829

Shell elongate-ovate, pupaeform, smooth, shining, glossy. Aperture circular, peristome slightly thickened and reflected with two canals, one above and the other at the columellar side. Operculum thin, flat, multispiral.

Japan, S. China, Malay Peninsula and Archipelago, Philippines, New Guinea, Australia and also Pacific islands.

#### Subgenus *Tylotoechus* Kobelt & Mollendorff, 1897

#### 21. *Pupina (Tylotoechus) nicobarica* Pfeiffer, 1852 (pl. IV, fig. 1)

*Pupina (Registoma) nicobarica* Pfeiffer, 1852, *Proc. zool. Soc. Lond.* : 145.

*Pupina nicobarica* : Reeve, 1876, *Conch, Icon.*, 20, pl. 3, fig. 26.

*Registoma nicobaricum* : Moersch, 1876, *J, Conch, Paris.*, 24 : 362.

*Pupina nicobarica* : Godwin-Austen, 1897, *Land & Freshwater Moll. India*, 2 : 42,

*Pupina (Tylotoechus) nicobarica* : Gude, 1921, *Fauna Brit, India Mollusca (land operculates)* : 196.

*Material examined* : (i) 11 exs., Gt. Nicobar (Coll. F. Stoliczka), (ii) 33 exs., Camorta ; 11 exs., Katchal (Coll. ?), (iii) 2 exs., Armyland,

5 km. N. of Campbell bay, Gt. Nicobar islands (Coll. S.S. Saha, 20.6.84).

*Mesurements* (in mm) : Length      Diameter      Height of aperture  
5.5-6.85      3.8-4.15      1.9-2.45

*Distribution* : Restricted endemic to Nicobar islands (Camorta, Katchal, Gt. Nicobars).

*Remarks* : Shell ovate, pupaeform, imperforate ; highly polished and shining, whorls  $4\frac{1}{2}$ -5, convex, sutures very shallow, the last whorl broad, obliquely descending. Aperture circular, peristome single, rather callously thickened, slightly expanded, interrupted by two canals—one at the junction of the columellar callus with the peristome and the other at the middle of the columellar margin. Operculum thin, multispiral, edges of the whorls slightly raised.

#### Family 5. DIPLOMMATINIDAE

Shell small, turreted, spire rather irregularly coiled, the last whorl slightly compressed. Aperture sometimes with tooth. Operculum horny. Asia and North Australia.

Some species are recorded from arboreal habitat also.

#### Genus 15. *Palaina* O. Semper, 1865

Shell small, turreted or cylindrical, dextral. Sculptured with oblique ribs. Last whorl constricted just above the aperture. Aperture circular, toothless, peristome closely double, continuous, a little reflected.

Japan, Philippines, Malay Archipelago, New Guinea, N. Australia, Pacific islands.

#### 22. *Palaina nicobarica* (Godwin Austen, 1886)

(Pl. IV, fig. 2)

*Diplommatina carreola* var. (? distinct species), Nevill, 1878, *Hand List Mollusca Indian Mus.*, 1 : 284 (in part).

*Diplommatina nicobarica* Godwin-Austen, 1886, *Land & Freshwater Moll. India*, 1 : 185, pl. 46, figs. 7, 7a.

*Diplommatina nicobarica* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates : 324.

*Material examined* : (i) 2 exs., Batte Malve (Coll. F. Stoliczka), (ii) 14 exs., Trinket island, Nicobars ; 17 exs. Jungle behind Malacca Circuit House, Car Nicobar (Coll. A.G.K Menon, 1872) ; 1 ex., Coconut grove, Tapang vill., Nancouri.

*Mesurements* (in mm.) : Length      Diameter  
2.65-2.85      1.15-1.20

**Distribution :** Restricted endemic to the Nicobar islands (Batte Malve, Trinket, Nancouri, Car Nicobars).

**Remarks :** Shell small, fusiform, imperforate, closely and rather lamellosely costulate on the body whorl but indistinctly on the apical whorls, brownish, apex acuminate, whorls 7, more or less convex, penultimate broadest ; last whorl constricted above the aperture. Aperture circular, suboblique, peristome closely double, reflected, continuous, columellar margin straight ; a faint trace of columellar tooth present in some but absent in some shells.

Though this species was hitherto treated under the genus *Diplomatina*, following Jutting (1948) we have placed it under *Palaina* O. Semper, because of simple toothless peristome. However, as pointed out by Peake (1971) the taxonomic status of the genus is nevertheless open to question.

#### Family 6. ASSIMINEIDAE

Shell small (Seldom exceeding 10 mm) subglobose to conical, narrowly perforate to deeply umbilicate, usually smooth ; aperture ovately rounded, angular above. Operculum horny.

#### Genus 16. *Omphalotropis* Pfeiffer, 1851

Shell small, narrowly umbilicate, turreted or globosely turbinata, last whorl usually subangulate, keeled around umbilical region. Aperture ovate, peristome not continuous but usually joined by a callus ; straight or a little reflected ; columellar margin expanded, often curved. Operculum thin, corneous, paucispiral, slightly angulate, nucleus central or subcentral.

Mascarene area, India, Malaysia, Polynesia. Some found on trees.

#### Key to the species of *Omphalotropis*

- |  |     |                      |
|--|-----|----------------------|
| 1. Shell with decussating sculpture  | ... | <i>O. decussata</i>  |
| Shell without decussating sculpture  | ... | 2                    |
| 2. Shell globose, with costulate striae at the suture and umbilical region | ... | <i>O. disterrina</i> |
| Shell conically ovate, without concentric striae                           | ... | <i>O. andersoni</i>  |

#### 23. *Omphalotropis andersoni* Blanford, 1880

(Pl. IV, fig. 3)

*Realia (Omphalotropis) andersoni* Blanford, 1880, *J. Asiat. Soc. Beng.*, 49 (2) : 216, pl. 2, fig. 18.

*Omphalotropis andersoni* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) : 356.

*Material examined* : 15 exs., Andamans (Coll. ?).

*Measurements* (in mm.) : 

Height	Diameter	Height of aperture
3.9-7.25	2.85-5.0	2.45-3.4

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell ovately conical, thin, perforate, brownish with oblique microscopic striae, whorls 7, rather flatly rounded, suture impressed, last whorl angulate at the periphery and also around the umbilical opening, rounded at the base. Aperture oblique ovate, peristome simple, a little expanded, not continuous but the margins joined by a thin callus ; columellar margin slightly reflected below, angulately cut at the umbilical opening to produce a small sinus.

#### 24. *Omphalotropis distermina* Benson, 1868

(Pl. IV, fig. 4)

*Omphalotropis distermina* Benson, 1868, *Ann. Mag. nat. Hist.*, (3) 12 : 425.

*Omphalotropis distermina* : Hanley & Theobald, 1876, *Conch. Indica*, pl. 145, fig. 10.

*Omphalotropis distermina* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) : 357,

*Material examined* : 21 exs., Andamans (Coll. E. Roepstorff) ;  
(ii) 2 exs., Andamans (Coll. G.H. Booley).

*Measurements* (in mm.) : 

Length	Diameter	Height of aperture
6.5	4.6	3.55

*Distribution* : Restricted endemic to the Andaman islands (Mt. Harriet).

*Remarks* : Differs from the preceding species by being more globose, the last whorl being only indistinctly subangulate at the periphery, the aperture being slightly less wide and being keeled around the umbilicus and also by possessing costulate striae near the suture and inside umbilicus. Operculum thin, flat, paucispiral with a central nucleus.

This species was collected by Nevill (1878) from large trees at the top of Mt. Harriet at an altitude of 1000 ft.

#### 25. *Omphalotropis decussata* (Blanford, 1880)

(Pl. IV, fig. 5)

*Realia decussata* Blanford, 1880, *J. Asiat. Soc. Beng.*, 49 (2) : 218.

*Realia decussata* : Gude, 1921, *Fauna Brit. India*, Mollusca (land operculates) : 358.

*Material examined* : 6 exs., Andamans (Coll. ?).

*Measurements* (in mm.) : 

Height	Diameter	Height of aperture
3.6 4.0	2.3-2.9	1.8 1.95

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell perforate, ovately conical, brownish, thin, finely obliquely marked, decussated by spiral striae near the suture, sutures impressed, whorls  $6\frac{1}{2}$ -7, rounded, last whorl with a pale band at the periphery ; base rounded and radiately striate ; keel around the perforation feeble. Aperture oblique, oval, peristome thin, simple, margins joined by a thin callus. Columellar margin a little expanded below, angularly curved to produce a re-entering sinus at the perforation.

Though this species was retained under the genus *Realia* by Gude (1921), here it is placed under *Omphalotropis*, since, all the characters agree with the latter (e.g. peristome is not continuous as in *Realia* but merely joined by a callus as in *Omphalotropis*. Moreover the distribution of *Realia* as given by Thiele (1931) is New Zealand.

#### SHELL PARAMETERS OF SPECIES OF OMPHALOTROPIS

	Length	Colour	Sculpture etc.	Distribution
<i>O. decussata</i>	3-4	Brownish	Decussately striate (prominent on lower whorls)	Andaman
<i>O. disterrina</i>	6 6.5	Brownish	Concentrically striate near the suture and inside umbilicus	Andaman
<i>O. andersoni</i>	3-7.25	Reddish brown	Obliquely striate	Andaman

#### Genus 17. *Acmella* Blanford, 1869

Shell minute (seldom reaching 3 mm), corneous, subcylindrical, very narrowly perforate, vertically striate. Aperture ovate, peristome a little thickened, margins joined by a callus. Operculum thin, paucispiral.

India, Burma, Comoro island, Philippines, New Guinea, New Caledonia, Polynesia.

#### Key to the species of *Acmella*

Oblique striae faint and restricted to the sutural regions only	...	<i>A. moreletiana</i>
Oblique striae distinct and present throughout	...	<i>A. roepstorffiana</i>

#### 26. *Acmella moreletiana* Nevill, 1878

*Acmella moreletiana* Nevill, 1878, *Hand List Moll. Indian Mus.*, 1 : 251.

*Acmella moreletiana* : Nevill, 1879. *Proc. zool. Soc. London* : 737, pl. 59, fig. 4.

*Acmella moreletiana* : Gude, 1921, *Fauna Brit. India, Mollusca (land operculates)* : 362.

*Material examined* : 1 ex., Batti Malve (Coll. F. Stoliczka). Holotype, Reg. No. M 17735/3 ; 82 exs., Batti Malve (Coll. F. Stoliczka).

<i>Measurements</i> (in mm.) :	Height	Diameter
	1.9	1.25

*Distribution* : Restricted endemic to the Nicobar islands (Batti Malve).

*Remarks* : Shell minute, subcylindrical, distinctly perforate, corneous, whorls  $5\frac{1}{2}$ , well rounded, striate, striae more prominent below the sutures, last whorl globose. Aperture rather oblique, widely ovate, peristome a little thickened and expanded, not continuous but distinctly joined by a callus. Columella slightly thickened and expanded below ; umbilical region distinctly plicate.

### 27. *Acmella roepstorffiana* Nevill, 1878

*Acmella roepstorffiana* Nevill, 1878, *Hand List Mollusca Indian Mus.*, 1 : 251.

*Acmella roepstorffiana* : Nevill, 1879, *Proc. zool. Soc. London*, 737, pl. 59, fig. 5.

*Acmella roepstorffiana* : Gude, 1921, *Fauna Brit. India Mollusca* (land operculate) : 362.

*Material examined* : (i) 3 exs., Katchal (Coll. F. Stoliczka)-syntypes. ZSI. Reg. No. M 16953/2, (ii) 1 ex., Katchal (Coll. ?).

<i>Measurements</i> (in mm.) :	Height	Diameter
	1.6	1.0

*Distribution* : Restricted endemic to the Nicobar islands (Katchal).

*Remarks* : Shell minute, translucent, narrowly perforate, rather cylindrically turreted ; finely and obliquely striate, whorls 5, convex ; last whorl a little compressed. Aperture subcircular ; peristome slightly thickened and reflected, margins joined by a callus. Columella expanded partially obliterating the narrow perforation, plications present near the perforation.

It differs from the preceding species by its less globose form, more expanded peristome and more regular striae on whorls.

### Family 7. SUCCINEIDAE

Shell thin, imperforate, oval (internal in the genus *Hyalimax*) with a short, rather conoid spire and rapidly increasing whorls ; aperture large, oblong, columella simple with a thin fold.

Animal with a large foot, short tentacles. Penis with a single retractor muscle, male and female opening close together.

World-wide. Amphibious, some are arboreal in habit.

The phylogenetic position of the family Succineidae has been the

subject of controversy for a long time. Its inclusion in Stylommatophora was disputed by Rigby (1965), according to whom the Succineidae had more affinities towards opisthobranchs rather than stylommatophorans. Butot and Kiauta (1967) even suggested forming a separate order Succinoidea. However, following Taylor and Sohl (1962), and Patterson (1971), who discussed its relationships with other stylommatophorans in regard to several characters like, the eye bearing tentacles, pedal grooves etc., it is retained in its present position.

Key to the genera of Succineidae

Shell external	...	<i>Quickia</i>
Shell internal	...	<i>Hyalimax</i>

Genus 18. *Quickia* Odhner, 1950.

Shell ovately conical with regular, very fine striae, whorls 3, aperture ovate, a columellar plait present.

The pen is is with a penial retractor muscle but lacks a penial sheath.

India and Africa.

28. *Quickia graveleyi* subspecies *andamanensis* (Rao, 1924).

(Pl. III, fig. 5 & 6)

*Succinea graveleyif. andamanensis* Rao, 1924, *Rec. Indian Mus.* 26 : 404.

*Material examined* : (i) 1 ex., top of Mt. Harriet (1,000 ft.), S. Andaman, on damp soil, base of banana tees (Coll. N. Annandale, Dec. 1923) - Holotype. ZSI. Reg. No. M 12424/2. (ii) 4 exs. Mt. Harriet, S. Andaman (Coll. N. Annandale, Dec. 1923) - Paratypes, ZSI. Reg. No. M 22:68/4, (iii) 1 ex., Near Chiriatapu village, S. Andaman (Coll. B.K. Tikader & N.V. Subba Rao, 30.5.1971).

*Measurements* (in mm.) : Length Diameter Height of aperture  
8.45-9.1 5.1-5.5 6.0-6.5

*Distribution* : This subspecies is restricted to the Andaman islands (S. Andaman).

*Remarks* : Shell narrowly ovate, translucent and with regular striae, it differs from the typical form in being a little more tumid and having slightly coarser sculpture.

The greater tumidity of the shell is particularly marked in the penultimate whorl. However, anatomically this form perfectly agrees with the typical form (Rao, 1924). Incidentally, it is the first report of this form after its original discovery in 1923.

*Q. graveleyi* is a polytypic species ; the typical form of this species

was described from Adyar, Madras, along with several subspecific forms viz, *bombayensis*, *deccanensis*, *andamanensis* by Rao (1924). Since the differences in shell characters are observed to be fairly constant the form *andamanensis* is retained here and in conformity with the modern taxonomic conception is elevated to a subspecific rank. But whether all the described forms (? subspecies) are valid or not requires further investigation.

#### Genus 19. *Hyalimax* H. & A. Adams, 1855.

Animal slug-like, elongate-ovate, dorsally convex, usually greenish with a posteriorly pointed foot; foot wide and without distinct pedal grooves. Respiratory orifice nearly at the centre on the right side, anal opening behind it.

Shell internal, thin, flat.

Zanzibar, Reunion island, Burma and India (Andaman & Nicobar islands). Arboreal in habit.

Patterson (1971) recommended the inclusion of *Hyalimax* as a subgenus under *Succinea* on the contention that the reproductive anatomy of *Hyalimax* was of *Succinea* type, (e. g. presence of penial sheath and absence of penial appendix). But in view of the considerable variations in radular structures and other morphological characters (e. g. presence of internal shell), following Thiele (1931) and Godwin-Austen (1882) *Hyalimax* is here retained as a separate genus with the subgenus *Jarava* to accommodate the Indian species.

#### Key to the species of *Hyalimax*

Shell ovate, milky white, fairly thick with a lateral nucleus	...	<i>H. andamanica</i>
Shell scapuliform, transparent, thin with a central nucleus	...	<i>H. reinhardti</i>

#### 29. *Hyalimax* (*Jarava*) *andamanica* Godwin Austen, 1882.

*Hyalimax* (*Jarava*) *andamanica* : Godwin-Austen 1882, *Moll. India* 1 : 57, pl. 11, figs. 1-4.

*Hyalimax* (*Jarava*) *andamanica* : Gude, 1914, *Fauna Brit. India*, Mollusca, 11 : 498.

*Material examined* : 1 ex., (shell) Ross island, Andamans (Coll. H. H. Godwin-Austen).

<i>Measurements</i> (in mm.) :	Length	Diameter
(Shell)	5.1	3.9

*Distribution* : Restricted endemic to the Andaman islands (Port Blair, Ross island).

*Remarks* : Animal pale green, yellowish on the mantle with stripes

on upper part of the neck.

Shell ovate, comparatively thicker than in *H. reinhardti*, whitish with close concentric growth lines, thin, nucleus near the base.

### 30. *Hyalimax (Jarava) reinhardti* Moersch, 1872

*Hyalimax reinhardti* Moersch, 1872, *J. Conch. Paris.*, 20 : 314.

*Hyalimax (Jarava) reinhardti* : Godwin-Austen, 1882, *Moll. India*, 1 : 59.

*Hyalimax (Jarava) reinhardti* : Gude, 1914, *Fauna Brit. India Mollusca*, II : 501.

*Material examined* : (i) 2 exs., Near South bay, on N. S. Rd., Great Nicobar ; 2 exs., Leola Nullah, on N. S. Rd., Great Nicobar (Coll. S. S. Saha, 1984).

<i>Measurements</i> (in mm.) :	Length	Diameter
(Shell)	7.95	4.1

*Distribution* : Nicobar Islands (Pulo Panjang, Gt. Nicobar).

*Remarks* : The specimens studied had lost their natural colour and were greatly contracted. However, the animal is elongate ovate, posteriorly aeuminate, greenish with some bluish colouration on head region ; tentacles short, respiratory orifice at the right margin, anal opening behind that, covered by the mantle. Foot broad, a scarcely discernible median area on the sole of foot. Pedal grooves not at all distinguishable, only a few weakly impressed lines present on the side of foot, at the posterior end. Shell completely covered by the mantle, flat, narrowly elongate, thin, almost membrane-like, semi-transparent with concentric markings and a few shallow furrow-like lines radiating from a central nucleus (apex).

These are arboreal in nature ; the specimens studied were collected from the leaves of shrubs.

