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The non-marine aquatic Mollusca of Thailand.

By

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With 30 plates.

Contents.

I.	Prefatory note	1
II.	Introduction	1
III.	History	2
IV.	Zoogeography	3
V.	Systematic part	4
	<i>Gastropoda</i> CUVIER, 1804	4
	<i>Streptoneura</i> SPENGLER, 1881	4
	<i>Archaeogastropoda</i> THIELE, 1929	4
	<i>Neritoidea</i> MORTON & YONG, 1964	4
	<i>Neritacea</i> LAMARCK, 1816	5
	<i>Neritidae</i> LAMARCK, 1816	5
	<i>Neritinae</i> LAMARCK, 1816	5
	<i>Neritiliinae</i> THIELE, 1929	17
	<i>Mesogastropoda</i> THIELE, 1929	17
	<i>Viviparacea</i> GRAY, 1847	18
	<i>Viviparidae</i> GRAY, 1847	18
	<i>Bellamyiinae</i> ROHRBACH, 1937	19
	<i>Ampullariidae</i> GRAY, 1847	47
	<i>Littorinacea</i> GRAY, 1847	53
	<i>Rissoacea</i> H. & A. ADAMS, 1854	56
	<i>Bithyniidae</i> WALKER, 1927	57
	<i>Hydrobiidae</i> TROSCHER, 1857	66
	<i>Triculinae</i> ANNANDALE, 1924	67
	<i>Cochliopinae</i> TRYON, 1866	69
	<i>Rehderiellinae</i> n. subfam.	70
	<i>Lithoglyphinae</i> P. FISCHER, 1885	72
	<i>Stenothyridae</i> P. FISCHER, 1887	113
	<i>Iravadiidae</i> THIELE, 1928	134
	<i>Assimineidae</i> H. & A. ADAMS, 1858	140
	<i>Tornidae</i> WENZ, 1939	158
	<i>Cerithiacea</i> (FLEMING) H. & A. ADAMS, 1858	159
	<i>Pleuroceridae</i> THIELE, 1929	160
	<i>Paludominae</i> GILL, 1971	160
	<i>Thiaridae</i> GRAY, 1847	162
	<i>Thiarinae</i> GRAY, 1847	162
	<i>Melanatriinae</i> THIELE, 1929	170
	<i>Potamididae</i> H. & A. ADAMS, 1853	189
	<i>Triphoridae</i> THIELE, 1929	198
	<i>Neogastropoda</i> WENZ, 1941	198
	<i>Muricacea</i> HINDS, 1844	199
	<i>Muricidae</i> FLEMING, 1821	199
	<i>Muricinae</i> FLEMING, 1821	199
	<i>Buccinacea</i> HINDS, 1841	200
	<i>Buccinidae</i> FLEMING, 1821	200
	<i>Volutacea</i> PHILIPPI, 1853	204
	<i>Marginellidae</i> GRAY, 1847	204
	<i>Euthyneura</i> SPENGLER, 1881	205