As Godwin-Austen (1882) remarked the animals in the two species are very similar to each other but with distinct internal shells.

## Order SOLEOLIFERA

### Family 8. VERONICELLIDAE

Animal without a shell, body elongate, the eye-bearing tentacles contractile (not retractile) and the other pair bilobed. Mantle covers the whole back of the body. Foot narrow and transversely grooved. The male genital opening on the anterior right side of body, female opening just below the middle.

Veronicellidae, the commonest family of Indian land slugs, is represented in the islands by a single species. The status of the other species, *Vaginulus giganteus*, described by Godwin-Austen (1895) is not clear since the description was based on a single specimen, which accor-

ding to him was larger than any other Indian forms (total length 68.0 mm, width 23.0 mm). Moreover, the single specimen was not dissected and the external characters given by the author are perfectly in conformity with those of the species *Laevicaulis alte*.

Tropical regions of Asia, Africa, America, Australia, West Polynesia. Nocturnal, herbivorous in habit. Living on grounds between low vegetations, under decaying foliage etc.

### Genus 20. *Laevicaulis* Simroth, 1913

Body elongate, oval when contracted, linear when extended. A deep furrow present around the margin separating the mantle from the foot. Head retractile under the mantle; two pairs of tentacles, upper pair longer and cylindrical, the lower shorter. Foot, when retracted does not extend over the anus, anal opening slit-like, not covered by any flap.

Hermaphrodite; both self and cross fertilisation take place.

Africa, Asia, Australia, New Caledonia and the Loyalti island.

### 31. *Laevicaulis alte* (Ferussac, 1821)

*Vaginulus alte* Ferussac, 1821, *Tabl. Syst. Limaces*, p. 14.

*Laevicaulis alte*: Ray, 1961, *Treubia*, 25 (3): 275

*Laevicaulis alte*: Subba Rao & Mitra, 1979, *Rec. zool. Surv. India*, 75: 10.

*Laevicaulis alte*: Blshop, 1977, *Mcm. Qd. Mus.*, 18 (1): 55.

*Material examined*: 1 ex., From a damp jungle between Jirkatang and Shoal Bay, Andamans (Coll. H. S. Rao, 5.12.1932), 1 ex., Under a log, Campbell Bay, Great Nicobar, (coll. S. S. Saha, 30.8.84).

<i>Measurements</i> (in mm.)	Length	Diameter
	19.5-21.80	6.4-6.9

*Distribution*: India: Andhra Pradesh, Bihar, Gujarat, Maharashtra, Rajasthan, Tamil Nadu, Pondichery, West Bengal, Uttar Pradesh, Punjab, Andaman and Nicobar islands.

*Elsewhere*: East Africa, Mauritius, Reunion island, Madagascar, Sri Lanka, Hong Kong, China, Formosa, Indonesia, New Caledonia and Loyalti islands, Malay Peninsula and Archipelago and Australia.

*Remarks*: The mantle is pigmented with dark brown color, usually with a yellowish band down the middle.

The two alcohol specimens studied are juveniles, normally it grows to much bigger size.

It remains very active during the March-April to October period, and voraciously feeds on both green plants and decaying organic material, often causing extensive damage to garden plants,

The exceptionally wide distribution of this species is attributed to the human agency. According to Verdcourt (1972) this does not indicate an ancient species but a recent artificial extension of distribution.

#### Family 9. CLAUSILIIDAE

Shell cylindrical or fusiform, usually sinistral, rimate ; striate or ribbed ; spire turreted, sutures shallow ; aperture rather small, usually pear shaped or subquadrately ovate with a number of folds and some times with palatal plications. Possesses a curved flexuous elastic lid-the clausilium (resting between the folds) used to close the aperture when the animal withdraws inside the shell.

Animal slender, usually greyish black with a greenish tinge on the posterior part ; tentacles short but distinct, foot rather short ; posteriorly pointed.

The genital apparatus usually possesses an appendage to the duct of receptaculum seminis and an epiphallus.

Asia, Africa, Europe, S. America, India, Burma, China, Japan, Malay Archipelago.

The classification and characters for the family Clausiliidae are after Loosjes (1953).

#### Key to the genera of Clausilliidae

Shell with wavy transverse striae, spiral lamella not connected with upper lamella, lowest palatal plica not the smallest	...	<i>Phaedusa</i>
Shell with straight transverse striae, spiral lamella connected with upper lamella, lowest palatal plica the smallest	...	<i>Acrophaedusa</i>

#### Genus 21. *Acrophaedusa* Boettger, 1877

Shell with straight transverse striae, cylindrical at top, there being little or no increase in diameter in the upper whorls, the increase is more noticeable on the lower whorls. Aperture pear shaped ; spiral lamella usually joined with the upper lamella ; palatal plicae of variable number, the lowest usually shortest.

Duct of the receptaculum seminis with an appendix. Usually viviparous. India, Java and Sumatra.

#### 32. *Acrophaedusa wuellerstorfi* (Zeilebor, 1867)

(Pl. V, fig. 4)

*Clausilia wuellerstorfi* Zeilebor, 1867, *Verh. K. K. Zool. Bot. Ges.*, 17 : 806.

*Clausilia nevilliana* : Mocclendorff, 1882, *J. Asiat. Soc. Beng.*, 57 : 11.

*Clausilia (Phaedusa) wuellerstorfi* : Gude, 1914, *Fauna Brit. India, Mollusca (land operculates)* : 327, text-fig. 113.

*Acrophaedusa wuellerstorfi* : Loosjes, 1953, *Beaufortia*, 3 (31) : 78, fig. 53.

*Material examined* : 6 exs., Camorta, Nicobar islands (Coll. A. J. Peile) ; (ii) 5 exs., Campbell Bay, Great Nicobar islands (Coll. S. S. Saha, 29. 8. 84).

*Measurements* (in mm.) : Length      Diameter      Height of aperture  
16.25 19.2      4.0-4.25      4.0-4.7

*Distribution* : Restricted endemic to the Nicobar islands (Camorta, Nancoury, Gt. Nicobar).

*Remarks* : Shell cylindrically fusiform, rimate, yellowish ; obliquely and finely striate, spire with straight or rather convex sides ; apex fairly obtuse ; whorls 10, apical whorls sometimes forming a cylindric top ; aperture pyriform. Upper margin sinuate at the upper parietal fold. Peristome continuous, rather simple or very little thickened. Outer margin descends straight and runs a little left, the columellar margin descends in a curve to a semicircular base. Upper lamella continuous with the spiral lamella. Palatal plicae 3, the upper one long and the lower two short.

The plate of the clausilium long, tongue-shaped with parallel sides.

### Genus 22. *Phaedusa* H. & A. Adams, 1855

Shell fusiform, usually exceeding 12mm., provided with wavy striae, very distinct on the last whorl; fairly solid, spire with rather straight lateral outlines. Lunule absent and replaced by a number of small parallel plicae. Spiral lamella usually disjoined. Last whorl rather appressed. Duct of the receptaculum seminis with an appendix.

Mostly viviparous.

India, Burma, China, Japan, Malay Archipelago.

Gude (1914) remarked that most of the Indian clausilids are confined to the Himalayan region. Loosjes (1953) also mentions that most of the Indo-Australian *Phaedusinae* (to which subfamily the Indian clausilids belong) are mountain dwelling forms with a few tree climbing forms. In general, they inhabit shady moist or sometimes wet places.

### 33. *Phaedusa corticina nicobarica* Gude, 1914 (Pl. V, fig. 3)

*Clausilia (Phaedusa) wuellerstorfi* : Mocclendorff, 1882 (non *C. wuellerstorfi* Zelebor, 1867), *J. Asiat. Soc. Beng.*, 51: 11.

*Clausilia (Phaedusa) nicobarica* Gude, 1914, *Fauna Brit. India, Mollusca* (land operculates) : 328, text-fig. 114.

*Phaedusa corticina nicobarica* : Loosjes, 1953, *Beaufortia*, 3 (31) : 25, fig. 3,

*Material examined* : 3 exs., Gt. Nicobar (Coll. ?).

*Measurements* (in mm.) : Length Diameter Height of aperture  
24.0 26.4 5.0-5.3 5.8 6.05

*Distribution* : Restricted endemic to the Nicobar islands (Gt. Nicobar).

*Remarks* : Shell cylindrical, solid, rimate, very closely and finely striate; spire turreted with an acute apex; whorls 10-11, fairly convex with straight sides; last whorl rather laterally compressed. Aperture pyriform; parietal folds divergent, the upper low and interrupted, the lower more raised and stout, almost touching the margin but not exactly reaching the peristome. Palatal plicae 2, upper one longer and parallel to the suture, the lower one shorter. Peristome expanded and reflected. The parietal margin of the peristome not sinuate at the upper fold.

The subspecies differs from the typical form in possessing less rough sculpture, being slightly more reddish brown and the upper palatal plica being quite longer.

The clausilium is broad and strongly curved at the one third from top of the plate. The top of the plate is thickened.

#### Family 10. ACHATINIDAE

Shell moderately large to very large, ovately conical, imperforate with convex whorls; aperture ovate, outer lip thin, simple; columella concave or straight, usually truncate below.

Africa.

#### Genus 23. *Achatina* Lamarck, 1799

Shell large to very large, thick, elongate-ovate, spire conical, apex obtuse; whorls convex, apical whorls smooth; aperture ovate, outer lip simple; columella concave and truncate below.

Africa. The species, *A. fulica* subsequently naturalised and established in many other countries including India.

#### 34. *Achatina* (*Lissachatina*) *fulica fulica* (Bowdich, 1822)

(Pl. III, fig. 7)

*Helix fulica* Ferussac, 1821, *Table, Syst. Limacens* : 49, No. 347 (nom nud).

*Achatina fulica* "Lamarck" : Bowdich, 1822, *Elements of Conchology, I*, pl. 13, fig. 3.

*Achatina* (*Lissachatina*) *fulica fulica* : Bequart, 1950, *Bull. Mus. Comp. zool, Harvard*, 105 (1) : 1-216, pl. 8.

*Material examined* : (i) 7 exs., Port Blair, Andaman (Coll. Agricultural Office, Port Blair). (ii) 15 exs., Humphrygunje, Andamans; 12 exs., Aberdeen, Port Blair, 35 exs., South Andamans; 5 exs., Jungle-

ghat, Port Blair (Coll. B.S. Lamba, 1964); (iii) 7 exs., Aberdeen, Port Blair (Coll. K. K. Tiwari, 13.1.59), (iv) 6 exs., Aberdeen, Port Blair (Coll. ?), v) 3 exs., Atlanta Point (Coll. ?).

*Measurements* (in mm.) : Length      Diameter      Height of aperture  
54.0-95.0      37.85-55.0      35.75-44.5

*Distribution* : Assam, Manipur, Mizoram, Nagaland, Tripura, Uttar Pradesh, Bihar, Maharashtra, Gujarat, West Bengal, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Andaman (South Andaman, Long island, Rangat, Mayabandar, Diglipur) & Nicobar islands (Car Nicobar, Camorta).

*Elsewhere* : Madagascar, Seychelles, Zanzibar, Mauritius, Singapore.

*Remarks* : Shell large, ovately conical, strongly inflated, pale yellowish to whitish with brown streaks all over, inside the aperture bluish white; whorls 8, rapidly increasing, last whorl large, equalling more than half the total length of the shell. Sutures deep with short spiral striations just below, more distinctly on lower whorls, apical whorls smooth. Aperture large, ovate, outer lip simple, columella strongly arched and truncate below.

Oviparous, lays ovoid yellowish or whitish eggs in heaps usually inside holes (nest) of 3 to 5 cms deep, dug out for this purpose.

It is a well known agri-horgicultural pest. These snails remain active during the rainy season and coinciding with the length of the monsoon their active period is longer in these islands, extending from 6 to 8 months.

These are nocturnal in habit and for taking rest during the day time usually climb walls or tree trunks up to a height of 400 cms. (Raut & Ghose, 1984).

Introduced by the Japanese soldiers during the world war II, these snails are now common to abundant in the main island of South Andaman, Long island, Rangat, Mayabandar, Diglipur, Car Nicobar and Camorta.

*Control* : Important reports on various control measures tried to combat the menace of *A. fulica* in these islands comprise Srivastava (1966, 1970, 1976), Srivastava & Srivastava (1967, 1968) and Srivastava et. al. (1968, 1971, 1975).

The methods tried are chiefly of two categories, Chemical and Biological.

*Chemical* : Two different concentration (3% and 5%) of metaldehyde suspension were effectively used at Port Blair to control these snails (Srivastava, 1970, Srivastava et. al. 1968). Copper sulphate,

mixed with lime though successfully applied elsewhere (Hoda, 1971) failed to produce good result in these islands because of its hygroscopic nature (Srivastava, 1976).

**Biological :** The hermit crab (*Coenobita cavipes*) which feeds upon *A. fulica*, was successfully used as an agent to control the snail in some areas of South Andamans. Following the release of these crabs in good numbers the population of the snail was brought down considerably in these areas in 1967 (Srivastava, 1968).

*Orthomorpha* sp., a millipede, though very thinly populated in these islands was observed by Srivastava and Srivastava (1967) to prey upon the giant African snail by paralysing it with its acidic secretion.

The attempt made by Srivastava et. al. (1975) to use *Gulella bicolor*, the small carnivorous snail as a predator of *A. fulica* in South Andamans, was not much successful.

As reported by Srivastava (1970) the Livestock Department at Port Blair had successfully used these snails as poultry feed. Eggs and juvenile snails were observed to be devoured by ducks and this resulted in a considerable decline in the snail population in Andamans (Srivastava, 1976). (The result of Raut and Ghose's (1984) attempt to use these snails as a poultry feed however did not corroborate this).

Among the vertebrates, pigs are also reported to feed on this snail in Andamans (Srivastava et. al. 1971).

As suggested by Srivastava and Srivastava (1968), the leucodermia like disease of *A. fulica* which resulted in 28% to 50% mortality in nature can be spread by spraying the aqueous extract of the affected snail thereby putting a check on the snail population.

#### Family 11. SUBULINIDAE

Shell variable, small to moderate, turreted to cylindrical or elongate ovate; usually uniformly coloured, smooth or striate; without internal lamellae, aperture ovate, peristome thin, simple, usually arched forward; columella concave or straight, truncate or rounded below.

Foot with undivided sole and without caudal gland.

World-wide. Mostly on grounds.

#### Key to the genera of Subulinidae

- |   |   |   |                   |
|---|---|---|-------------------|
| 1. Columella abruptly truncate at base  | — | — | <i>Subulina</i>   |
| Columella rounded and continuous with the basal lip   |   | — | 2                 |
| 2. Shell smooth or faintly sculptured with fine more or less straight striations            |   | — | <i>Lamellaxis</i> |
| Shell densely and often costulately sculptured with oblique and forwardly arched striations |   | — | <i>Prosopeas</i>  |

Genus 24. *Lamellaxis* Strebel, 1882

Shell small, elongate turreted; imperforate or narrowly perforate. Whorls rather flatly convex, smooth or microscopically striate; suture moderately deep. Aperture ovate, peristome thin, columella usually concave and rounded below, not sinuate, margin slightly reflected.

Oviparous in nature, produces small spherical eggs.

Tropical and subtropical regions of the world, except Australia.

35. *Lamellaxis gracile* (Hutton, 1834)

(Pl. IV, fig. 7)

No. 5, *Bulimus*: Hutton, Hutton, 1834, *J. Asiat. Soc. Beng.*, 3 : 84 ; No. 5 *Bulimus* ? (mihi) *graciles* : p. 93.

*Opeas apex* Mousson, var. *nicobarica* Moersch, 1872, *J. Conch. Paris*, 20 : 313.

*Material examined* : (i) 105 exs., Camorta, Nicobars; 1 ex., Andaman (Coll. ?). (ii) 4 exs., Forest adjoining Rest House, Tugapore (Coll. B. K. Tikader & N. V. Subba Rao, 13.5.71) (iii) 17 exs., Trinket island, Nicobar; 25 exs. Car Nicobar island; 15 exs., Camorta (Coll. A.G.K. Menon).

*Measurements* (in mm.) : Length Diameter Height of aperture  
4.9-9.1 1.8-3.05 1.6-2.85

*Distribution* : India: Common throughout including Andaman (Camorta, Trinket) & Nicobar islands (Car Nicobar).

Elsewhere : East Africa, Bangladesh, Pakistan, Sri Lanka, Burma, Malay Peninsula and Archipelago, Japan, China, the Philippines and Polynesia.

*Remarks* : Shell small, tapering, transparent to pale; whorls rounded, the last whorl equals the preceding two whorls together in width; sutures deep, rather crenulate. Aperture semiovate, longer than broad, peristome thin, unexpanded, columellar lip straight, rounded below.

Animal light yellow, very commonly seen in freely active condition in shady parts of garden, on damp walls, flower pots etc. during the monsoon or just after it. These snails are reported to cause considerable damage to potted plants (Ray & Mukherjee, 1963).

From the laboratory studies it is seen that the snail takes six weeks to attain sexual maturity and on an average lay 131 eggs during its life span (Subba Rao *et al.*, 1980, 1981).

Genus 25. *Prosopeas* Moersch, 1876

Shell moderate to fairly large, elongate with subglobose obtuse apex; imperforate or very narrowly perforate, whorls flatly convex, obliquely striate; the striae arched forward and retracted to the sutures

above. Aperture ovate, columella concave or straight, rounded at the base, sometimes a little folded above, margin slightly reflected.

India, Malay Peninsula and Archipelago, China and the Philippines.

In India this genus is restricted to the Andaman and Nicobar islands except a single species (*P. hebes*) which is recorded from the Nilgiris, in South India.

#### Key to the species of *Prosopeas*

- |   |   |                       |
|---|---|-----------------------|
| 1. Shell broad, usually exceeding 10 mm in diameter, side of whorl more or less straight          | — | <i>P. haughtoni</i>   |
| Shell narrow, usually below 10 mm in diameter, side of whorl more or less rounded                 | — | 2                     |
| 2. Last whorl wider, equalling a little less than half of total length, columella slightly folded | — | <i>P. roepstorffi</i> |
| Last whorl narrow, equalling a little less than one third of total length, columella not folded   | — | <i>P. walkeri</i>     |

#### 36. *Prosopeas haughtoni* (Benson, 1863) (Pl. IV, fig. 9)

*Spiraxis haughtoni* Benson, 1863, *Ann. Mag. nat. Hist.* (3) 11 : 90.

*Prosopeas haughtoni* : Gude, 1914, *Fauna Brit. India*, Mollusca, 2 : 364.

*Material examined* : (i) 33 exs., Andamans; 12 exs., Port Blair, Andamans (Coll. ?). (ii) 59 exs., Andamans (Coll. J. Anderson). (iii) 2 exs., Forest near Diglipur, N. Andaman (Coll. B. K. Tikader & N. V. Subba Rao), (iv) 3 exs., (young ones) Forest near Rest House, Tugapur, N. Andaman (Coll. B. K. Tikader & N. V. Subba Rao) (v) 3 exs., Andamans (Ex. British Mus.)

*Measurements* (in mm) : Length      Diameter      Height of aperture  
14.25-32.2      6.75-11.2      7.4-10.2

*Distribution* : Restricted endemic to the Andaman islands (S. & N. Andaman).

*Remarks* : Shell whitish, elongately conical, subturreted, imperforate, solid, closely and obliquely striate, costulately so on the apical whorls and also at the sutures on lower whorls; apex obtuse, whorls 7, moderately convex, the last obsolete subangulate at the periphery in adult shells but strongly so in case of young shells. Aperture ovately elliptical, peristome not much curved, columella with thick callus deposit, concavely arched.

One old lot identified as var. *oxynter* Benson, is present in the National Zoological Collection. These are slightly thicker, larger and darker in colour. The recently collected specimens however, agree with

the typical form.

37. **Prosopeas roepstorffi** Moerch, 1876

(Pl. V, fig. 1)

*Bulimus (Prosopeas) roepstorffi* Moerch, 1876, *J. Conch. Paris*, 24 : 358.

*Prosopeas roepstorffi* : Pilsbry, 1906, *Man. Conch.*, (2) 18 : 27, pl. 3, figs. 97-99.

*Prosopeas roepstorffi* : Gude, 1914, *Fauna Brit. India*, Mollusca, II : 366.

*Material examined* : (i) 3 exs., Nicobars; 2 exs., Armyland, 55 kms. north of Campbell Bay, Great Nicobar (Coll. S. S. Saha, 20.6.84), (ii) 3 exs., Nicobar (Coll. ?), (iii) 60 exs., Nicobars (Coll. F. Stoliczka & J. Roepstorff).

*Measurements* (in mm.) : Length    Diameter    Height of aperture  
10.0-22.6    4.3-8.95    5.15-9.3

*Distribution* : Restricted endemic to the Nicobar islands (Camorta, Gt. Nicobar).

*Remarks* : Shell elongately fusiform, pale, imperforate, costulately sculptured with slightly oblique and forwardly arcuate striae; apical whorls rather smooth, whorls 8, moderately convex, last whorl long, equalling almost half of the total length of the shell; sutures deep, oblique. Aperture oblique, narrowly ovate, outer lip thin, arched, rather widely rounded at base; columella a little concave and folded above, columellar lip slightly reflected.

Shell in this species, shows variations in general shape, some being narrower and more elongate with a proportionately longer spire.

38. **Prosopeas walkeri** (Benson, 1863)

(Pl. IV, fig. 10)

*Spiraxis walkeri* Benson, 1863, *Ann. Mag. nat. Hist.*, (3) 11 : 90.

*Prosopeas walkeri* : Pilsbry, 1906, *Man. Conch.*, (2) 18 : 29 pl. 6, fig. 70.

*Prosopeas walkeri* : Gude, 1914, *Fauna Brit. India*, Mollusca, II : 363.

*Material examined* : (i) 10 exs., Andamans (Coll. F. Stoliczka), (ii) 16 exs., Hope Town, Port Blair, S. Andaman (Coll. ?, 1930).

*Measurements* (in mm.) : Length    Diameter    Height of aperture  
8.8-17.75    2.85-4.5    3.5-4.15

*Distribution* : India : Andaman islands (Port Blair)

Elsewhere : Burma, Thailand.

*Remarks* : Shell white, imperforate, narrow, rather cylindrically turreted, apex subglobose obtuse, apical whorls rather smooth, rest of the whorls obliquely striate; sutures deep, whorls 9-9½, convex. Aperture oblique, rather elliptical, peristome thin, strongly arched, columella arched, callosed with a straight, slightly reflected margin.

Some of the shells examined measure longer than that given by Gude (1914). The largest shell (17.75 mm long) is incidentally larger than the shell referred by Solem (1966).

### Genus 26. *Subulina* Beck, 1837

Shell turreted, imperforate, narrow, thin, brownish or rather translucent, apex obtuse; whorls rounded, smooth or plicate at the sutural regions. Aperture oblique, ovate, columella concave, truncate below.

Tropical America and Africa (one species *S. octona* introduced and established in many countries including India.)

On grounds.

#### 39. *Subulina octona* (Bruguiere, 1789)

(Pl. IV, fig. 8)

*Bulinus octonus* Bruguiere, 1789, *Encycl. Meth. Vers.*, 1 : 325.

*Subulina octona* : Pilsbry, 1906, *Man. Conch.*, (2) 18 : 72, pl. 12, figs. 8-9; p. 222, pl. 39, figs. 28-37.

*Subulina crotalaria* (nec. Schumacher) : Moerch, 1872, *J. Conch. Paris.*, 20 : 337.

*Subulina octona* : Gude, 1914, *Fauna Brit. India*, Mollusca, II : 341.

*Material examined* : (i) 165 exs., Agricultural Farm, Car Nicobar; 68 exs., Coconut Grove, Car Nicobar (Coll. A. G. K. Menon, 1972) (ii) 35 exs., Camorta (Coll. ?).

*Measurements* (in mm.) : 

Length	Diameter	Height of aperture
7.35-14.9	2.6-3.85	2.4-3.7

*Distribution* : Very widely distributed ; India, West Indies, America (North & South), West Africa, Mauritius, Seychelles, Sri Lanka, Sumatra and also many other islands like, New Caledonia and New Hebrides. Its occurrence in hot houses in Europe and N. America lends colour to the theory of its dispersal through cultivation (Gude, 1914).

*Remarks* : Shell thin, turreted, translucent, yellowish, very regularly tapering to the obtuse apex ; irregularly striate throughout, rather coarsely on lower whorls; whorls 8-9, moderately convex ; sutures deep and crenulate, more regularly towards the apex, last whorl rounded. Aperture suboblique, ovate, columella arched above, abruptly truncate at the base ; peristome thin.

The shells from the Nicobars (Camorta and Car Nicobar) are apparently immature as is indicated by the trace of subangulation at the periphery. Moreover, the average length of these shells is also comparatively less, the highest being 14.9 mm. Gude (1914) refers to some shells from Bombay having 10 whorls and being 19 mm long. The average length of some shells from Cuba present in the NZC is also above 10 mm.



deeply perforate, covered with a brownish epidermis ; with very fine spiral ribs crossed by radial growth markings ; whorls  $5\frac{1}{2}$ , flatly convex, sutures deep, last whorl rather bicarinate (a fine second rib present above the carinate periphery). Aperture subvertical, rather ovate, peristome slightly thickened, columellar margin oblique, simple.

The shells from the Nicobars are labelled as '*Sagdinella didrichsenii* Moersch. Obviously this is the lot which was tentatively identified by Nevill and included in his Hand List as sp. 206 (p. 33) and a part of which was sent to Godwin-Austen for confirmation, who placed it under the present species (as *sitala*, Gude, 1914, p. 16).

Godwin Austen (1882) examined the type of Moersch's *Sagdinella didrichsenii* from Sambelong, Nicobars but he was unable to come to any conclusion. He sceptically retained the species with its original description (p. 44). But in the index the species was included as '*Sagdinella didrichsenii* = young *Pupina nicobarica*.'

#### Superfamily ARIOPHANTACEA

#### Family 13. TROCHOMORPHIDAE

Shell moderate, depressedly trochiform, thin, apex obtuse ; whorls flatly convex, usually closely striate, periphery keeled ; aperture depressed, oblique, peristome thin or little thickened, often arcuate ; edges of umbilicus often angulate.

Animal with a long narrow foot, sole without longitudinal divisions ; overhanging lobe at the extremity of foot absent, peripodial margin distinct and double.

India, Burma, China, Japan, Malaysia, Philippines, New Guinea and the Pacific islands.

Since it is very difficult to differentiate *Videna* and *Sivella* on shell characters alone, we accept the conclusion drawn by Gude (1914) and place all the insular species under *Videna* H. A. Adams, leaving *Sivella* Blanford for the continental species. Out of the 11 species of *Videna* recorded from these islands, 4 occur in the Andamans and the remaining 7 are found in the Nicobar islands. Two of the Nicobar species, namely *V. lardea* and *V. bicolor* extend to Malaysia also. Only one species (*V. billiana*) is common to the Nicobar islands and the mainland (Subba Rao & Mitra, 1979).

#### Genus 28. *Videna* H. & A. Adams, 1858.

Shell depressed, widely umbilicate, acutely keeled, a little convex at base ; without parietal lamella, embryonic whorls with weak sculpture, last whorl a little deflected at the aperture. Aperture oblique, depressed ;

peristome simple or slightly marginate.

Radular marginals with broader, shorter cusps. India, the Pacific Islands (Baker, 1941).

Key to the species of the genus *Videna*

1.	Width of the umbilicus more than 3 mm	—	2
	Width of the umbilicus less than 3 mm	—	6
2.	Columellar lip descending at an angle, edges of the umbilicus angulate	—	3
	Columellar lip descending in a regular curve, edges of the umbilicus rounded	—	4
3.	Shell convex on base, edges of the umbilicus sharply keeled	—	<i>V. andamanica</i>
	Shell flatly convex on base, edges of the umbilicus subangulate	—	<i>V. pseudosanis</i>
4.	Shell with spiral sculpture on base, last whorl descending in front	—	5
	Shell without spiral sculpture on base, last whorl not descending in front	—	<i>V. iopharynx</i>
5.	Shell with brownish colouration at sutures	—	<i>V. trilineata</i>
	Shell without brownish colouration at sutures	—	<i>V. sulcipes</i>
6.	Last whorl wide and slightly descending near the aperture	—	<i>V. billeana</i>
	Last whorl not wide and not descending near the aperture	—	<i>V. sanis</i>

41. *Videna andamanica* (Godwin-Austen, 1895)  
(Pl. VIII, fig. 8)

*Discus andamanica* (Nevill) Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 448.  
*Trochomorpha (Videna) andamanica* : Gude, 1914, *Fauna Brit. India, Mollusca*, 2 : 6.

*Material examined* : (i) 41 exs., Andamans (Coll. ?), (ii) 3 exs., Andamans (Coll. G. H. Booley), (iii) 2 exs., Forest near Luxmipur, Diglipur, N. Andaman (Coll. B. K. Tikader & N. V. Subba Rao, 24.4.71).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Umbilicus
10.0-13.7	3.75-5.55	3.0-4.45	3.3-4.7

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell subcircular, depressed, widely and deeply umbilicate, umbilicus funnel shaped, wide outside and gradually tapering inside, edges of umbilicus sharply keeled ; straw coloured, closely, obliquely striate ; sutures bordered by a well defined narrow margin, last whorl acutely keeled at the periphery. Aperture strongly oblique,

peristome slightly curved and a little thickened.

42. *Videna billeana* (Moerch, 1872)

(Pl. VII, fig. 8)

*Nanina (Videna) billeana* Moerch, 1872, *J. Conch. Paris*, 20 : 310.

*Discus billeana* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.

*Trochomorpha (Sivella) billeana* : Gude, 1914, *Fauna Brit. India; Mollusca*, 2 : 4

*Material examined* : (i) 18 exs., Camorta (Coll. J. Roepstorff), (ii) 8 exs., Kondul ; 26 exs., Katchal (Coll. ?), (iii) 2 exs., Armyland, 5 kms. West of Campbell Bay, Great Nicobar (Coll. S. S. Saha, 20.6.84).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
8.4-13.35	3.2-5.8	2.9-4.85	1.5-2.15

*Distribution* : Nicobars (Camorta, Kondul, Katchal, Great Nicobar) and Maharashtra (Pune).

*Remarks* : Shell depressedly conoid, deeply but narrowly umbilicate, edges of umbilicus rounded ; yellowish brown, finely and closely striate with faint spiral markings below ; whorls 6, narrow, rather depressed at the sutural region, last whorl sharply carinate at the periphery. Aperture oblique, depressedly rhomboid, peristome not much thickened.

43. *Videna iopharynx* (Moerch, 1876)

(Pl. VIII, fig. 9, 10)

*Nanina (Videna) iopharynx* Moerch, 1876, *J. Conch., Paris* 24 : 356.

*Discus iopharynx* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.

*Trochomorpha (Videna) iopharynx* : Gude, 1924, *Fauna Brit. India, Mollusca*, 2 : 7.

*Material examined* : (i) 2 exs., Katchal ; 4 exs., Camorta ; 10 exs., Nicobars (Coll. ?).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
12.0-16.8	4.35-6.5	4.0-5.8	4.0-5.7

*Distribution* : Restricted endemic to the Nicobar islands (Katchal, Camorta).

*Remarks* : Shell depressed, widely umbilicate, closely sculptured with oblique growth striae ; golden brown coloured ; apex obtuse ; dorsal surface more or less flat, whorls  $5\frac{1}{2}$ -6, scarcely convex, last whorl acutely keeled. Aperture oblique, peristome slightly thickened.

44. *Videna trilineata* (Moerch, 1876)

(Pl. VII, figs. 4, 5)

*Nanina (Videna) sulcipes* var. *trilineata* Moerch, 1876, *J. Conch. Paris.*, 24 : 355.*Discus sulcipes* var. *trilineata* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.*Discus trilineata* : Godwin-Austen, 1893-1895, *Proc. malac. Soc. Lond.*, 1 : 185, pl. 19, fig. 2 (Anatomy).*Trochomorpha (Videna) trilineata* : Gude, 1914, *Fauna Brit. India*, Mollusca, 2 : 10.

*Material examined* : (i) 10 exs., Katchal ; 4 exs., Camorta, Nicobars, 13 exs., Nicobars (Coll. ?), (ii) 7 exs., Rubber Plantations, Katchal, Nicobars, (Coll. K. V. S. Rao, 6.2.74), (iii) 1 ex., Coconut grove, Daring vill. Camorta (Coll. A. G. K. Menon, 20.3.72).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
13.35-14.7	5.75-6.6	4.5-5.0	3.45-4.5

*Distribution* : Restricted endemic to the Nicobar islands (Katchal, Camorta).

*Remarks* : Shell depressedly conoid, widely umbilicate, pale white in colour usually with brownish markings along the sutures and also below the periphery on the base ; finely striate above and granulately sculptured below. Whorls 6, moderately convex ; sutures deep, marginate, last whorl carinate, wider at the mouth and slightly descending in front. Aperture oblique, less depressed.

Shell in this species is nearer to *V. billeana* but differs in being more widely umbilicate, the sculpture being much finer and also by being more swollen on the base.

Though raised to a specific status by Godwin-Austen (1893-95) on the basis of anatomy, the shell of this species is now for the first time figured and described.

45. *Videna pseudosanis* (Fulton, 1897)

(Pl. VII, fig. 6, 7)

*Discus pseudosanis* (Nevill) Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.*Trochomorpha (Videna) pseudosanis* Fulton, 1897, *Ann. Mag. nat. Hist.* (6) 20 : 213, pl. 6, fig. 5.*Trochomorpha (Videna) pseudosanis* : Gude, 1914, *Fauna Brit. India*, Mollusca, 2 : 8.*Material examined* : 47 exs., Andamans (Coll. ?).*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
9.15-13.12	2.95-4.4	2.8-4.2	3.1-4.5

*Distribution* : Restricted endemic to the Andaman island.

*Remarks* : Shell much flattened, scarcely convex above and below,

widely umbilicate, edges of umbilicus subangulate ; distinctly striate, whorls narrow, sutures marginate. Aperture oblique.

This species differs from *V. andamanica* in having flatter shell with less marginate sutures, closer striation and only subangulate and not keeled umbilical edges.

The name *pseudosanis* was a manuscript name given by Nevill, Godwin-Austen (1895) included it in his list but did not provide a description for this, hence the authorship of this species goes to Fulton.

#### 46. *Videna sanis* (Benson, 1861)

*Helix sanis* Benson, 1861, *Ann. Mag. nat. Hist.*, (3) 7 : 84.

*Discus sanis* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.

*Trochomorpha (Videna) sanis* : Gude, 1914, *Fauna Brit. India, Mollusca*, 2 : 8.

*Material examined* : (i) 86 exs., Andamans (Coll. ?), (ii) 2 exs., Ramjao, Camorta, Nicobars (Coll. A. G. K. Menon, 20.3.72).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
7.55-15.15	3.2-5.7	1.75-5.0	1.45-2.75

*Distribution* : Endemic to the Andaman & Nicobar islands.

*Remarks* : Shell depressed, rather narrowly umbilicate ; finely and somewhat granulately striate above and below ; whorls narrow, planulate, sutures deep, marginate, last whorl distinctly wider, sharply carinate. Aperture oblique, peristome arcuate and a little thickened.

This species differs from *V. pseudosanis* in having closer sculpture on the shell and a narrow umbilicus with more rounded edges.

#### 47. *Videna sulcipes* (Moerch, 1872)

(Pl. VIII, figs. 6, 7)

*Nanina (Videna) sulcipes* Moerch, 1872, *J. Conch. Paris*, 20 :

*Discus sulcipes* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.

*Trochomorpha (Videna) sulcipes* : Gude, 1914, *Fauna Brit. India, Mollusca*, 2 : 9.

*Material examined* : (i) 3 exs., Coconut grove, Car Nicobar ; 2 exs., West of IAF Camp, Car Nicobar (Coll. A. G. K. Menon, March, 1972).

*Measurements* (in mm) :

Diameter	Height	Height of aperture	Width of Umbilicus
4.6-5.1	14.65-16.4	1.8-5.45	3.75-4.3

*Distribution* : Restricted endemic to the Nicobar islands (Nancouri, Car Nicobar).

*Remarks* : Shell depressed, broad, widely umbilicate, swollen at base ; spire scarcely raised, apex blunt ; sculptured with distant oblique

SHELL PARAMETERS OF SPECIES OF *VIDENA*

	Diameter of shell	Diameter of umbilicus	Colour	Sculpture etc.	Distribu- tion
<i>V. billeana</i>	8-13.35	1-2.15	Yellowish brown	Finely striate below. Edge of umbilicus rounded.	Nicobars
<i>V. topharynx</i>	12-16.8	4-5.7	Brown	Obliquely striate. Edge of umbilicus rounded.	Nicobar
<i>V. andama- nica</i>	10-13.6	3-4.7	Yellowish brown	Obliquely striate. Edge of umbilicus sharply keeled.	Andamans
<i>V. pseudo- sanis</i>	9-13.2	3-4.5	Dark brown	Obliquely striate. Edge of umbilicus subangulate.	Andaman
<i>V. sanis</i>	7-15.15	1-2.75	Brownish	Spirally striate, both above and below, Edge of umbilicus rounded.	Nicobars
<i>V. sulclipes</i>	14-16.4	3-4.3		Obliquely striate above, spirally below. Edge of umbilicus angulate.	Nicobars
<i>V. trilineata</i>	13-14.75	3-4.5	Pale white	Obliquely striate above, spirally below. Edge of umbilicus rounded.	Nicobars

growth striae throughout ; faintly and obsoletely spirally lirate below ; whorls  $5\frac{1}{2}$ , last whorl wide and slightly descending in front ; acutely keeled at periphery ; sutures deep, marginate. Aperture broad, strongly oblique, peristome arcuate and slightly thickened.