Entomotaeniata COSSMANN, 1896	206
Pyramidellacea GRAY, 1847	206
Pyramidellidae GRAY, 1847	206
Basommatophora KEFERSTEIN, 1864	210
Ellobiacea H. & A. ADAMS, 1858	211
Ellobiidae H. & A. ADAMS, 1858	211
Pedipedinae THIELE, 1931	212
Pythiinae ZILCH, 1959	215
Cassidulinae ZILCH, 1959	218
Melampodinae H. & A. ADAMS, 1855	223
Ellobiinae H. & A. ADAMS, 1855	226
Lymnaeacea GRAY, 1842	228
Lymnaeidae GRAY, 1842	228
Ancylacea BROWN, 1844	233
Bulinidae BAKER, 1945	233
Planorbidae GRAY, 1840	235
Camptoceratinae n. subfam.	236
Amerianninae HUBENDICK, 1955	237
Planorbinae GRAY, 1840	238
Segmentininae BAKER, 1945	243
Ancyliidae BROWN, 1844	247
Bivalvia LINNAEUS, 1758	252
Pteriomorphia BEURLEN, 1944	253
Arcoida STOLICZKA, 1871	253
Arcacea LAMARCK, 1809	254
Arcidae LAMARCK, 1809	254
Mytiloida FÉRUSSAC, 1822	255
Mytilacea RAFINESQUE, 1815	255
Mytilidae RAFINESQUE, 1815	255
Ptereoconcha COX, 1960	258
Pteriina NEWELL, 1965	258
Pteriacea BRODERIP, 1839	258
Isognomonidae WOODRING, 1925	259
Anomiacea RAFINESQUE, 1815	259
Anomiidae RAFINESQUE, 1815	259
Ostreina FÉRUSSAC, 1822	259
Ostreacea RAFINESQUE, 1815	259
Ostreidae RAFINESQUE, 1815	259
Schizodontida STEINMANN, 1888	260
Unionoida STOLICZKA, 1871	260
Unionacea FLEMING, 1828	260
Margaritiferidae HENDERSON, 1929	260
Amblemidae RAFINESQUE, 1820	262
Pseudodontinae FRIERSON, 1927	262
Hyriopsinae MODELLE, 1942	271
Parreysiinae HENDERSON, 1935	279
Rectidentinae MODELLE, 1942	287
Modellnainae n. subfam.	301
Unionidae FLEMING, 1828	302
Heterodonta NEUMEYR, 1884	302
Veneroida H. & A. ADAMS, 1858	303

Astartedontina KOROBKOV, 1953	303
Solenacea LAMARCK, 1809	303
Novaculidae GHOSH, 1920	303
Solenidae LAMARCK, 1809	304
Tellinacea BLAINVILLE, 1824	305
Psammobiidae FLEMING, 1828	305
Venerina VOKES, 1967	306
Dreissenacea GRAY, 1847	306
Dreissenidae GRAY, 1840	306
Corbiculacea GRAY, 1847	308
Corbiculidae GRAY, 1847	308
Pisidiidae GRAY, 1857	328
Veneracea RAFINESQUE, 1815	334
Glaucomyidae CHENU, 1862	334
Va. Appendix	334
VI. Bibliography	335
VII. Index	407

I. Prefatory note.

After the Second World War an extensive study of helminthic diseases was started in Thailand by the Faculty of Tropical Medicine and the SEATO Medical Laboratory in Bangkok. As it was known that even a cursory study of trematodes is impossible without a profound knowledge of their intermediate hosts a systematic study of the fresh-water molluscan fauna of Thailand was started, particularly with regard to its importance to human parasitology. This work was sponsored by two grants of the U. S. Army Research & Development Command (No. DA-MD49-193-63-G99 and No. DA-MD-49-193-66-G9199).

The collection on which this report is based was made by the author and his assistants during the years 1963-1970 and is stored partly in the U. S. National Museum in Washington and partly in the Senckenberg Museum in Frankfurt am Main. Reference collections were donated to the University in Hamburg and the National Reference Collections of Thailand.

Descriptions of hitherto unknown species would be beyond the scope of the present faunistic report. Most of these descriptions have already been published in separate papers (BRANDT 1968, 1970; TEMCHAROEN 1971, BRANDT & TEMCHAROEN 1971; DAVIS 1968; HUBENDICK 1967).

It is impossible to list for acknowledgement all Thai and foreign friends, provincial health officers, staff members, curators and malacologists to whom I am indebted for all the assistance I have received. However, it gives me great pleasure to name Colonel DALE E. WYKOFF, Walter Reed Army Institute of Research as the initiator of our studies, without whose efforts this survey would never have been started. My thanks are also due to Prof. CHAMLONG HARINASUTA, Dean of the Faculty of Tropical Medicine in Bangkok, for all the facilities, office and laboratory space, he made available to me during a period of 11 years. Special gratitude, however, is extended to my three co-workers, Mr. JIRAPON VIBULJAVATNA, Mr. PRASONG TEMCHAROEN and Mr. SUCHAT PARIYAMANDA, without whose help in the field and in the laboratory this work could not have been successfully concluded. Finally thanks are also due to my friend Dr. ADOLF ZILCH, the editor of this periodical, for having made available the financial means for publication and for having sacrificed innumerable hours of his spare time in revising this manuscript for type-setting and in preparing the plates.

II. Introduction.

During his stay in Thailand from April 1963 until February 1971 the author has spent more than 900 days in the field, about 700 in Thailand, the rest in neighbouring countries, Burma, Laos, Cambodia and West Malaysia. However, other countries were also visited, albeit for short periods only. The author collected in the Philippines (Luzon, Negros, Mindoro and Mindanao), India, Nepal, Taiwan and Indonesia (Java, Sumatra, Bali, Celebes and Borneo).

All 70 provinces of the Kingdom of Thailand were visited several times and material was collected in most of the Districts (Ampoe). As this malacological survey was planned within the framework of a parasitological research, it is understandable that our attention was focused particularly on the fauna of the proximity of inhabited areas, although remote and uninhabited areas were not completely neglected.

In 1965, 1967, 1968 and 1971 the author of this report has had ample opportunity to study the collections in many museums in the United States (Cambridge/Mass., New York, Philadelphia and Washington) and in Europe (London, Paris, Brussels, Amsterdam, Leiden, Copenhagen, Vienna and Frankfurt/Main) as well as in Calcutta, Singapore, Perth, Melbourne, Adelaide and Sydney. His intention was to study type material of at least those species whose identity was still slightly doubtful. Fortunately most of the material on which the taxa by LEA, MABILLE, LE MESLE, ROCHEBRUNE, POIRIER, BAVAY, DAUTZENBERG and L. MORLET were based were easily traced. However, many types by A. MORELET and by ANCEY were not traceable and some of them must be considered to be lost. This applies also to type material supposed to be stored in the Indian Museum in Calcutta.

III. History

A malacological history of Southeast Asia would in effect only be a report of malacological research in Burma, Malaysia and Indo-China, as very little collecting had been done in Thailand.

BANKS and SOLANDER who accompanied Captain COOK on his famous voyages, were the first Europeans to stop at the coasts of Southeast Asia in order to collect natural history specimens including molluscs. Their findings were described by MARTYN.

Almost a century later the first malacological reports came from Thailand. Four missionaries, two French (LARNAUDIE and PALLEGOIX) and two American (INGALLS and HOUSE) sent molluscs from Thailand to their respective home countries. These were described by LEA, A. MORELET, PFEIFFER and REDFIELD. In 1862 another Frenchman, BOCOURT, undertook a scientific mission to Siam. His findings were published by ROCHEBRUNE, MABILLE, MORELET, PRIME and BROU.

The German physician E. VON MARTENS visited Siam with the Prussian expedition to Southeast Asia as a naval officer and collected around Bangkok, Saraburi and Ratburi. MARTENS published his papers on this material in 1860, 1862 and 1872 and included some findings by the French Consul (CASTELNEAU) and the British Consul (SCHOMBURGK) to Siam. The description of his collection by KOBELT only added to the synonymy of already known species. The faunistic lists edited by P. FISCHER in 1891 and by H. FISCHER & DAUTZENBERG in 1904 included the molluscan fauna of Thailand known at that date. BLANFORD reported in 1903 on a small collection of molluscs from the surroundings of Pitsanulok sent to London by DALY. After the First World War the extremely active group of the Zoological Survey of India also visited Thailand and the results of their surveys were included in papers by ANNANDALE & PRASHAD (1920, 1928). Between the two World Wars and after the Second World War an

American ichthyologist, E. A. SMITH, sent a moderately large collection of molluscs to the U. S. National Museum in Washington. The species he found were covered in the faunistic reports by SUVATTI in 1938 and 1950. In 1952 F. HAAS reported on a small collection of molluscs which originated from the valley of the Ping River. In 1964 F. R. WOODWARD gave a detailed description of the anatomy of *Chamberlainia hainesiana* (LEA), a large clam endemic to a few rivers in Thailand. In the same year HABE published a paper based on some fresh-water molluscs collected by the Japanese parasitologist ITO in Thailand. A work published in 1968 by A. SOLEM dealt predominantly with land molluscs but also included some fresh-water species.

About $\frac{1}{3}$ of the collected aquatic molluscs in Thailand had already been reported from that country by other authors. Another $\frac{1}{3}$ had been described from neighbouring countries and the remaining $\frac{1}{3}$ were undescribed species endemic to Thailand, and in the case of those collected in the Mekong River to Thailand and Laos and sometimes also to Cambodia.