As per the measurements the present material may belong to the var. *major* mentioned by Moerch (1872).

#### Family 15. ARIOPHANTIDAE

Shell small to large, thin to fairly solid ; usually perforate, shape variable, depressedly turbinate to globosely inflated or conoid ; smooth, striate or obliquely ribbed ; peristome usually thin, simple, columella sometimes reflected over the perforation.

Animal with a narrow foot, pedal groove double, caudal gland present at the extremity of foot, with or without an overhanging lobe. Dart sac long and cylindrical.

Asia and Africa.

Mostly on grounds, though some of the species of *Kaliella* and *Sitala* are known to be arboreal occurring on plants like, bamboo, mango, orange, lemon etc.

Though the Ariophantidae, one of the largest families of Indian land molluscs, has been placed under the family Helicarionidae as a subfamily (along with 3 others, Euconulinae, Helicarioninae and Dyakiinae), by Baker (1941) and Solem (1965), we prefer to retain it as a family following Blanford and Godwin-Austen (1908), the latest comprehensive document on Indian zonitid snails, with minor modifications in accordance with the arrangements of Taylor and Sohl (1961).

#### Key to the genera of Ariophantidae

- |  |   |                     |
|--|---|---------------------|
| 1. Columellar margin with a tooth-like swelling at base        | — | <i>Rhysoptops</i>   |
| Columellar margin without any tooth-like swelling at base      | — | 2                   |
| 2. Shell depressed or lenticular, distinctly broader than high | — | <i>Macrochlamys</i> |
| Shell more or less trochiform nearly as broad as high          | — | <i>Sitala</i>       |

#### Subfamily MACROCHLAMYDINAE

#### Genus 29. *Macrochlamys* Gray, 1847

Shell depressedly turbinate to conoid or lenticular, perforate (rarely imperforate), thin, horny, with or without fine sculpture above, smooth below. Aperture lunate, peristome thin or sometimes internally

labiate. Columellar margin reflected at the perforation.

Animal with a rather narrow foot, caudal gland with a fleshy horn-like process above ; sole of foot tripartite.

South-eastern Asia (except North west India).

Out of the 9 species of *Macrochlamys* recorded from these islands, 7 are from the Andamans only. One, *M. aulopis*, (hitherto known from Andamans only) is now recorded from the Nicobars. The only other species recorded from Nicobars (*M. battimalvensis*) is known from literature only. Moreover, Blanford and Godwin-Austen (1908) also expressed doubt about its identity saying "the only specimen may be immature". *M. indica* is the only species common to these islands (Andamans) and the mainland.

#### Key to the species of the genus *Macrochlamys*

1. Shell with vertical aperture	—	2
Shell with oblique aperture	—	3
2. Shell conoid, last whorl rounded, usually up to 6 mm. in diameter	—	<i>M. pungi</i>
Shell depressed, last whorl compressed. usually above 6 mm. in diameter	—	<i>M. stephus</i>
3. Shell depressed with indistinct sculpture	—	4
Shell lenticular with distinct sculpture	—	6
4. Shell with rather distinct sculpture, last whorl with rounded periphery	—	<i>M. indica</i>
Shell with obsolete spiral sculpture, last whorl subangulate at the periphery	—	5
5. Whorls 5, last whorl distinctly wide at the mouth, columellar margin vertical above	—	<i>M. choinix</i>
Whorls 6, last whorl scarcely wide at the mouth, columellar margin oblique	—	<i>M. exul</i>
6. Shell usually up to 10 mm in diameter, aperture higher than broad	—	<i>M. pseudaulopis</i>
Shell usually above 10 mm in diameter, aperture broader than high	—	7
7. Shell sharply keeled, without rugose sculpture	—	<i>M. aulopis</i>
Shell bluntly angulate, with rugose sculpture	—	<i>M. fordiana</i>

#### 48. *Macrochlamys choinix* (Benson, 1861)

(Pl. VI, figs. 10, 11)

*Helix choinix* : Benson, 1861, *Ann. Mag. nat. Hist.*, (3) 7 : 83.

*Macrochlamys choinix* : Godwin-Austen, 1883, *Moll. India*, 1 : 120, pl. 22, fig. 6.

*Macrochlamys choinix* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 124.

*Material examined* : (i) 30 exs., Jungle near Mt. Harriet, Andamans (Coll. F. Stoliczka, G. Nevill, J. Woodmason), (ii) 75 exs.,

Andamans ; 14 exs., In a ditch at Aberdeen, Port Blair, Andamans (Coll. ?).

*Measurements* (in mm) : Diameter      Height      Height of aperture  
10.0-16.15      5.45-9.2      5.1-8.0

*Distribution* : Restricted endemic to the Andaman islands (South & Middle Andaman).

*Remarks* : Shell very narrowly perforate, depressed with a nearly flattened spire, translucent, sculptured with very fine close oblique striae and obsolete spiral lines both above and below ; whorls 5, rather flat, last whorl distinctly wider, subangulate at the periphery, tumid at the base. Aperture oblique, very broadly lunate, peristome thin, columellar margin vertical above and evenly curved, slightly reflected.

#### 49. *Macrochlamys exul* (Theobald, 1864)

(Pl. VIII, fig. 4)

*Helix exul* Theobald, 1864, *J. Asiat. Soc. Beng.*, 245.

*Orobia (Helix) andamanensis* : Tryon, 1869-78, *Am. J. Conch.*, 5 : 110, pl. 10, fig. 4.

*Macrochlamys exul* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca* : 125.

*Material examined* : (i) 19 exs., Andamans (Coll. ?), (ii) 1 ex., Forest near Laxmipur, Diglipur, N. Andaman (Coll. B.K. Tikader & N.V. Subba Rao).

*Measurements* (in mm) : Diameter      Height      Height of aperture  
10.55-17.5      6.3-9.7      5.7-7.75

*Distribution* : Restricted endemic to the Andaman islands (S. & N. Andaman).

*Remarks* : Shell narrowly perforate, conoidly depressed with a little raised spire ; sculptured with fine oblique growth striae (often with indistinct close spiral lines), whorls 6-6½, convex, gradually increasing in width, the last one rather compressed, subangulate at the periphery (immature shells more distinctly angulate). Aperture oblique, broadly lunate, columellar margin obliquely curved, reflected at the perforation.

Young shells in this species are more closely wound and distinctly angulate.

#### 50. *Macrochlamys indica* (Godwin-Austen, 1883)

(Pl. VIII, fig. 1)

*Macrochlamys indica* Godwin-Austen, 1883, *Moll. India*, 1 : 97, pl. 18, figs. 1-8.

*Macrochlamys indica* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca* : 95, text-fig. 43.

*Macrochlamys indica* : Subba Rao & Mitra, 1979, *Rec. zool. Surv. India*, 75 : 15.

*Material examined* : 4 exs., Andamans (Coll. M.R.E. Khany).

*Measurements* (in mm) : Diameter    Height    Height of aperture  
10.6-16.6    6.05-9.0    5.9-7.2

*Distribution* : India : Assam, Maharashtra, Orissa, Tamil Nadu, W. Bengal and the Andaman islands.

Elsewhere : Sri Lanka.

*Remarks* : Shell perforate, conoidly depressed with a little raised spire ; rather smooth with fine close spiral striae, sutures impressed, whorls  $5\frac{1}{2}$ , convex, last whorl much wider than the rest, rounded at the periphery. Aperture a little oblique, reflected above.

The shell possesses much finer and closer spiral striae than usual and obviously belong to the same group referred to by Blanford & Godwin-Austen (1908) from Kurnool and Sri Lanka. However in all other respects the shell agrees with that of typical *M. indica*.

It is the commonest species of *Macrochlamys* in India and has a wider distributional range than that mentioned by Blanford and Godwin-Austen (1908). It is recorded for the first time from the Andaman islands.

### 51. *Macrochlamys pungi* (Theobald, 1859)

*Helix pungi* Theobald, 1859, *J. Asiat. Soc. Beng.*, 307.

*Macrochlamys pungi* : Godwin-Austen ; 1882, *Moll. India*, 1 : 90.

*Macrochlamys? Pungi* : Blanford & Godwin-Austen : 1908, *Fauna Brit. India*, Mollusca, 122.

*Material examined* : 1 ex., Andaman islands, (Coll. ?).

*Measurements* (in mm.) : Diameter    Height    Height of aperture  
6.8    5.2    3.65

*Distribution* : India : Meghalaya and the Andaman islands (new record).

Elsewhere : Burma.

*Remarks* : Shell small, conoidly turbinate, perforate with fine indistinct spiral lines ; whorls 6, convex, the last whorl rounded at the periphery. Aperture vertical, lunate, peristome thin ; columella a little reflected and slightly expanded.

Blanford & Godwin-Austen (1908) included this species under *Macrochlamys* as one with doubtful generic position. The present report (which happens to be the first record of this species from these islands), based on a single, slightly damaged shell present in The National Zoological Collection, is also a tentative one.

52. *Macrochlamys stephus* (Benson, 1861)

(pl. VIII, fig. 2)

*Helix stephus* Benson, 1861, *Ann. Mag. nat. Hist.*, (3) 7 : 84.*Macrochlamys stephus* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca* : 127.

*Material examined* : (i) 6 exs., Mt. Harriet, Port Blair (Coll. G. H. Booley), (ii) 2 exs., Forest near Luxmipur, Diglipur, N. Andaman (Coll. B. K. Tikader & N. V. Subba Rao, 24. 4. 71), (iii) 30 exs., Andamans (Coll. ?).

*Measurements* (in mm) : Diameter    Height    Height of aperture  
7.55-14.65    4.1-8.2    3.5-6.24

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell very narrowly perforate, depressed with a flatly conoid spire, smooth and highly polished with traces of very faint microscopic striae ; whorls 7, convex above, closely wound, last whorl rounded, rather compressed and obsoletely subangulate above the periphery, distinctly so in case of immature shells. Aperture vertical, narrowly lunate, peristome thin, basal margin a little arcuate and slightly expanded above.

Animal yellow with black tentacles.

Shells of this species are sometimes confused with those of *M. exul*, particularly the immature ones and can be distinguished by round periphery and vertical aperture.

53. *Macrochlamys aulopis* (Benson, 1863)

(Pl. VIII, fig. 3)

*Helix aulopis* Benson, 1863, *Ann. Mag. nat. Hist.*, (3) 11 : 318.*Macrochlamys aulopis* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca* : 128.

*Material examined* : (i) 24 exs., Andamans (Coll. J.W. Moersch), (ii) 41 exs. Mt. Harriet, Andamans (Coll. ?), (iii) 10 exs., Rubber plantations at Katchal, Nicobars (Coll. K.V.S. Rao, 6.8.74) (iv) 3 exs., Gt. Nicobar ; 7 exs., Coconut groves, Car Nicobar (Coll. A.S. Rajagopal, 1972).

*Measurements* :                    Diameter    Height    Height of aperture  
12.4-12.70    6.5-8.4    5.4-7.1

*Distribution* : Restricted endemic to the Andaman ( S. Andaman) and Nicobar islands (Katchal, Car Nicobar & Gt. Nicobar).

*Remarks* : Shell thin, horny, perforate, depressedly conical, lenticular, decussately sculptured by close oblique striae and microscopic impressed spiral lines ; spiral lines usually more distinct below ; whorls

5, flatly convex ; sutures slightly marginate, last whorl distinctly wider, sharply carinate at the periphery, convex below. Aperture oblique, subquadrately lunate, peristome thin, columellar margin slightly oblique and triangularly reflected at the perforation.

Animal light grey with dark mottlings.

Though considered as not common by Blanford & Godwin-Austen (1908), judging by the number of shells collected, this species seems to be fairly common in these islands.

For Nicobars, it is the first record of this species.

#### 54. *Macrochlamys pseudaulopis* (Godwin-Austen, 1888)

(Pl. VII, figs. 6, 7)

*Macrochlamys pseudaulopis* Godwin-Austen, 1888, *Ann. Mag. nat. Hist.*, (6) 2 : 56.

*Macrochlamys pseudaulopis* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 128.

*Material examined* : (i) 91 exs., Andamans ; 4 exs., Wimberley-gunge, Andamans ; 12 exs., Viper Island, Andamans, 1.12.83, Coll. ?), (ii) 1 ex., Govt. Agriculture Farm, Port Blair, Andaman (Coll. B.K. Tikader & N.V. Subba Rao, 4.6.71).

*Measurements* (in mm) : Diameter      Height      Height of aperture  
7.85-11.5      5.6-7.45      3.6-5.55

*Distribution* : Restricted endemic to the Andaman islands (S. Andaman).

*Remarks* : Shell depressedly conoid, perforate, thin, lenticular, rufous brown, decussately sculptured above and below by close spiral lines and oblique striae ; whorls 5, convex, sutures sub-canalicate last whorl bluntly angulate at the periphery, swollen below ; aperture broadly lunate, columella vertical, a little reflected.

Animal blackish throughout.

It differs from the preceding species by being smaller, more convex, more swollen below and the last whorl being much less sharply keeled. It also differs from that in the form of aperture.

#### 55. *Macrochlamys fordiana* (Godwin-Austen, 1888)

*Macrochlamys fordiana* Godwin-Austen, 1888, *Ann. Mag. nat. Hist.*, (6) 2 : 56.

*Macrochlamys fordiana* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 128.

*Material examined* : 4 exs., Andamans (Coll. ?).

*Measurements* (in mm) : Diameter      Height      Height of aperture  
14.8-18.75      8.75-11.8      7.25-9.2

*Distribution* : Restricted endemic to the Andaman island.



## SHELL PARAMETERS OF SPECIES OF MACROCHLAMYS

	Diameter	Colour	Sculpture etc.	Distribution
<i>M. aulopis</i>	12-12.70	Greyish brown	With decussating sculpture, spiral striae more distinct below ; sharply carinate at periphery.	Andaman & Nicobar
<i>M. choinix</i>	10-16.15	Brownish	With faint decussating sculpture, both above and below ; subangulate at periphery.	Andaman
<i>M. exul</i>	10-17.15	Light brownish	With oblique striae, sometimes with faint spiral lines above ; subangulate at periphery.	Andaman
<i>M. fordiana</i>	14-18.95	Pale yellowish	With fine decussating sculpture below and irregular wavy markings above.	Andaman
<i>M. indica</i>	10-16.6	Pale brownish	With fine close spiral striae ; rounded at periphery.	Andaman
<i>M. pseudaulopis</i>	7-11.5	Rufous brown	With decussating sculpture ; spiral striae close and weak below ; angulate at periphery.	Andaman
<i>M. pungi</i>	6.8	Chestnut brown	With fine spiral sculpture, distinct on lower whorls ; rounded at periphery.	Andaman
<i>M. stephus</i>	7-14.65	Yellowish brown	With fine spiral sculpture, subangulate at periphery.	Andaman

Aperture subquadrate, columella vertical, a little reflected over the umbilicus.

... Close to *S. attegia* in general shape, but differs in being more coarsely lirated and more openly perforate.

57. *Sitala haroldi* (Godwin-Austen, 1882)

(Pl. VI, fig. 5)

*Sitala haroldi* Godwin-Austen, 1882, *Moll. India*, 1 : 33, pl. 10, fig. 7 (shell).

*Sitala haroldi* : Blanford and Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 231.

*Material examined* : (i) 1 ex., Coconut grove, Trinket island ; 1 ex., Coconut grove, S. W. of "Tee Top" Guest House, Car Nicobar (Coll. A.S. Rajagopal, March, 1972) ; (ii) 52 exs., Katchal ; 2 exs., Andamans (Coll. ?).

<i>Measurements</i> (in mm) :	Height	Diameter
	1.3-2.56	1.8-2.3

*Distribution* : Restricted endemic to the Andaman and Nicobar islands (Trinket, Car Nicobar, Katchal).

*Remarks* : Shell small, trochiform, horny, narrowly perforate, with fine spiral lirations which are more distinct on lower whorls (on last and the penultimate whorls about 10 lines present), decussately sculptured with radial and spiral striae on base ; whorls 7, flatly convex ; sutures moderately deep, last whorl carinate ; aperture oblique, subrhomboidly lunate, peristome thin, columellar margin obliquely descending and forming an obtuse angle with the basal margin.

Blanford & Godwin-Austen (1908) referred to the Nos. 200 and 208 cited by Nevill (1878) in his Hand List for unnamed collections of *Nanina* (*Microcystis*). The material studied now include recent collections from the Nicobar islands and also an old lot labelled as *Kaliella christinae* Nevill (possibly a manuscript name) which contains shells from both Andamans and Nicobars.

58. *Sitala attegia* (Benson, 1859)

(Pl. VI, fig. 7)

*Helix attegia* Benson, 1859, *Ann. Mag. nat. Hist.*, (3) 3 : 184.

*Sitala attegia* : Godwin-Austen, 1882, *Moll. India*, 1 : 29, pl. 8, fig. 2, 2f.

*Sitala attegia* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 227.

*Material examined* : (i) 16 exs., Andamans (Coll. G. H. Booley), (ii) 1 ex., Andamans (Coll. M. R. E. Khamy), (iii) 13 exs., Andamans (Coll. ?).

<i>Measurements</i> (in mm) :	Diameter	Height	Height of aperture
	9.1-12.95	9.8-12.7	5.0-6.55

*Distribution* : India : Andaman islands.

Elsewhere : Burma.

*Remarks* : Shell very narrowly perforate, thin, pale yellowish, trochiform with regular spiral as well as radial striae both above and below, the spiral striae being rather distant at the base ; whorls  $7\frac{1}{2}$  - 8, convex, sutures impressed, last whorl keeled at the periphery, swollen below. Aperture oblique, quadrately lunate ; peristome thin, columellar margin vertical, triangularly reflected at the perforation.

The thickness and sculpture of the shell are variable ; it may be thick or thin with strong or fine sculpture.

The species is widely distributed in Burma. Blanford & Godwin-Austen (1908) examined shells from both Andaman & Nicobar islands, but we have the collection only from the Andamans.

### Genus 31. *Rhyssotopsis* Ancey, 1887

Shell perforate, solid, subglobose conoid, with distinct spiral striae. Aperture oblique, a little thickened inside ; columellar margin with a small tooth like elevation below.

Animal with a short foot behind, sole of foot undivided, mucous pore rather large without an overhanging lobe.

Restricted endemic to the Andaman islands.

On grounds.

### 59. *Rhyssotopsis conferta* (Pfeiffer, 1856)

(Pl. VI, fig. 4)

*Helix conferta* Pfeiffer, 1856, *Proc. zool. Soc. Lond.*, p. 328.

*Helix haughtoni* : Benson, 1863, *Ann. Mag. nat. Hist.*, (3) 11 : 87.

*Haughtonia conferta* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca* : 295.

*Material examined* : (i) 18 exs. Andamans (Coll. F. Stoliczka, J. Woodmason & E. Roepstorff, (ii) 2 exs., Birchgunje island, Andamans (Coll. ?)

*Measurements* (in mm) : Diameter      Height      Height of aperture  
20.25-40.2      14.0-25.9      12.95-14.45

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell subglobose conoid, solid, yellowish brown, perforate, sculptured with oblique markings, decussated by fine close spiral lines, both above and below ; apex subglobose obtuse ; whorls  $4\frac{1}{2}$  - 5, convex, last whorl showing a trace of subangulation at the periphery in adult shells (distinctly angulate in case of immature shells), rounded below. Aperture oblique, wide and subquadrangularly lunate,

peristome slightly thickened inside, columellar margin oblique (vertical in immature shells), a little thickened and reflected at the perforation and bearing a blunt tooth-like projection at the base in adult shells.

Animal dark brown with reddish pedicles, pedal groove distinct with whitish tubercles ; caudal gland with a swollen edge.

Following Thiele (1931), this species is placed under *Rhyssotopsis*.

### Genus 32. *Austenia* Nevill, 1878

A single specimen collected from Port Blair is present in the unnamed material. Unfortunately, the shell of this specimen was already removed and hence could not be examined at present. It is only provisionally placed under *Austenia*. This specimen is interesting since so far there is no record of any of the two allied slug like genera *Austenia* or *Girasia* from these islands. Incidentally, Godwin-Austen (1895) made a passing reference to a specimen found by his brother Mr. Harold Godwin-Austen on the Saddle peak in Andamans, which resembled *Girasia*. Unfortunately that specimen was lost in the transit and could not be examined by him. Since Godwin-Austen himself could not see the specimen and since the two genera *Austenia* and *Girasia* are strikingly similar in external characters it is quite possible that the referred specimen may belong to *Austenia*. Moreover, the genus *Austenia* has a comparatively wider geographical range than *Girasia*, extending from Darjeeling, Sikkim to east through the Abor hills to Yunnan in China and to South through the Khasi hills to Burma. Also Thailand and possibly Laos and Vietnam (Solem, 1966).

Though the locality for this specimen is given as port Blair, presumably it was collected at the Mt. Harriet. The present report confirms, to a certain extent, the presence of this slug-like molluscs in the Andamans, though it seems rather strange that this should have not been collected in more numbers by subsequent parties from the Zoological Survey of India. However, further collection, if available, will establish its occurrence in these islands and will also make its specific determination possible.

### Family 16. HELICARIONIDAE

Shell small to large, depressed or globose, thin, polished, glassy, perforate or imperforate. Aperture usually widely lunate ; peristome not continuous, thin or rarely thickened.

Sole of foot divided or undivided, caudal gland usually present, sometimes with an overhanging process.

Hermaphrodite, dart apparatus present or absent.

Tropical and temperate regions of the world. Mostly on grounds.

Key to the genera of Helicarionidae

- |   |     |                     |
|---|-----|---------------------|
| 1. Columellar margin with a small projecting angular process at the perforation | ... | <i>Microcystina</i> |
| Columellar margin without any such projection                                   | ... | 2                   |
| 2. Shell with spiral sculpture and deep groove along the suture                 | ... | <i>Taphrospira</i>  |
| Shell without spiral sculpture and without any groove along the suture          | ... | <i>Satiella</i>     |

Genus 33. *Microcystina* Moersch, 1876

Shell small, thin, horny, depressed to low conical; imperforate or narrowly perforate, with microscopic spiral striae; shining and transparent. Aperture broadly lunate, columellar margin with a peculiar small angular projection at the umbilical region.

Animal with a caudal gland and a pointed overhanging process. Male organ has a small dart sac.

India, Sri Lanka and the Malay Archipelago.

Key to species of *Microcystina*

- |   |     |                         |
|---|-----|-------------------------|
| 1. Columellar margin vertical               | ... | <i>M. moerchiana</i>    |
| Columellar margin oblique                   | ... | 2                       |
| 2. Spiral sculpture present                 | ... | 3                       |
| Spiral sculpture absent                     | ... | <i>S. brunii</i>        |
| 3. Aperture subvertical, suture shallow     | ... | <i>M. warnefordiana</i> |
| Aperture oblique, suture deep, submarginate | ... | <i>M. rinki</i>         |

60. *Microcystina rinki* (Moersch, 1872)

(Pl. VI, fig. 8)

*Nanina (Microcystina) rinki*: Moersch, 1872, *J. Conch. Paris*, 20: 311.

*Nanina (Microcystina) rinki*: Moersch, 1876, *J. Conch. Paris*, 24: 354.

*Microcystina rinki*: Godwin-Austen, 1882, *Moll. India*, 1: 12.

*Microcystina rinki*: Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca*: 254.

*Material examined*: (i) 2 exs., Nicobars (Coll. ?), (ii) 8 exs., Coconut grove, "Fee Top" village, Car Nicobar, 5 exs., Coconut grove, 5 m. west of IAF Camp, car Nicobar (Coll. K.V.S. Rao, March, 1972), (iii) 6 exs., Coconut grove, Trinket island, (Coll. A.S. Rajagopal, 15.3.72).

*Measurements* (in mm): Diameter    Height    Height of aperture  
4.5-5.85    2.8-3.35    2.55-3.09

*Distribution*: Restricted endemic to the Nicobar islands (Gt. Nicobar, Katchal, Camorta, Teressa, Trinket).

**Remarks :** Shell small, very narrowly perforate, convexly depressed, smooth and polished, with very fine close spiral striations both above and below ; whorls  $5\frac{1}{2}$ -6, convex, sutures impressed, last whorl rounded at the periphery ; usually slightly descending in front, convex below. Aperture oblique, lunate, peristome thin, columellar margin oblique, reflected, nearly closed by the angular process.

Since the species was named after Rink, the correct spelling of this should be 'rinki' as given by Blanford & Godwin-Austen(1908).

### 61. *Microcystina brunii* (Moerch, 1872)

(Pl. VI, fig. 9)

*Nanina (Liocystis) brunii* Moerch, 1872, *J. Conch., Paris*, 20 : 311.

**Material examined :** 5 exs., Nicobars (Coll. ?).

**Measurements** (in mm) : Diameter    Height    Height of aperture  
4.45-7.6    3.95-4.6    3.0-3.75

**Distribution :** Restricted endemic to the Nicobar islands.

**Remarks :** Shell thin, globosely depressed, narrowly perforate, sculptured with rather distant fine growth striae (spiral sculpture not seen), whorls 5, convex, suture scarcely impressed. Aperture subvertical, lunate ; columellar margin oblique, reflected, perforation almost closed by the angular process.

Based on five shells present in the old collection of the survey. this species is tentatively included here. Blanford & Godwin-Austen (1908) did not include this species, but as per the measurements given by Moerch (1872), this should be the largest species of *Microcystina* from these islands and not *M. moerchiana* as mentioned by the former (p. 255).

### 62. *Microcystina moerchiana* (Godwin-Austen, 1882)

(Pl. VI, fig. 10)

*Microcystina moerchiana* Godwin-Austen, 1882, *Moll. India*, 1 : 13, pl. 3, fig. 9.

*Microcystina moerchiana* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca ; 254.

**Material examined :** (i) 19 exs., Jungle behind Malacca Circuit House, Car Nicobar (Coll. A.S. Rajagopal 3.3.72.)

**Measurements** (in mm) : Diameter    Height    Height of aperture  
3.4-5.55    2.4-3.6    1.95-2.75

**Distribution :** Restricted endemic to Car Nicobar.

**Remarks :** Shell small, conoidly depressed, brownish, imperforate or very narrowly perforate, polished, with fine close spiral striae both above and below ; whorls 5, rather convex, last whorl rounded,



*Measurements* (in mm) : Diameter    Height    Height of aperture  
6.71-10.1    3.9-6.3    4.45-6.65

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell thin, membranaceous, imperforate, globosely depressed, smooth (except prominent growth striae) and translucent, yellowish ; spire scarcely raised, suture deep ; whorls  $3\frac{1}{2}$ —4, convex, rapidly increasing in width, the last rounded, much swollen below. Aperture oblique, roundly lunate, peristome thin, a little arcuate above, columellar margin vertical.

In the single badly preserved specimen the animal appears dark with a narrow foot and a lobe over the mucous pore.

### Genus 35. *Taphrospira* Blanford, 1905

Shell depressed, thin, horny, perforate with rounded whorls and a deep groove along the suture throughout the shell.

Animal greyish with a very narrow foot, the sole of which has a narrow median area ; the lobe over the caudal gland prominent and finger-like. No amatorial organ.

India (Assam and the Andamns) and Burma.

### 65. *Taphrospira bathycharax* (Godwin-Austen, 1888) (Pl. VII, figs. 2,3)

*Macrochlamys bathycharax* (Benson MS) Godwin-Austen, 1888, *Ann. Mag. nat. Hist.*, (6) 2 : 56 (Refers to Theobald, *Cat. Supp.*, p. 17)

*Taphrospira bathycharax* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 280.

*Material examined* : (i) 5 exs., Andamans (Coll. ?), (ii) 1 ex., Tugapur, Mayabandar (Coll. B. K. Tikader & N. V. Subba Rao, 9.5.71).

*Measurements* (in mm) : Diameter    Height    Height of aperture  
6.8-8.0    3.25-4.4    2.7-3.7

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell depressed, rather openly perforate, thin, horny, brownish ; sculptured with very fine close spiral striae both above and below ; whorls  $5\frac{1}{2}$ , the last rounded at the periphery ; suture deeply and broadly canaliculate. Aperture oblique, broadly lunate, peristome simple, columellar margin oblique, slightly reflected.

Animal light grey, with broad and extensible shell lobes.

Theobald (1876) in his Catalogue of land and freshwater shells of India, attributed the authorship to Benson, who had never described the species. Godwin-Austen (1888) was the first to provide a description

for this species and hence the authorship should go to him.

### Family 17. CAMAENIDAE

Shell depressed to low conoid or turreted, thick ; usually perforate, aperture ovate to roundly lunate, sometimes with fold or tooth ; peristome thickened and reflected. Foot in animal simple without distinct pedal margins, sole undivided.

Tropical zones of Indo-Australian region and of America.

This family is represented in these islands by 4 genera. While the arboreal *Amphidromus* is a widely distributed genus, the monotypic *Oreobba* is endemic to the Nicobar islands and has been treated as a subgenus under *Obba* by Thiele (1931). The characters of *Chloritis* and *Planispira* are more or less intergrading and the demarcating line between these two genera is not very clear. The species arrangement of Gude (1914) has been followed here.

#### Key to the genera of Camaenidae.

- |  |     |   |
|--|-----|---|
| 1. Shell higher than broad, columellar margin angled at base, sinistral                                | ... | <i>Amphidromus</i><br>( <i>undamanica</i> ) |
| Shell broader than high or nearly as broad as high, columellar margin rounded at base, dextral         | ... | 2   |
| 2. Columellar margin with a blunt tooth  | ... | <i>Oreobba</i>                              |
| Columellar margin without any tooth  | ... | 3   |
| 3. Last whorl bluntly angulate at the periphery and with a groove-like depression above the angulation | ... | <i>Chloritis</i><br>( <i>hemiopta</i> )     |
| Last whorl acutely carinate at the periphery and without any groove-like depression                    | ... | <i>Planispira</i><br>( <i>trochalia</i> )   |

#### Genus 36. *Amphidromus* Albers, 1850

Shell moderate, turreted, sinistral or dextral, narrowly perforate or imperforate, usually polished and brightly coloured, with fine striae ; whorls 6-8, convex, regularly increasing, suture shallow. Aperture slightly oblique, irregularly oval, peristome not continuous, expanded and reflected ; columellar margin reflected, partly obliterating the umbilicus.

India, Burma, Malay Peninsula, New Guinea, the Philippines.

Arboreal. Reported to be occurring on large trees like bamboo, banana, mango and various shrubs etc.

Though nothing is known about the reproductive habits of any

Indian species of this genus, from the accounts given by Jutting (1950) it is clear that these snails are in the habit of preparing 'nests' by sticking leaves together for the purpose of laying eggs. This is in contrast to the habit of coming down to the ground and to lay eggs under humus etc. as seen in the American arboreal genus *Liguas* (Voss, 1976)\*.

66. *Amphidromus forcillatus andamanicus*

(Hanley & Theobald, 1876)

(Pl. V, fig 7,8)

*Bulimus andamanicus* Hanley & Theobald, 1876, *Conch. Indica* : 59, pl. 148, fig. 10.

*Amphidromus andamanicus* : Pilsbry, 1900, *Man. Conch.*, (2) 13 : 217, pl. 66, fig. 41.

*Amphidromus andamanicus* : Gude, 1914, *Fauna. Brit. India*, Mollusca, 2 : 184.

*Amphidromus forcillatus andamanicus* Laidlaw & Solem, 1961, *Fieldiana* (zool.), 41 (4) : 585.

*Material examined* : (i) 6 exs., Andamans (Coll. ?), (ii) 4 exs., Andamans (Coll. G.H. Booley), (iii) 9 exs., Port Blair, S. Andaman (Coll. K.N. Das, July, 1930), (iv) 1 ex., Interview island, N. Andaman (Coll. K.K. Tiwari, 1959), (v) Jungle behind Malacca Circuit House, Car Nicobar (Coll. A.S. Rajagopal, 3.3.72).

*Measurements* (in mm) : Diameter Length Height of aperture  
13.3-20.8 20.55-37.8 10.6-17.65

*Distribution* : India : Andaman and Nicobar islands (Car Nicobar, Katchal).

Elsewhere : Burma.

*Remarks* : shell sinistral, elongate-turreted with a conical spire, thick, narrowly perforate, polished, sculptured with oblique growth striae and very fine close spiral markings ; pale yellowish white with oblique brown or dark brown bars, finer and usually with bifurcating tops on upper whorls, broader and crowded on lower ones ; last whorl usually with a greenish tinge and with two brown bands on the lower half, just below the periphery and the other around columella ; whorls 6-6½, convex, last whorl rounded in adult shells but distinctly angulate in young. Aperture rather ovate, a little oblique ; peristome expanded and slightly reflected ; a thin parietal callus present ; columellar margin vertical, meeting the basal margin at an angle, reflected at the perforation.

Animal not seen.

A single shell from N. Andamans, examined is without any brown bars except the two bands on the lower whorls and a few brown dots on the apical whorls, this may be an exception because it otherwise perfectly agrees with the other typical shells of this species.

Genus 37. *Chloritis* Beck, 1837

Shell subglobose to depressed with a little raised spire, apex flat or sometimes sunken; thick, distinctly umbilicate; usually with a coarse surface due to the presence of granules or hair points. Aperture lunate, peristome not continuous, thickened and reflected.

Animal with undivided sole of foot, pedal margin absent, caudal region rounded with a median longitudinal impressed line. Hermaphrodite, dart apparatus absent.

India, Burma, China, Japan, Thailand, Malay Peninsula, the Philippines, Papuan islands and N. Australia.

On grounds.

67. *Chloritis* (*Trichochloritis*) *hemiopta* (Benson, 1863)

(Pl. VI, fig. 1)

*Helix hemiopta* Benson, 1863, *Ann. Mag. nat. Hist.*, (3) 11 : 318.

*Chloritis* (*Trichochloritis*) *hemiopta* : Pilsbry, 1894, *Man. Conch.*, (2) 11 : 124.

*Chloritis hemiopta* : Gude, 1914, *Fauna Brit. India, Mollusca* 2 : 174.

*Material examined* : (i) 17 exs., Andamans (Coll. ?), (ii) 1 ex., On the Jungle-path between port Bonington and Base Camp, N. Andamans (Coll. H.S. Rao, 24.12.33).

<i>Measurements</i> :	Diameter	Height	Height of aperture
	9.3-18.95	5.8-13.8	5.0 8.85

*Distribution* : Restricted endemic to the Andaman islands.

*Remarks* : Shell thick depressedly conoid, openly perforate, obliquely striate and minutely granulate throughout but more distinctly below; whitish, whorls 5-5½, convex, sutures fairly deep, last whorl slightly descending in front, angulate at the periphery and also with a channel like depression just above the angulation, swollen beneath. Aperture oblique, subquadrately lunate, peristome expanded and reflected, slightly arcuate at the upper margin, approaching margins of the peristome joined by a thin callus, columellar margin dilated at the base, strongly reflected above the perforation.

Animal not seen.

This species is said to show much variation in shell colouration. The shells examined at present are all uniformly white, but shells with coloured peripheral bands or reddish brown lower whorls are also fairly common (Gude, 1914).

Genus 38. *Oreobba* Pilsbry, 1894

Shell globose conoid, thick, perforate, shining with fine spiral striations; whorls rounded; peristome thickened and reflected;

columellar margin expanded and with a blunt tooth.

Endemic to the Nicobar islands.

*Oreobba* has been treated as a subgenus under *Obba* Beck, by Thiele (1931). Following Gude (1914), it is given a generic status here.

68. *Oreobba codonodes* (Pfeiffer, 1846)

(Pl. V, figs. 10,11)

*Helix codonodes* Pfeiffer, 1846, *Proc. zool. Soc. Lond.*, 1846 : 112

*Helix codonodes* : Reeve, 1851, *Conch Icon.*, 7, pl. 22. fig. 91.

*Obba (Oreobba) codonodes* : Pilsbry, 1894, *Man. Conch.*, (2) 9 : 109, pl. 19, fig. 11.

*Oreobba codonodes* : Gude, 1914, *Fauna Brit. India, Mollusca*, 2 : 152.