IV. Zoogeography

With regard to the zoogeography of fresh-water molluscs six distinct regions can be identified:

1. The central — the catchment area of the Chao Praya River,
2. The western — the basin of the Maeklong River,
3. The northwestern — a part of the system of the Salwen River,
4. The northern, northeastern and eastern — comprised by the Mekong Basin,
5. The southeastern — comprised by the system of the Bang Prakong River and numerous small and independent rivers and rivulets in the Provinces of Trat, Chantaburi, Rayong and Chonburi,
6. The southern— which occupies the northern part of the Malaysian Peninsula.

Whilst most of the fresh-water species found in still water in Thailand are also distributed over large parts of South, Southeast and East Asia, most of the fluviatile species are endemic to specific river systems.

The species found in the tributaries of the Salwen River (Maenam Moei, Maenam Yuam, Maenam Pai in the Provinces of Mae Hongson and Tak) belong to the fauna of Burma which is conspicuously different from that of Thailand and China but closely related to that of Bengal and Bangladesh. The southern provinces of Thailand show a fauna almost identical with that of western Malaysia. The exceptionally large number of species found in the Mekong are shared with Laos and some also with Cambodia. Some species of Thai tributaries of the Mekong, however, are endemic to Thailand, particularly those from the Mun River, the largest Thai branch of the Mekong. Also the exclusively Thai river systems of the Bang Prakong River, the Chao Praya River and the Maeklong River are inhabited by a small amount of endemic species. The small rivers in the south and in the southeast did not yield any species peculiar to these rivers. A more extensive discussion of the geographical relationship of Thai species with those of neighbouring countries will be included in a general report on malacological observations in Southwest Asia at a later date.

V. Systematic part.

Gastropoda CUVIER, 1804.

Asymmetrical molluscs with head and foot unless rudimentary in parasitic species. Free-living species with or without a shell. This consists generally of one piece and is either spirally coiled, ear- or cap-shaped. — The visceropallium has undergone a torsion of 180° . Head with one or two pairs of tentacles which are rarely rudimentary. The eyes — if present — are generally placed either on top of the upper pair or at the base of the only pair or between the tentacles on the fore-head.

Distribution: Cosmopolitan.

Habitat: Marine, fresh and brackish water and terrestrial.

Parasitology: Gastropods have become an important class of the animal kingdom for parasitology, as — with extremely rare exceptions — trematodes need snails as intermediate hosts for the development of their life-cycles.

Key to the subclasses:

1. Shell, when present, generally without operculum (exception: Amphibolacea); hermaphroditic; nervous system not or only slightly crossed; the gills are never true ctenidia Euthyneura.
2. Shell of free-living species almost always present, generally with an operculum; dioecious (exception: Valvatidae and few marine families). Nervous system crossed, streptoneurous. The gills are true ctenidia Streptoneura.

Streptoneura SPENGLER, 1881.

Shell in free-living species normally present and generally closed by an operculum; coiled, cap- or ear-shaped. The mantle cavity contains one or two ctenidia. Nervous system crossed. Head with one pair of tentacles. This subclass was formerly known as Prosobranchia.

Key to the orders:

1. Shell not siphonate, radula with more than 3 teeth in one row 2
— Shell siphonate, radula with 1 or 3 teeth in one row Neogastropoda.
2. Radula with many marginals; heart with two auricles Archaeogastropoda.
— Radula with 2 marginals, heart with one auricle Mesogastropoda.

Archaeogastropoda THIELE, 1929.

Shells of the representatives of this order very polymorphic, spiral, cap- or ear-shaped, without common characteristics. — Radula generally with more than 7 teeth in one row, rhipido- or docoglossate. With one or two bipectinate (“aspidobranch”) ctenidia. Heart with two auricles (“diotocardiate”).

Neritoidea MORTON & YONG, 1964.

This suborder differs from the other Archaeogastropoda by having an inner fertilization and a cephalic penis. The left renal organ is enlarged and became the

functional kidney; right renal organ reduced to a duct of the genital tract. — Radula with many marginals.

Distribution Circumtropical and subtropical.