*Material examined* : (i) 7 exs., Great Nicobar island, (ii) 1 ex., Log Point, Dagmar River (Coll. A. Daniel, 9.4.66), (iii) 4 exs., Armyland, 5 km. West of Campbell bay, Great Nicobar ; 5 exs., Leola nullah, on North-South Road, Great Nicobar island (Coll. S.S. Saha, 25.7.84).

*Measurements* (in mm) : Diameter      Height      Height of aperture  
9.65-19.15      6.35-21.2      5.0-9.8

*Distribution* : Restricted endemic to the Nicobar islands (Great Nicobar, Kondul, Camorta).

*Remarks* : Shell solid, globosely conoid, perforate, finely sculptured with oblique markings and rather granulate spiral striae ; spire conoid with a subglobosely obtuse apex ; whorls  $5\frac{1}{2}$ , convex, somewhat carinate above the suture in some cases, suture deep, last whorl high, equalling nearly more than half the total length of the shell, slightly compressed in front and descending a little near the aperture. Aperture subquadrately rounded, peristome thickened, reflected, margins joined by a callus ; columellar margin dilated obstructing the umbilicus and with a blunt tooth-like projection on the inner side.

Shell in this species greatly varies in colouration and also in length-breadth ratio, some shells being nearly as broad as high. While some shells possess a chocolate band along the periphery through the entire shell on a pale yellowish ground colour, some are with a brownish last whorl. Shells of uniform pale yellowish colour without bands also occur.

Immature shells are much depressed with carinate last whorl, simple aperture and without the columellar tooth.

Animal uniformly light brown in preserved condition, foot short and pointed behind with a simple pedal margin and undivided sole. No caudal gland or lobe.

Genus 39. **Planispira** Beck, 1894

Shell discoidal to depressedly globose or orbiculate, usually openly perforate with a rough sculpture above ; granulate or coarsely striate ; last whorl broad and descending in front ; aperture oblique, expanded, peristome not continuous but often joined by a raised callus.

Sole of foot in some species feebly tripartite. Jaw arcuate with ribbed anterior surface.

India, Burma and Sri Lanka.

69. **Planispira trochalia** (Benson, 1861)

(Pl. V, fig. 9)

*Helix trochalia* Benson, 1861, *Ann. Mag. nat. Hist.*, (3) 7 : 82.

*Planispira (Trachia) trochalia* : Pilsbry, 1894, *Man. Conch.*, (2) 9 : 115, pl. 34, figs. 4, 5.

*Planispira trochalia* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 442.

*Planispira (Trachia) trochalia* : Gude, 1914, *Fauna Brit. India*, Mollusca, 2 : 164.

**Material examined** : (i) 8 exs., Andamans (Coll. F. Stoliczka & G. Nevill), (ii) 1 ex., Jirkatang, Andamans (Coll. H.S. Rao, 5.12.32.).

**Measurements** (in mm) : Diameter      Height      Height of aperture  
20.0-22.15    13.55-14.74    8.1-9.25

**Distribution** : Restricted endemic to the Andaman islands (S. Andaman).

**Remarks** : Shell thick, solid, of light chest-nut colour, orbiculately trochiform, narrowly umbilicate, sculpture consists of rather dense arcuate vertical striae and close indistinct feeble spiral lines, the latter prominent on the last whorl both above and below ; whorls 5, flatly convex, more or less keeled above the sutures, the last acutely and rather compressedly carinate at the periphery, distinctly descending at the aperture and is somewhat compressed just behind the peristome. Aperture strongly oblique, elliptically lunate, peristome expanded and reflected, margins joined by a slightly elevated callus, columellar margin dilated and expanded over the umbilicus.

Animal not seen.

## Family 18. STREPTAXIDAE

Shell depressedly and distortedly helicoid to turreted, usually colourless and transparent, smooth or ribbed but without strong sculpture, often with teeth or lamellae in the aperture.

Animals hermaphrodite, carnivorous, subulinids being the most frequent prey.

Tropical zones of the world. Africa, South Arabia, the Indian Peninsula, Malay, Archipelago, East Indian islands, Philippines, N. &

S. Vietnam, China and Japan.

Essentially a tropical family with only a small number of species occurring in the subtropica (van Bruggen, 1967).

Though practically nothing is known about the ecology of the species occurring in these islands, most of the streptaxids are known to occur in leaf-litters, under stones, logs or under the exposed roots of trees etc.

The two subfamilies, namely, Streptaxinae and Enninae are represented in these islands by two species each.

#### Key to the genera of Streptaxidae

1. Shell depressedly ovate, without tooth on peristome	...	<i>Haploptychius</i>
Shell cylindrical, with tooth on peristome	...	2
2. Cylindrically turreted, imperforate with faint close striae	—	<i>Gulella</i>
Cylindrically ovate, perforate with prominent distant striae	—	<i>Sinoennea</i>

#### Genus 40. *Gulella* Pfeiffer, 1856

Shell small, ovate to cylindrically turreted, usually thin, transparent, smooth or finely ribbed, obliquely deformed in some species ; peristome thickened and expanded.

Africa, South and East Asia, West Indies.

#### 70. *Gulella* (*Huttonella*) *bicolor* (Hutton, 1834)

(Pl. V, fig. 2)

*Pupa bicolor* Hutton, 1834, *J. Asiat. Soc. Beng.*, 3 : 85 & 93, 96.

*Ennea bicolor* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca, 1908 : 19.

*Gulella* (*Huttonella*) *bicolor* : Benthem Jutting, 1950, *Treubia*, 20 (3) : 504.

*Huttonella bicolor* : Dance, 1970, *J. Conch. Paris.*, 27 : 1553

*Material examined* : (i) 1 ex., Andamans ; 1 ex., Chatham island, Andamans ; 1 ex., Ross island, Andamans (Coll. ?), (ii) 1 ex., Coconut garden, Tapong village, Nancoury island, Nicobars (Coll. A. S. Rajagopal, 17.3.72).

*Measurements* (in mm) : Diameter 1.8 Height 6.1 Height of aperture 1.5

*Distribution* : A cosmopolitan species, widely distributed through S. E. Africa, West Indies. In India it is fairly common and is recorded



throughout, whorls 7, convex, the penultimate and the antipenultimate broadest, the last slightly compressed and rather ascending in front, rounded at base ; sutures deep, crenulate. Aperture vertical, distorted and obstructed by a strong vertical parietal fold and another less prominent one slightly anterior to the outer margin of peristome which is reflected and curved back into a sinus above.

This species is known by its holotype and has not been recorded subsequently.

#### 42. *Haploptychius* Moellendorff, 1886

Shell thin, hyaline, subrhomboid, perforate mostly with fine sculpture, spire usually produced and distorted, last two whorls being eccentric, last whorl rather flattened at base ; usually a single parietal lamella present.

India, Burma, China, Malay Peninsula, Celebes and Sangihe island.

#### Key to the species of *Haploptychius*

- |  |     |                       |
|--|-----|-----------------------|
| 1. Last whorl distinctly broader than the penultimate whorl, aperture nearly rounded | ... | <i>H. pfeifferi</i>   |
| Last whorl as broad as the penultimate whorl, aperture compressed at upper margin    | —   | <i>H. andamanicus</i> |

#### 72. *Haploptychius andamanicus* (Benson, 1860)

(Pl. V, fig. 5)

*Streptaxis andamanicus* Benson, 1860, *Ann. Mag. nat. Hist.*, (3) 6 : 192.

*Streptaxis andamanicus* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India*, Mollusca : 5.

*Material examined* : (i) 8 exs., Andamans (Coll. G. H. Booley), (ii) 2 exs., Near Chiriatapu vill., S. Andaman (Coll. B. K. Tikader & N. V. Subba Rao, 30.5.71.).

*Distribution* : India : Andamans (S. Andaman).

Elsewhere : Burma.

*Measurements* (in mm) :

Diameter	Height	Height of aperture
8.55	6.0	2.5

*Remarks* : Shell small, whitish, translucent, umbilicate, subrhomboid, finely arcuately striate above, smoother beneath ; whorls  $6\frac{1}{2}$ , fairly convex, the last scarcely wider (across) than the penultimate ; viewed from below, nearly half the width of penultimate whorl is visible

beyond the last ; last whorl rounded, a little flattened at base ; suture deep ; aperture truncately oval, peristome not continuous, expanded and reflected, arcuate at the upper margin resulting in a compression of aperture, a thin parietal callus and a moderately developed lamella present.

In the National Zoological Collections there are 16 shells from Cocos island. Except in being smaller and smoother the shells conform to the description of this species suggesting that this species may occur in Burma also. On the other hand according to Blanford & Godwin-Austen (1908) *H. blanfordi* from Burma is an ally of the Andaman species.

### 73. *Haploptychius pfeifferi* (Zelebor, 1867)

(Pl. V., fig. 6)

*Streptaxis pfeifferi* Zelebor, 1867, *Verh. zool. bot. Ges. Wien*, 17 : 806.

*Streptaxis pfeifferi* : Godwin-Austen, 1895, *Proc. zool. Soc. Lond.*, 1895 : 443.

*Streptaxis pfeifferi* : Blanford & Godwin-Austen, 1908, *Fauna Brit. India, Mollusca*, 1908 : 6.

*Material examined* : (i) 11 exs., Camorta, Nicobars ; 27 exs., Katchall, Nicobars (Coll. ?), (ii) 11 exs., Nicobars (J. Roepstorff), 1 ex., Baring village, Camorta, Nicobars, 1 ex., Nancoury island, Nicobars ; 9 exs., Car Nicobar island (Coll. A. S. Rajagopal, 1972), (iii) 10 exs. Car Nicobar ; 20 exs., Nicobars (Coll. F. Stoliczka).

*Measurements* (in mm) : Diameter    Height    Height of aperture  
6.65-6.6    7.35 9.4    2.4-3.5

*Distribution* : Restricted endemic to the Nicobar islands (Camorta, Katchall, Car Nicobar, Nancoury).

*Remarks* : Shell depressedly ovate, with a conoid spire, umbilicate, whitish, translucent, finely closely and flexuously striate above, rather smooth beneath, whorls  $6\frac{1}{2}$ , rounded, the last distinctly wider than the rest and a little flattened below ; penultimate whorl rounded at the periphery and viewed from below, scarcely extends beyond the last, suture deep. Aperture roundish and not compressed as in the preceding species ; peristome expanded and reflected, scarcely arcuate above ; parietal lamella feebly developed and rather angulate in the front.

It closely resembles *H. burmanicus* from Burma differing from it in not being compressed around the umbilicus at base and also in not having the tubercle at the upper margin of peristome. The closeness of the

two species is demonstrated by the striking similarities shown by their juvenile shells. However, according to van Bruggen (1972), the immature shells of streptaxids conform to a definite flattened pattern and this should not necessarily suggest closeness of species.

## ENDEMISM AND SPECIES DIVERSITY

The group of islands, the spirinkling dots amidst the vast sprawling Bay of Bengal, comprise a few hundreds of islands, covering a total land mass of 8249 square kms. The proximity of the sea together with ample rainfall checks the extremes of temperature ; the variation ranges from 23° to 31°C. with a high rate of humidity (over 80%). Once a part of the Asian mainland millions of years ago, this chain of islands constitutes the physiographic continuation of the mountain ranges of Naga and Lushai Hills and Arakan Yoma of Burma through Cape Negrais to the Andaman and Nicobar islands and South-east to Sumatra.

The available niches in an island may be filled either by colonisation from adjacent areas or by speciation within the island (Gorman, 1979). Since the rate of endemism here is fairly high at nearly 70%, it can be said that the land molluscan fauna of these islands has resulted from speciation within the area. Again the fact that endemism at supra-specific level is practically nil, indicates that the present species diversity is the result of autochthonous evolutions undergone by an initial group of colonising taxa. It seems more likely because of the fact that these islands were once connected to the Asian mainland. (The process of 'Character displacement' resorted to by island fauna to achieve physiological and ecological isolation may also have played a role here). This perhaps explains the occurrence of a large number of closely related endemic species under a few families like, Cyclophoridae, Trochomorphidae, Ariophantidae and particularly under a few genera like, *Videna* and *Macrochlamys*.

Among the Andaman group, the mountainous part of the southern island with deep tropical evergreen forests and abundant rainfall (300 cms., annually) harbours approximately 21 sympatric species. In the Nicobar group, Great Nicobar and Car Nicobar are the two major islands accounting for 18 and 16 species, respectively. Other smaller islands namely, Trinket, Camorta, Katchall, Nancowry account for 7-12.

species each.

As a whole, the Nicobar group (1841 square kms.), though area-wise smaller, accommodates marginally higher number of species (57 with 41 endemic as against Andaman's 56, with 34 endemic) than the larger Andaman group (7368 square kms.). This corroborates the hypothesis that though island size and the number of occurring species are related, an increased area does not necessarily mean an increased species diversity and the area of an island has little effect on its snail fauna (Solem, 1984). Sympatric diversity obviously depends upon available habitat diversity.

The land molluscs of the Andaman and Nicobar islands with a high level of local differentiation and a low rate of colonisation, are comparable to those of the Pacific islands, as shown by Solem (1973).

#### SUMMARY

The total number of species of land molluscs recorded from the Andaman and Nicobar group of islands is 101, comprising 18 families and 42 genera. Out of this, 71 species belonging to 17 families and 37 genera have been physically examined. Of these 101 species as many as 74 are restricted endemic to these islands. The Andaman group has 34 restricted endemic species out of a recorded total of 56, (15 families and 34 genera), whereas the Nicobar group has 40 restricted endemic species out of a recorded number of 57 (16 families and 32 genera) (Family-wise species composition and endemism are shown in figure 1 and Table 1). Twenty species are common to both the islands. Taxa shared between these islands and the mainland India include a meagre 8 species under 7 genera which are in fact widely distributed synanthropic species such as *Lamellaxis gracile*, *Achatina fulica*, *Laevicaulis alte*, *Gulella bicolor* etc. Those shared between these islands and the adjacent geographical areas (including Burma) are marginally higher, with 13 species under 12 genera. This is perfectly in conformity with the remarks made by Godwin-Austen (1895) and Nevill (1881) pointing to the past connections between these areas.

There are four new records from the Andamans, of which two species namely, *Georissa pyxis* and *Macrochlamys pungi* were hitherto known from Burma and the other two namely, *Leptopoma immaculata* and *Sulfurina behniana* were from the Nicobars only. The operculates

account for 39 species (6 families and 14 genera) and the pulmonates for 62 species (12 families and 28 genera). While restricted endemism is mostly confined to the species level, the two monotypic genera, *Rhysso-topsis* and *Oreobba* are restricted endemics to the Andaman and Nicobar islands respectively. Genera like, *Hyalimax*, *Acmella*, *Georissa*, *Omphalotropis* and the heliciniids, all of which are absent on mainland India, are represented by more than one species each and have obviously colonised these islands through Burma. The absences of the clausilids from the Andamans ; though occurring in Burma is on the other hand intriguing.

That the land molluscs of Andaman and Nicobar islands show clear affinity to Burma in the north and the Indonesia to the south-west is demonstrated by the reporting of a species of *Cyclohelix* from Java (Bentham Jutting, 1948) and the species *Macrochlamys pungi* (hitherto known from Burma) from the Andaman. The distribution of such genera as *Hyalimax*, *Acmella*, *Georissa* etc. also points to the affinities of malacofauna of these islands to that of Burma on one side and to Indonesia on the other.

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1. NUMBER OF TOTAL ENDEMIC SPECIES SHOWN FAMILY-WISE AND ISLAND-WISE

Families	<i>Andamans</i>		<i>Nicobars</i>		<i>Andamans &amp; Nicobar</i>	
	Total species	Total endemic species	Total species	Total endemic species	Total species	Total restricted endemic species
1	2	3	4	5	6	7
1. Hydrocenidae	1	—	—	—	1	—
2. Helicinidae	3	1	5	3	8	4
3. Cyclophoridae	7	4	15	13	19	17
4. Diplommatinidae	—	—	1	1	1	1
5. Pupinidae	—	—	1	1	1	1
6. Assimineidae	5	5	4	4	9	9
7. Succineidae	3	1	2	1	5	2
8. Clausiliidae	—	—	2	2	2	2
9. Valloniidae	1	1	—	—	1	1
10. Achatinidae	1	—	1	—	1	—
11. Subulinidae	4	1	4	2	6	3
12. Charopidae	2	1	1	—	2	1
13. Trochomorphidae	4	4	7	4	11	8
14. Ariophantidae	12	6	5	2	14	8
15. Helicarionidae	5	5	3	3	8	8
16. Camaenidae	4	3	3	2	6	5
17. Streptaxidae	2	1	3	2	4	3
18. Veronicellidae	2	1	1	—	2	1
Total—	56	24	57	40	101	74

DISTRIBUTION & LATEST YEAR OF COLLECTION

Name of the Species	ANDA-	NICO-	MAIN-	BURMA	LATEST YEAR OF COLLECTION
	MANS	BARS	LAND		
	1	2	3	4	5
<i>Georissa pyxis</i> Benson	+	—	—		1870
<i>Pteuropoma andamanica</i> (Benson)	+	+	—	+	1890
<i>P. dunkeri</i> (Zelebor)	—	+	—	—	1872
<i>P. nicobarica</i> (Pfeiffer)	+	+	—	—	1972
<i>P. scrupulum</i> (Benson)	+	+	—	—	1972
<i>Sulfurina behniana</i> (Pfeiffer)	+	+	—	—	1972