Of the three superfamilies, Neritacea, Helicinacea and Titiscaniacea, the latter is represented by one marine slug only. The Helicinacea are land-snails. Only the Neritacea are represented in fresh and brackish water.

Neritacea LAMARCK, 1816.

Shell auriform, subglobose or cap-shaped, generally with a broad columellar septum with serrate edge. Operculum calcareous, with an apophysis on the inner surface. This consists generally of a peg and a ridge which may be connected by a more or less high callus. — The radula consists of a rhomboidal or squarish rhachis, a large L₁, small L₂ and L₃; L₄ and L₅ are grown together to a large blade-shaped outer lateral. The numerous marginals have either a smooth or a serrate cutting edge. A jaw is missing. — Animal with large head and long, filiform tentacles. Eyes placed in small sockets; rostrum large, broad. Foot tapering to the end, without epipodium. There is only one bipectinate ctenidium. The oviduct of the female reproductive organs leads into a glandular tract which is often connected with a sack filled with calcareous bodies. This sack is connected with a large spermatocyst, whose anterior part serves as vagina. The spermatheca opens into this connection duct.

Distribution Like that of the suborder.

Only one family is represented in fresh and brackish water.

Neritidae LAMARCK, 1816.

Shell subglobose, ear- or cap-shaped or ovoidal-conic. Columellar and parietal margin of the aperture form a septum which is often serrate. — Operculum generally semilunar, calcareous, with an apophysis with peg and ridge.

This family is of no known parasitological importance.

Distribution Like that of the superfamily.

Key to the subfamilies:

- | | |
|--|---------------|
| 1. Radula with rhachis; operculum with peg and ridge | Neritinae. |
| 2. Radula without rhachis; operculum without peg and ridge | Neritiliinae. |

Neritinae LAMARCK, 1816.

Like the family but always with rhachis and apophysis.

Key to the genera:

- | | |
|--|------------------|
| 1. Shell subglobose or ovoidal-conic | 2 |
| — Shell cap-shaped | .. 5 |
| 2. Aperture without serrate internal lip | 3 |
| — Aperture with serrate internal lip | <i>Nerita</i> . |
| 3. D of shell larger than 15 mm | .. 4 |
| — D of shell smaller than 15 mm | <i>Clithon</i> . |

4. Columellar edge of septum smooth or serrate, but without tubercles; ridge of operculum smooth *Neritina*.
 — Columellar edge of septum smooth, with one tubercle; ridge of operculum with grooves *Neritodryas*.
 5. Edge of septum serrate, septum broad; operculum semilunar with well developed apophysis (*Dostia*).
 — Septum narrow, edge smooth; operculum rhomboid, apophysis rudimentary *Septaria*.

Nerita LINNAEUS, 1758.

Shell rather large, very solid, subglobose, auriform or ovoidal, with few whorls, low or depressed spire and large body whorl. The septum of the columella with folds and/or verrucae and always with dentition on the edge. — Aperture with a serrate lip within. — Operculum semilunar, calcareous, paucispiral, outer surface verrucose, inner surface smooth, with apophysis whose smooth ridge is without grooves.

Type species: *Nerita peloronta* LINNAEUS (MONTFORT, 1810).

Distribution: Circumtropical and subtropical, predominantly marine. Two species are known from the mud-flats or from brackish water in Thailand, one of the subgenus *Nerita* s. str. and one of *Theliostyla* MÖRCH.

Key to the subgenera:

1. Septum only slightly puckered *Nerita*.
 2. Septum with folds and tubercles *Theliostyla*.

Nerita (Nerita) s. str.

Shell sub- or semiglobose, thick, with flat or very low spire and large body whorl. Generally with deep spiral grooves. Septum only slightly puckered, without folds or tubercles, edge with few obtuse denticles in the middle part. Inner lip with numerous small teeth or folds.

Distribution and habitats like that of the genus. There is only one non-marine species of this subgenus known from Southeast Asia; it lives in the mud-flats of the nipa palm and mangrove swamps together with species of *Neritodryas* and with *N. planospira* ANTON. — As this species serves as food in the coastal area it has been carefully examined for cercariae and metacercariae. It has never been found to shed cercariae or to harbour metacercariae.

Nerita (Nerita) articulata GOULD, 1847.

pl. 1 fig. 1.

1791 *Nerita lineata* GMELIN, Syst. Nat. ed. 13: 3684 (in freto malaccensis) [non O. F. MÜLLER, 1774].

1847 *Nerita articulata* GOULD, Proc. Boston Soc. nat. Hist., 2: 220 (Tavoy, Burma).

1855 *Nerita balteata* REEVE, Conch. Icon., 9: pl. 6 fig. 28 (no locality).

1877 *Nerita (Pila) birmanica* TROSCHEL, Gebiß der Schnecken, 2: 190, pl. 17 fig. 6 (radula) (China).

1950 *Nerita lineata*, — SUVATTI, Fauna Thailand: 39 (Thailand, several localities).

Shell rather large, broad, subglobose, with rounded but depressed spire and large, expanded body whorl. The 2½ whorls increase rapidly in size. They are sculptured with more than 40 grey or blackish spiral ridges. The interspaces are rosy or greyish. — Aperture semi-circular, peristome sharp, regularly rounded, not continuous, inside with a white lip which carries 17-19 small teeth. Septum smooth and glossy with somewhat incised edge and three denticles. The surface of the septum shows a yellowish tint particularly on the upper and lower parts. — Operculum semicircular with greyish outer surface covered with small verrucae. Inner surface smooth and glossy. Ridge distinctly serrated, peg curved and without sulci.

Size A 24-32 mm; D 26-38 mm; aperture within 22 12 mm.

Animal grey with black concentric lines; tentacles short and thin. Foot oval, sole sand-coloured. — Radula: rhachis squarish, L₁ long and club-shaped, L₂ and L₃ small, L₄ with a long, serrated ridge with 33-36 small denticles. The numerous marginals decrease in size from the inner to the outer marginals.

Type locality: Tavoy (Burma).

Distribution: From Bengal around the coasts of Farther India to Indonesia, New Guinea, N, E and SE Australia. Thailand: Common in mangrove and nipa palm swamps at the coasts of the Gulf of Thailand and the Indian Ocean.

This species is eaten by the local population. No cercariae and metacercariae were found in several thousand examined specimens.

***Nerita (Theliostyla)* MÖRCH, 1852.**

Shell typical for the genus. This subgenus differs from *Nerita* s. str. by its verrucose septum. — Animal not different from that of *Nerita* s. str.

Distribution Circumtropical, predominantly marine.

Type species *Nerita albicilla* LINNAEUS.

***Nerita (Theliostyla) planospira* ANTON, 1839.**

pl. 1 fig. 2.

1839 *Nerita planospira* ANTON, Verz. Conch.: 30 (no locality).

1841 *Nerita atropurpurea* RÉCLUZ, Rev. Zool., 4: 107 (Apia, I. Witi).

1852 *Nerita (Theliostyla) bizonalis* MÖRCH, Cat. Yoldi: 168 [non LAMARCK, 1816].

1854 *Nerita angularis* HOMBRON & JACQUINOT, Voy. pole sud, Moll.: pl. 16 fig 7-11 (Solomon Isl.).

1897 *Nerita planospira*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl. Ostindien, 4: 219 (von den Nikobaren und Tenasserim bis zu den Samoa-Inseln und Carolinen).

Shell large, thick, rounded-triangular; spire flat, with pointed apex unless eroded; ash-grey, generally with brighter patches; sculptured with 25-28 spiral ridges. The large body whorl shows an obtuse angle beside the suture. — Aperture large, regularly rounded except for the angle on the upper part; ivory coloured within. Columellar septum with four teeth on the edge; these are prolonged over the surface by distinct folds which end behind the first third. On the second third are three or four tubercles. The dark inner third is verrucose. — The outer surface of the operculum is grey and glossy without verrucae.

Size A 22-25 mm; D 25-30 mm; d 14-17 mm.

Animal almost black with sand-coloured sole. — The radula differs from that of *N. articulata* by L_4 showing only 7 cusps on the cutting edge, 1 on the inner and 6 on the outer half.

Type locality „In Mari Chinensi“ (1844).

Distribution Burma, Nicobar and Andaman Islands, Farther India, Indonesia, Solomon Islands, Samoa, Caroline Islands, Amboina, Timor. — In Thailand at the same localities and habitats as the preceding species, but rarer.