Name of the Species	ANDA-	NICO-	MAIN-	BURMA	LATEST YEAR OF COLLECTION
	MAN	BAR	LAND		
	1	2	3	4	5
<i>S. bensoni</i> (Wagner)	—	+	—	—	
<i>S. rogersi</i> (Bourne)	+	+	—	—	
<i>S. zelevori</i> (Pfeiffer)	—	+	—	—	1972
<i>Cyclophorus charpentieri</i>					
<i>nicobarica</i> Moersch	+	+	—	—	1972
<i>C. foliaceus</i> Chemnitz	—	+	—	—	1876
<i>C. leai</i> Tryon	+	—	—	—	1971
<i>C. crocatus</i> (Born)	—	+	—	—	1972
<i>C. denslineatus</i> (Pfeiffer)	—	+	—	—	
<i>C. nicobaricus</i> (Pfeiffer)	—	+	—	—	1984
<i>C. perdix roepstorffiana</i>					
Godwin-Austen	—	+	—	—	
* <i>Leptopoma (Trocholeptopoma)</i>					
<i>immaculata</i> Chemnitz	+	+	—	—	1971
<i>L. (T.) roepstorffiana</i> Nevill	±	—	—	—	
<i>Lugochilus galathea</i> (Moersch)	—	+	—	—	1972
<i>L. roepstorfi</i> (Moersch)	—	+	—	—	1972
<i>L. warnefordianus</i> Nevill	+	—	—	—	1933
<i>L. polynema</i> (Moersch)	—	+	—	—	1846
<i>L. wuellerstorffianus</i> (Zelevor)	—	+	—	—	1872
<i>Cyathopoma natalicum</i>					
Godwin-Austen	—	+	—	—	
<i>C. tignarium</i> (Benson)	+	—	—	—	
<i>Pupina (Tylotoechus) nicobarica</i>					
Pfeiffer	—	+	—	—	1984
<i>Alycaeus (A.) reinhardti</i>					
Moersch	—	+	—	—	1972
<i>Chamalycaeus andamaniae</i>					
Benson	+	+	—	—	
<i>C. busbyi</i> Godwin-Austen	—	+	—	—	1876
<i>Palaina nicobarica</i>					
(Godwin-Austen)	—	+	—	—	1972
<i>Omphalotropis andersoni</i>					
Blanford	+	—	—	—	1880
<i>O. brevis</i> Godwin-Austen	+	+	—	—	
<i>O. distermia</i> Benson	+	—	—	—	1908
<i>O. sordida</i> (Frauenfeld)	—	+	—	—	
<i>O. decussata</i> (Blanford)	+	—	—	—	1880
<i>Realia pallida</i> Blanford	+	—	—	—	
<i>Acmella mellilla</i> Godwin-					
Austen	+	—	—	—	
<i>A. moreletiana</i> Nevill	—	+	—	—	1878
<i>A. roepstorffiana</i> Nevill	—	+	—	—	1878

\* Also occurs in the Philippines

Name of the Species	ANDA- MAN	NICO- BAR	MAIN- LAND	BURMA	LATEST YEAR OF COLLECTION
	1	2	3	4	5
<i>Hyalimax andamanica</i>					
Godwin-Austen	+	—	—	—	1880
<i>H. reinhardti</i> Moersch	—	+	—	—	1984
<i>Succinea vitrea</i> Pfeiffer	+	—	+	—	
<i>S. ceylanica</i> Pfeiffer	—	+	—	—	
<i>Quickia gravelyi</i> f.					
<i>andamanensis</i> (Rao)	+	—	—	—	1971
* <i>Laevicaulis alte</i> (Ferussac)	+	+	+	+	1984
<i>Acrophaedusa wullerstorfi</i>					
(Zelebor)	—	+	—	—	1984
<i>Phaedusa corticina nicobarica</i>					
(Gude)	—	+	—	—	1908
<i>Pupisoma constrictum</i> Godwin- Austen	+	—	—	—	
<i>Achatina fulica</i> (Bowdich)	+	+	+	—	1964
<i>Lamellaxis gracile</i> (Hutton)	+	+	+	+	1972
<i>Prosopias haughtoni</i> Benson	+	—	—	—	1971
<i>P. roepstorffi</i> (Moersch)	—	+	—	—	1984
<i>P. walkeri</i> (Benson)	+	—	—	+	1930
<i>P. achates</i> Moersch	—	+	—	—	
* <i>Subulina octona</i> (Bruguiere)	+	+	—	+	1972
<i>Philalanka subbillirata</i>					
(Godwin-Austen)	+	+	—	—	1970
<i>P. homfrayi</i> (Godwin-Austen)	+	—	—	—	
<i>Videna andamanica</i> (Godwin- Austen)	+	+	—	—	1971
<i>V. billeana</i> Moersch	—	+	—	—	1984
<i>V. lardea</i> (Martens)	+	+	—	—	
<i>V. iopharynx</i> Moersch	—	—	—	—	1932
<i>V. pseudosanis</i> Fulton	+	+	—	—	1876
<i>V. sanis</i> Benson	+	+	—	—	1972
<i>V. sulcipes</i> Moersch	+	—	—	—	1972
<i>V. subnigritella</i> (Beddome)	+	+	—	—	
<i>V. bicolor</i> (Martens)	—	+	—	—	
<i>V. frauenfeldi</i> (Zelebor)	—	+	—	—	
<i>V. trilineata</i> Moersch	—	+	—	—	1974
<i>Kaliella</i> (?) <i>kjellerupi</i> (Moersch)	—	+	—	—	
<i>Macrochlamys aulopis</i> Benson	+	+	—	—	1974
<i>M. choinix</i> Benson	+	—	—	—	1872
<i>M. exul</i> Theobald	+	—	—	—	1971
<i>M. fordiana</i> Godwin-Austen	+	—	—	—	1876
<i>Taphrospira bathycharax</i>					
(Benson)	+	—	—	—	1971

\* Also occurs in Thailand, the Philippines, Indonesia.

Name of the Species	ANDA-	NICO-	MAIN-	BURMA	LATEST YEAR OF COLLECTION
	MAN	BAR	LAND		
	1	2	3	4	5
<i>Rhysotopsis conferta</i> (Pfeiffer)	+	—	—	—	1876
<i>Chloritis</i> ( <i>Trichochloritis</i> )					
<i>hemiopta</i> (Benson)	+	—	—	—	1933
<i>Chloritis helferi</i> (Benson)	+	—	—	—	
<i>Chloritis wimberleyi</i> (Benson)	—	+	—	—	
<i>Planispira trochalia</i> (Benson)	+	—	—	—	1932
<i>Oreobba codonodes</i> (Pfeiffer)	—	+	—	—	1984
<i>Ambhidromus furcillatus andamanicus</i> (Hanley & Theobald)	+	+	—	+	1972
<i>Haploptychius andamanicus</i> (Benson)	+	—	—	+	1971
<i>H. pfeifferi</i> (Zeilebor)	—	+	—	—	1972
* <i>Gulella bicolor</i> (Hutton)	+	+	+	+	1972
<i>Sinoennea moerchiana</i> (Novill)	—	+	—	—	1976

\* Also occurs in Thailand, the Philippines and Indonesia,

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# **P L A T E S**



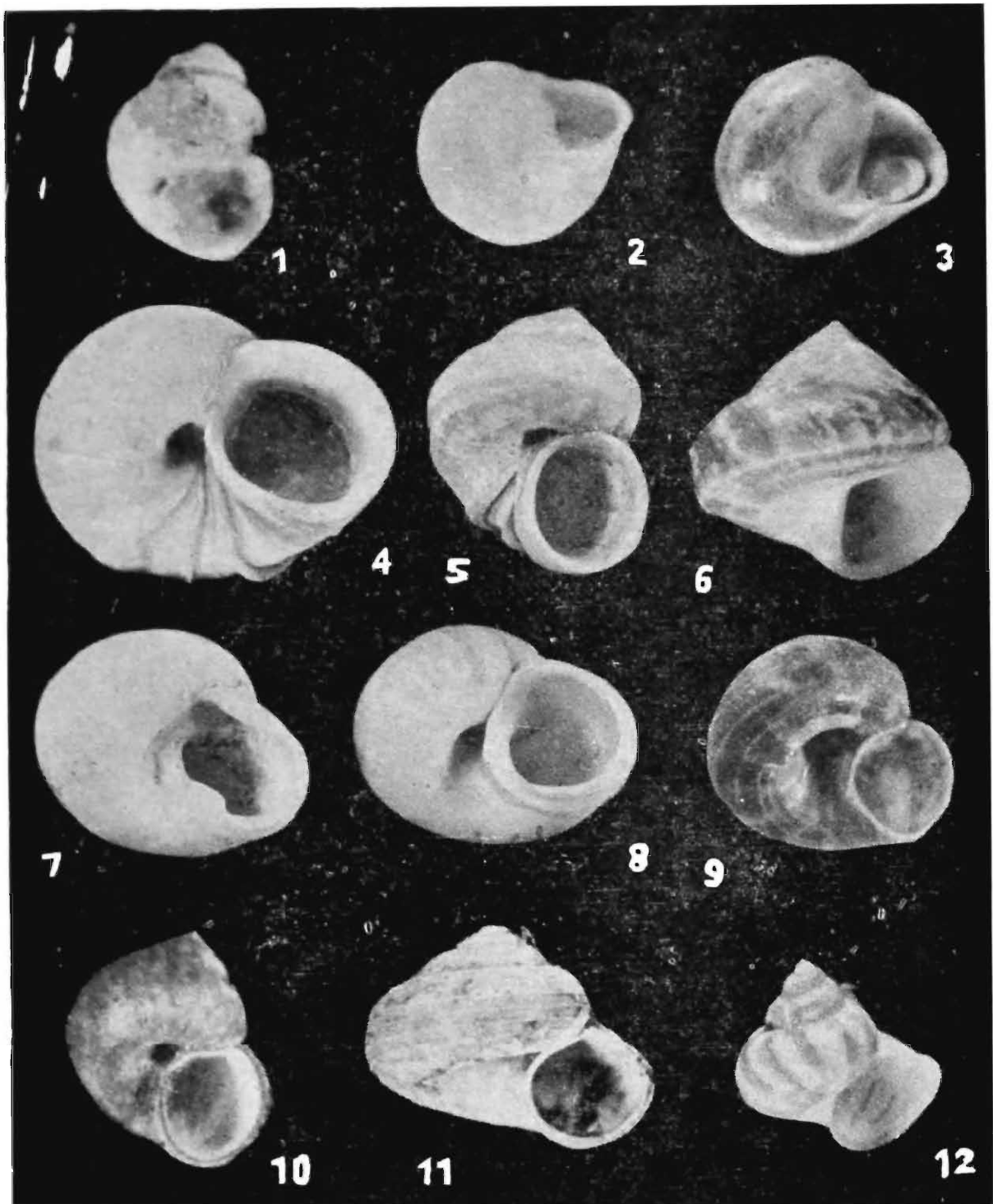


PLATE I : 1. *Hydrocena (Georissa) pyxis*, 2.05x1.65 mm ; 2. *Sulfurina behniana*, 5.0x7.20 mm ; 3. *S. zeleborei*, 4.75x5.0 mm ; 4. *Cyclophorus (Cyclohelix) foliaceus*, 24.40x27.65mm ; 5. *C. (Cyclohelix) leai*, 19.35x17.80 mm ; 6. *C. (Cyclohelix) crocatus*, 22.0x23.90 mm ; 7. *C. (Cyclohelix) nicobaricus*, 16.85x18.35mm ; 8. *C. (Glossostylus) charpentieri nicobaricus*, 20.50x21.25 mm ; 9. *Lagochilus galathea*, 5.0x5.25 mm ; 10. *L. polynema*, 4.50x5.50 mm ; 11. *L. roepstorfi*, 5.15x5.40 mm ; 12. *Leptopoma (Trocholeptopoma) roepstorffiana*, 12.60x11.50 mm.

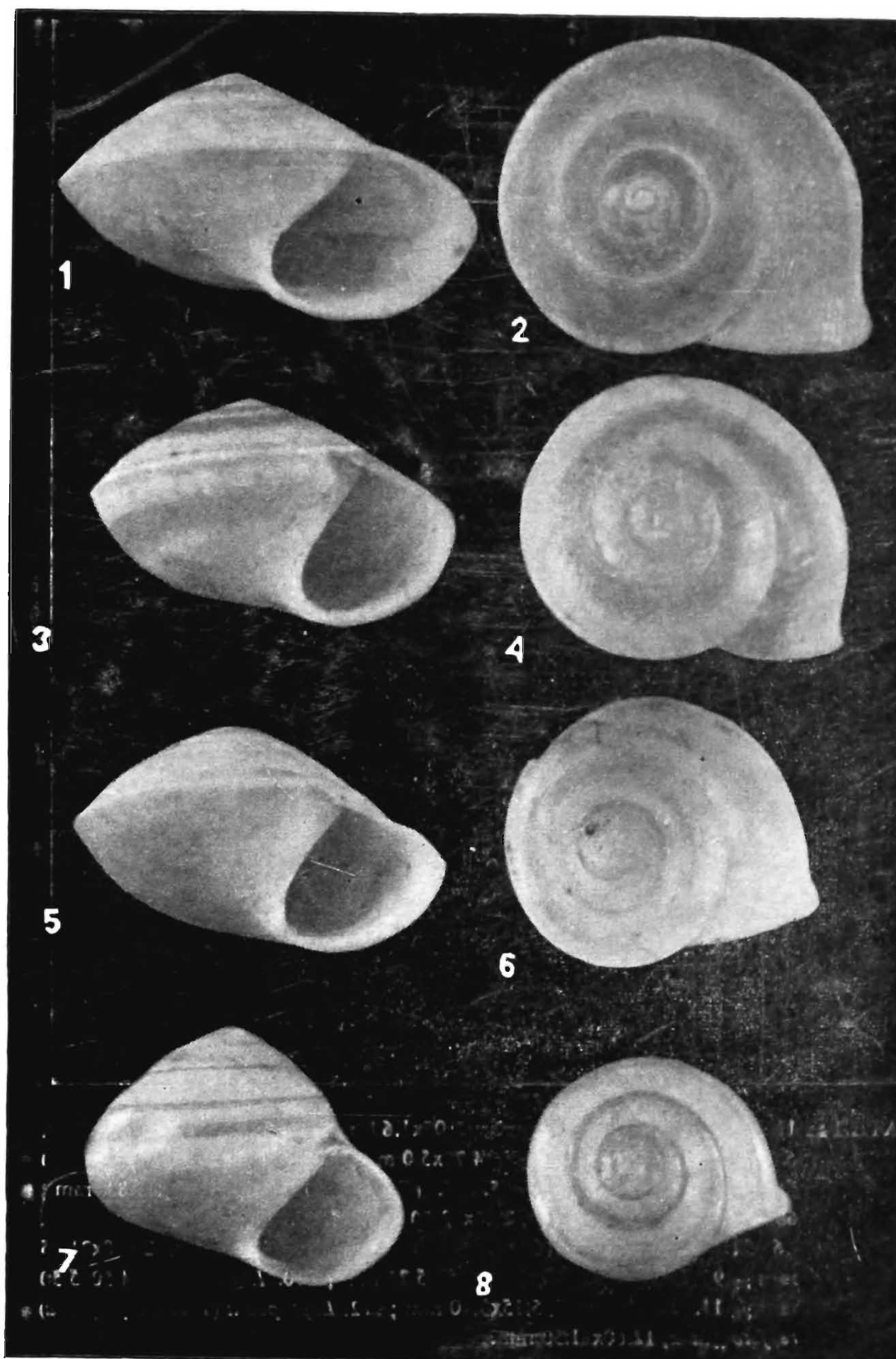


PLATE II: 1. & 2. *Pleuropoma nicobarica*, 4.1x7.15 mm; 3. & 4. *P. andamanica*, 5.80x9.65 mm; 5. & 6. *P. dunkeri*, 5.15x9.25 mm; 7. & 8. *P. scrupulum*, 4.45x5.15 mm.

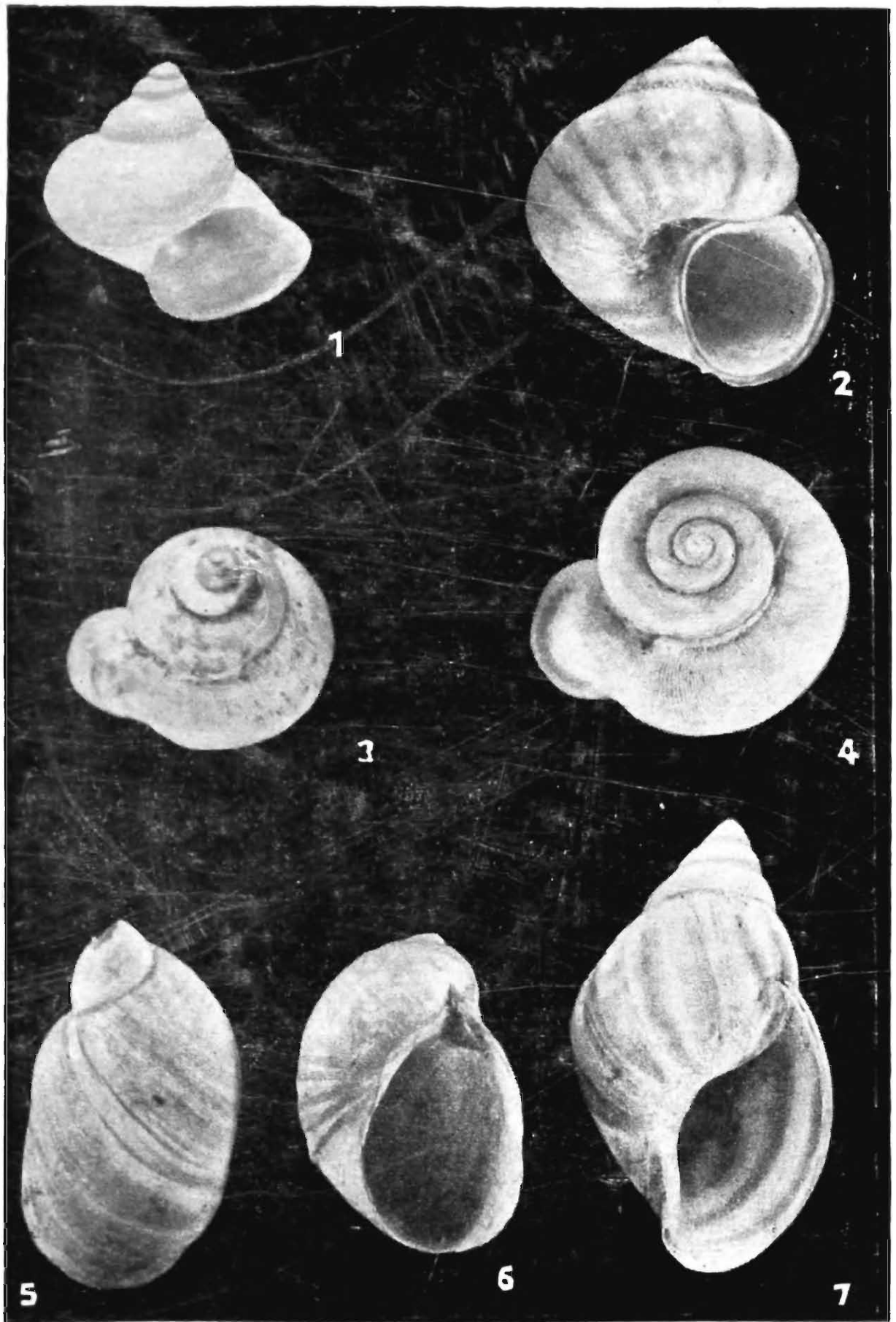
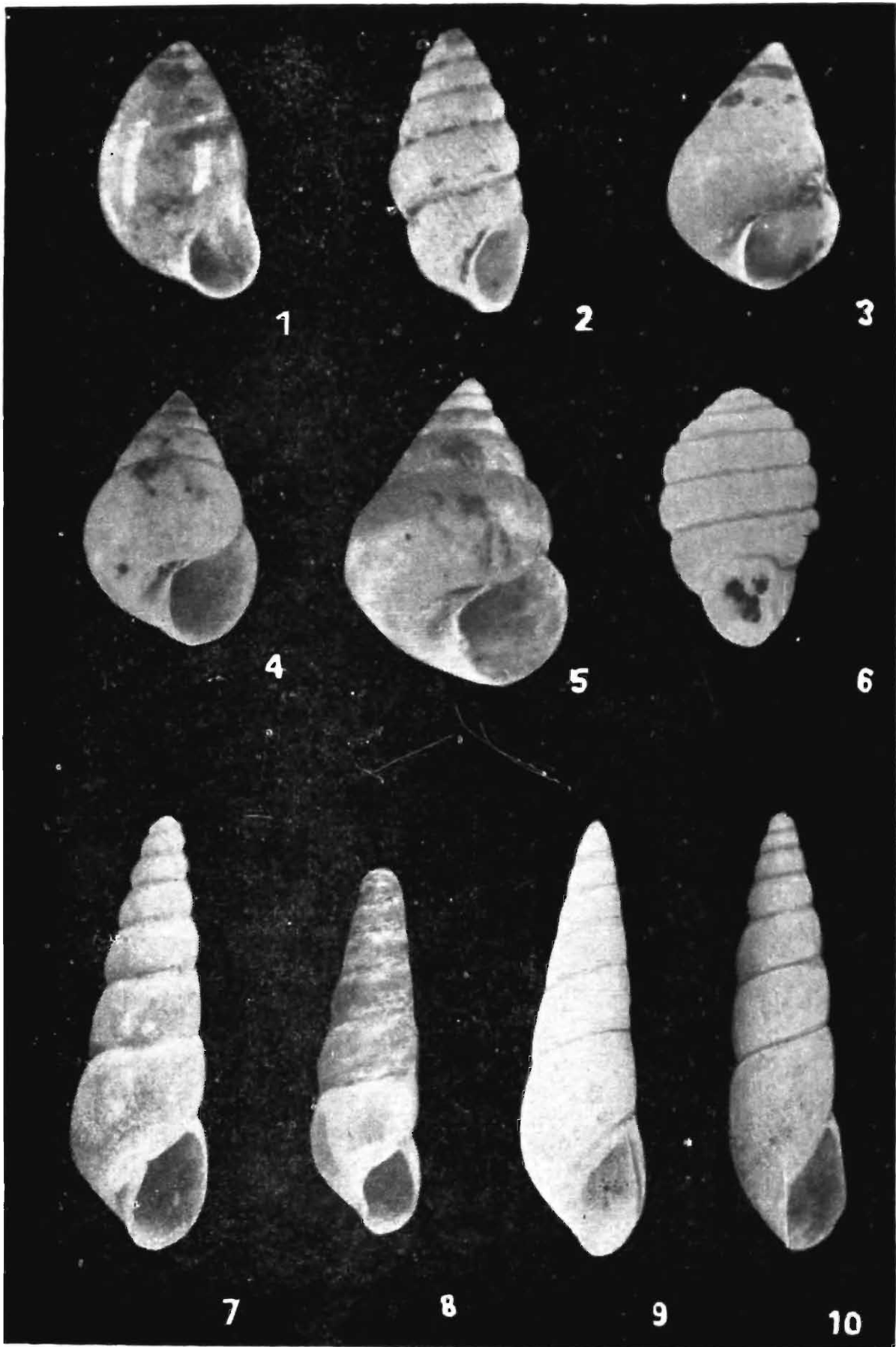