Neritodryas MARTENS, 1869.

Shell large or middle-sized for the family, subglobose, with large, semi-circular aperture. Edge of columellar septum smooth or with delicate teeth and strong tubercle. — Ridge on the inner surface of the operculum with parallel grooves, and often hand-shaped. Outer surface smooth. Animal typical for the genus. — Radula with broad rhachis, L_1 large, L_2 and L_3 small, $L_{4/5}$ dagger-shaped with an almost smooth cutting edge. Marginals with few cusps on the cutting edges.

Type species: *Nerita cornea* LINNAEUS.

Distribution Ceylon, SE Asia and from Indonesia to the Philippines and Tahiti. The report from Australia is doubtful. Found on mangrove trees and nipa palms.

There are two species known from Thailand:

1. Shell larger than 22 mm, with spiral ridges *cornea*.
2. Shell smaller than 22 mm, without spiral ridges *dubia*.

They were never found in fresh or running water as stated by other authors (VAN BENTHEM JUTTING 1956: 291) but seem to live only on trees in the mud flats somewhat above the water mark.

Neritodryas cornea (LINNAEUS, 1758).

pl. 1 fig. 3-4.

1758 *Nerita cornea* LINNAEUS, Syst. Nat. ed. 10: 777 (no locality).

1831 *Nerita amphibia* LESSON, Voy. Coquille, Zool., 2: 372, pl. 16 fig. 1 (Nouvelle Irland).

1831 *Nerita ampullaria* LESSON, Voy. Coquille, Zool., 2: 376.

1838 *Neritina morio* DESHAYES, Hist. anim. s. vert., ed. 2, 8: 585 [partim] (les îles de l'Océan austral.).

1839 *Nerita sulcata* ANTON, Verz. Conch. Samml.: 29 (no locality).

1849 *Neritina cornea*, — SOWERBY, Thes., 2: 518, pl. 111 fig. 67-71 (Puerto Galera, Mindoro).

1877 *Neritina gagates* TROSCHEL, Gebiß der Schnecken, 2: 178, pl. 16 fig. 15 (radula) (Philippinen).

Shell subglobose, solid, but not very thick, with depressed spire and large, inflated body whorl. The colour is of a reddish-brown, rarely yellow or almost black, generally with black spiral bands or radial streaks. The sculpture consists of low spiral ridges, about 26 on the last whorl. — Aperture large, semicircular, brown (or rarely whitish) within, without inner lip. Septum whitish or ivory-coloured, rarely greyish or completely brown, generally with two brown dots. Edge smooth or very delicately serrate, with a distinct tubercle on the lower

third. — Operculum greyish-olive on the external surface and violet-brownish within. The brown apophysis shows a long and protruding peg; the curved ridge is sculptured with 3 to 5 grooves.

Size A 20.5-25 mm; D 22.5-26.5 mm.

Radula with broad rhachis, $L_{4/5}$ with almost smooth cutting edge (the figure given by H. B. BAKER shows a much stronger dentition on the cutting edge than our specimens).

Type locality: Not designated.

Distribution: From S and SE Asia over Indonesia to the Philippines and New Caledonia. — Thailand: Known from mangrove swamps in the provinces of Grabi and Trang on the Indian Ocean only. Not yet found in the coastal area of the Gulf of Thailand.

Neritodryas dubia (GMELIN, 1791).

pl. 1 fig. 5-6.

1791 *Nerita dubia* GMELIN, Syst. nat., ed. 13: 3678 (no locality).

1816 *Nerita fasciata* LAMARCK, Encycl. méth.: 11, pl. 455 fig. 5 (Nouvelle Irlande).

1831 *Nerita lugubris* LESSON, Voy. Coquille, Zool., 2: 378 [non LAMARCK, 1822] (Nouvelle Guinée).

1832 *Nerita reticulata* QUOY & GAIMARD, Voy. Astrolabe, Zool., 3: 193, pl. 65 fig. 3-4 [non SOWERBY 1832] (Nouvelle Guinée).

1836 *Neritina Philippinarum* SOWERBY, Conch. Ill. (100): fig. 53 (Philippines).