PLATE III : 1. *Leptopoma (Trocholeptopoma) immaculata*, 12.80x11.60 mm ; 2. *Lagochilus warnefordi*, 6.90x6.0 mm ; 3. *Chamalycaeus busbyi* ; 6.50x11.55 mm ; 4. *Alycaeus (A.) reinhardti*, 3.20x3.60mm ; 5. & 6. *Qulckia gravelyi andamanensis*, 8.45x4.75 mm ; 7. *Achatina (Lissachatina) fulica fulica*, 54.0x37.85 mm.



**PLATE IV :** 1. *Pupina (Tylotoschus) nicobaricus*, 6.10x4.0 mm ; 2. *Palaina nicobarica*, 2.80x1.10 mm ; 3. *Omphalotropis andersoni*, 5.0x4.15 mm ; 4. *O. disterrmina*, 6.50x4.55 mm ; 5. *O. decussata*, 4.0x2.90 mm ; 6. *Sinoennea moerchiana*, 4.50x2.80 mm ; 7. *Lamellaxis gracile*, 8.30x2.35 mm ; 8. *Subulina octona*, 14.0x3.80 mm ; 9. *Prosopeas haughtoni*, 29.65x9.20 mm ; 10. *P. walkeri*, 15.50x4.0 mm.

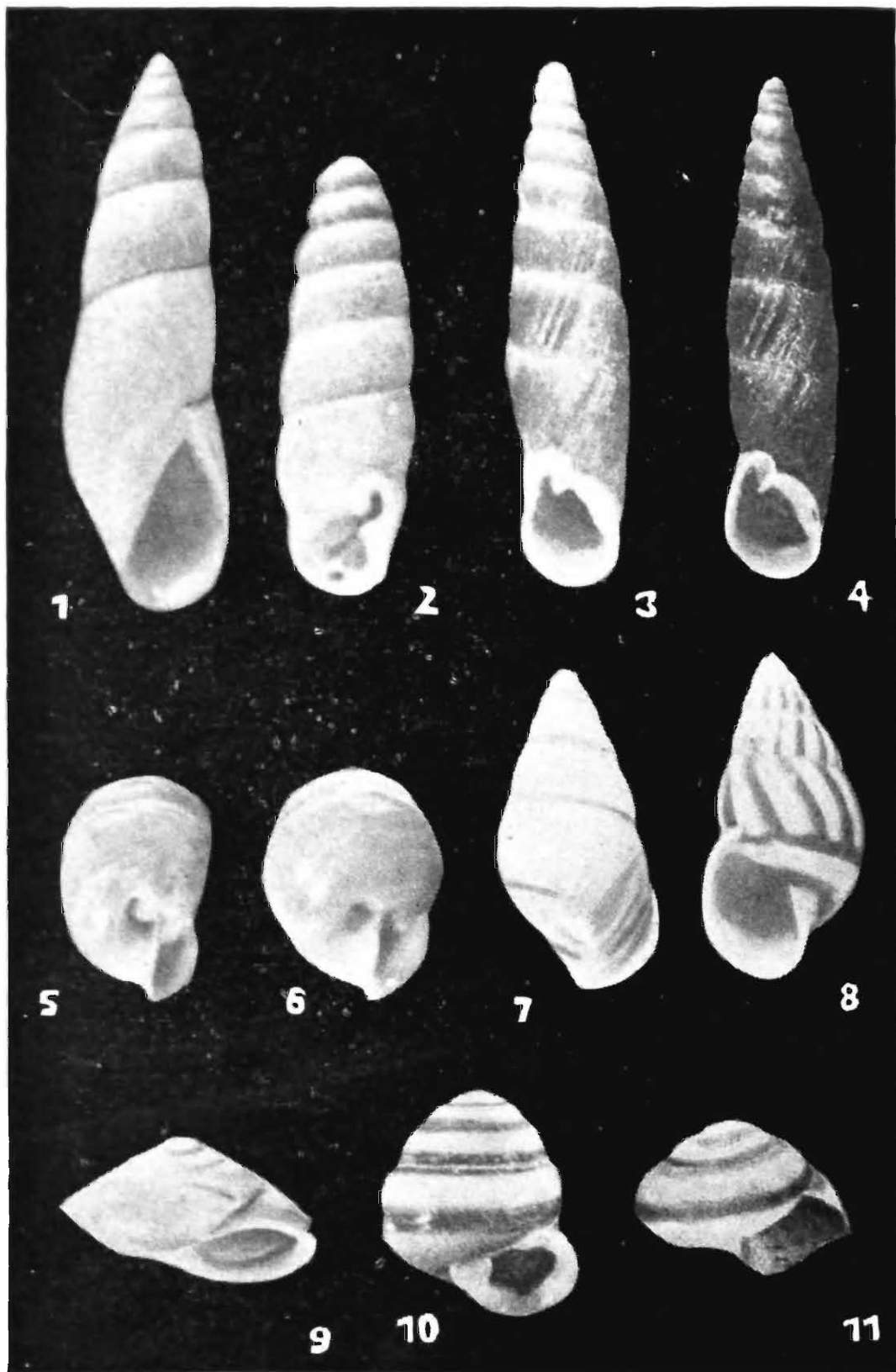


PLATE V : 1. *P. roepstorffi*, 22.50x8.95 mm ; 2. *Gulella bicolor*, 6.10x1.85 mm ; 3. *Phaedusa corticina nicobarica*, 26.40x5.30 mm ; 4. *Acrophaedusa wuellerstorfi*, 17.50x4.15 mm ; 5. *Haploptychius andamanica*, 6 20x8.55mm ; 6. *H. pfeifferi*, 8.70x5.80 mm ; 7. & 8. *Amphidromus andamanica*, 35.65x20 mm ; 9. *Planispira trochalia*, 14.75x22.15 mm ; 10. & 11. *Oreobba codonodes*, 18.50x17.65 mm.

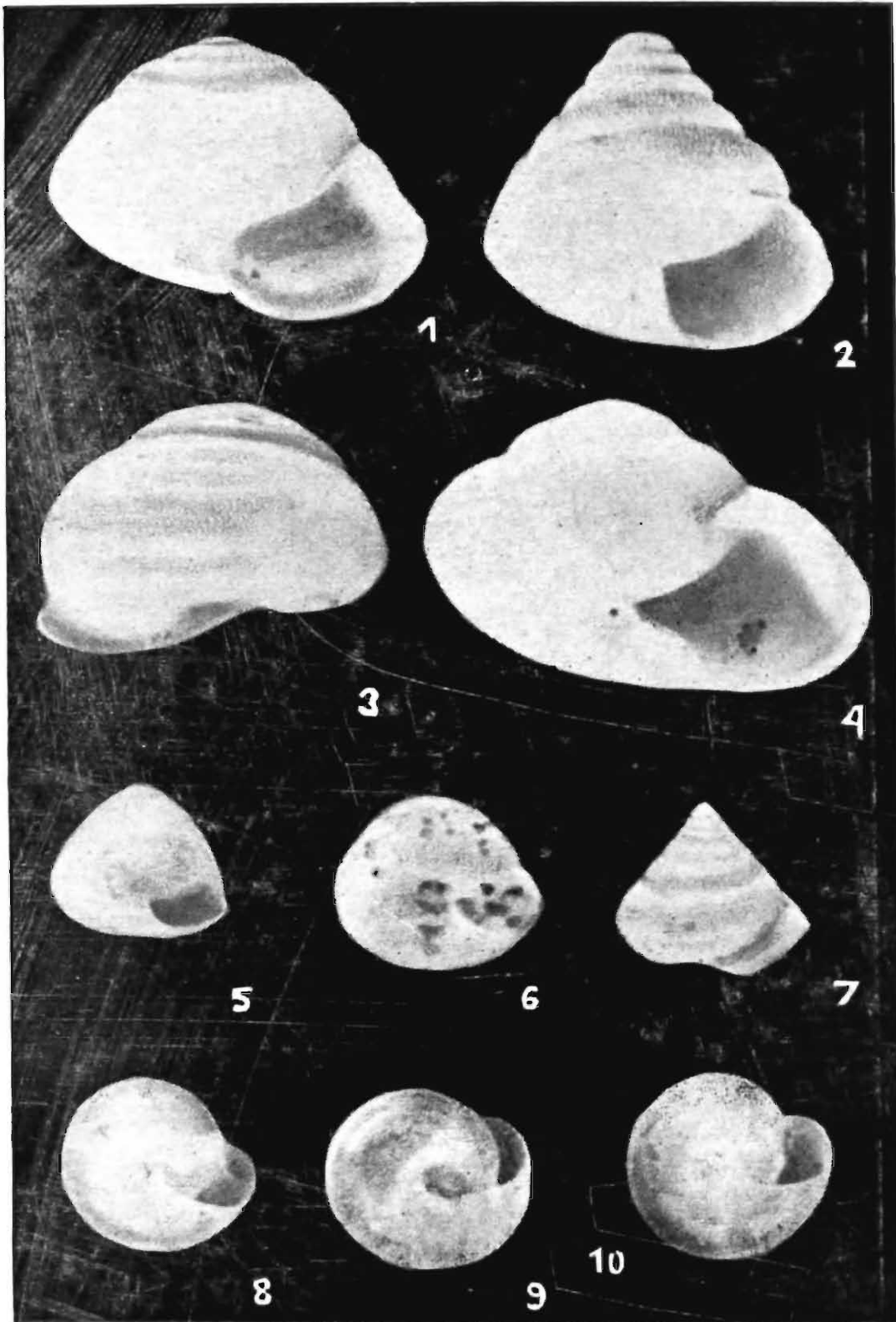


PLATE VI: 1. *Chloritis (Trichchloritis) hemiopta*, 13.50x18.45 mm. 2. *Sitala densilirata*, 6.50x6.50 mm; 3. *Chloritis (Trichochochloritis) hemiopta*, 13.50x18.45 mm; 4. *Rhyssotopsis comferta*, 21.15x30.0 mm; 5. *Sitala haroldi*, 2.25x2.0 mm; 6. *Philalanka subbilirata*, 2.90x2.0 mm; 7. *Sitala attegaia*, 10.50x10.90 mm; 8. *Microcystina rinki*, 3.0x5.0 mm; 9. *M. brunii*, 4.50x7.50 mm; 10. *M. moerchiana*, 3.55x5.50 mm.

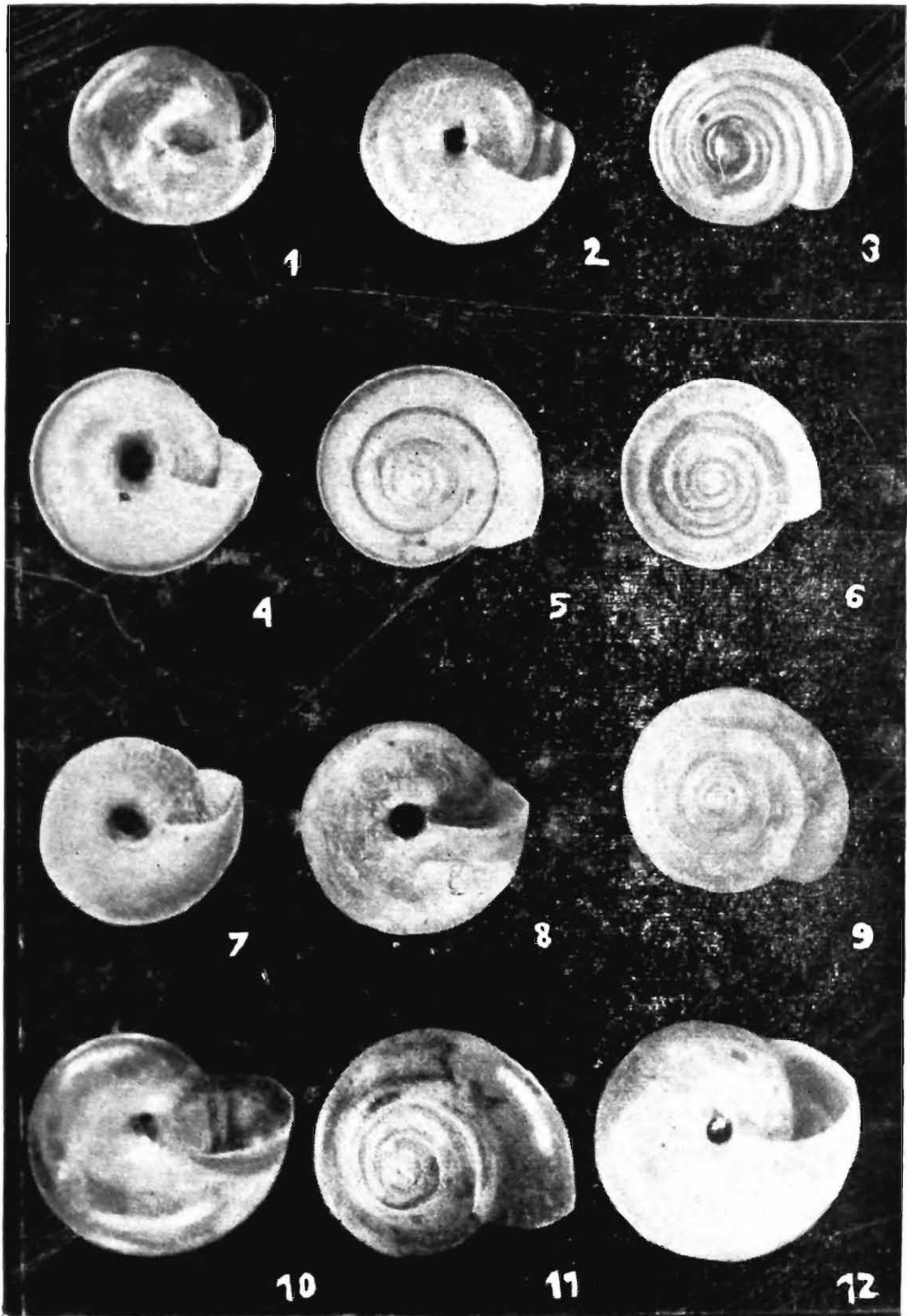


PLATE VII : 1. *Microcystina warnefordi*, 3.40x5.0 mm ; 2. & 3. *Taphrospira bathycharax*, 4.0x7.50 mm ; 4. & 5. *Videna trilineata*, 6.0x13.95 mm ; 6. & 7. *V. pseudosanis*, 3.80x12.50 mm ; 8. & 9. *V. billeana*, 5.30x12.20 mm ; 10. & 11. *Macrochlamys choinix*, 8.0x13.80 mm ; 12. *M. pseudaulopis*, 6.90x10.25 mm.



PLATE VIII: 1. *M. indica*, 7.0x10.50 mm ; 2. *M. stephus*, 8.0x14.0 mm ; 3. *M. aulopis*, 7.60x15.70 mm ; 4. *M. exul*, 7.50x12.75 mm ; 5. *Vidua andamanica*, 4.70x12.80 mm ; 6. & 7. *V. sulcipes*, 5.0x15.50 mm ; 8. *V. andamanica*, 4.70x12.80 mm ; 9. & 10. *V. iopharynx*, 5.50x13.90 mm.