1842 *Nerita vestita* SOULEYET, Rev. Zool., 1842: 269 (I. Luçon).

1843 *Neritina bella* VON DEM BUSCH in PHILIPPI, Abb. Besch. Conch., 1: 27, pl. 1 fig. 8 (Java).

1847 *Neritina Adamsi* ISSEL, Ann. Mus. civ. Stor. nat. Genova, 6: 104, pl. 7 fig. 23-24 (Sarawak).

1886 *Neritina funesta* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 4: 121 bis (Secaar).

Shell of medium size, semiglobose, not very thick, with rounded, depressed spire and large, inflated body whorl; smooth, without spiral grooves, yellowish brown, rarely unicoloured, generally with darker reticulate pattern. — Aperture yellowish brown within, without inner lip. The smooth, glossy septum either of the same colour or with a darker olive-brown patch, sometimes dark olive grey with an orange edge only. The edge is either smooth or very delicately serrate. — Operculum with yellowish or olive-grey outer surface, granulate. Peg rounded, ridge curved, with 3 to 4 grooves.

Size A 18-22 mm; D 19-23 mm.

Animal dark grey. — Radula with broad, squarish rhachis, long L_1 , small L_2 and L_3 . Cutting edge of $L_{4/5}$ irregularly serrate.

Type locality: New Ireland.

Distribution From Ceylon over SE Asia to the Philippines and Tahiti. — In Thailand common on nipa palms and mangrove trees in the coastal areas of the Indian Ocean and the Gulf of Thailand.

Clithon MONTFORT, 1810.

Type species *Nerita corona* LINNAEUS.

Shell small to medium-sized, subglobose, with rounded or only somewhat raised spire and large, inflated body whorl. The septum is smooth or delicately

Shell comparatively small, subglobose, with low, somewhat conical, but mostly eroded apex; glossy, with various patterns of coloured ornamentation. The ground colour of the periderm is generally greyish or olive-green, rarely blackish or yellow. The design consists of spiral bands, zigzag lines or a network of black lines. Unicoloured specimens are not rare. — Aperture oblique, semi-circular, bluish within; peristome sharp, without inner lip. Septum rather short, with minute verrucae or almost smooth; dentition of the edge very weak, with one (or two) larger denticles on the upper third and 3 to 5 very small teeth on the second third. — Operculum semicircular, outer surface greyish, very delicately verrucose; inner surface with a more or less distinctly curved ridge and short, knob-like peg. Ridge broad, flat, smooth, with straight end; connection between ridge and peg strong.

Size A 7.2-9.5 mm; D 6.3-8.4 mm.

Radula: rhachis shield-like, L₁ club-shaped, L_{2/3} very small, L₄ triangular, with 11 cusps on the cutting edge. Inner marginals with few, outer marginals without denticles. There are about 105 rows of teeth.

Type locality: Oualan.

Distribution: Coastal areas of S, SE and E Asia, the islands of the Indian and Pacific Oceans and N Australia. — Thailand: common in lagoons and estuaries of small rivers. The species lives on sand or silt ground and is never found in the mud-flats.

Clithon (Clithon) s. str.

Periderm not glossy, generally roughened or with scales and even with spines. Septum edge with one or two large and several small teeth. — Operculum with long, curved ridge and short, knob-shaped peg; the edge of the high connection is thick. — Radula: L_{4/5} with more than 15 cusps, cutting edges of all marginals simple or inner marginals with few cusps.

Distribution: Coasts and islands of the Indo-Pacific, from the east coast of Africa to Australia, Japan and the west coast of tropical America.

Three species of *Clithon s. str.* are known from Thailand. A fourth, *C. retropicta* MARTENS, reported from Thailand by its author, is restricted to Japan (? and the Fiji Islands) only.

Key to the species:

- | | |
|--|--------------------|
| 1. Shell subglose, spire rounded | 2 |
| — Shell ovate, spire conic | <i>sowerbyana.</i> |
| 2. Apex generally covered by the following whorls; edge of septum with two larger teeth and several smaller teeth in between | <i>faba.</i> |
| — Apex exserted; edge of septum with several small teeth and one larger tooth in the middle | <i>peguensis.</i> |

Clithon (Clithon) peguensis (BLANFORD, 1867).

1858 *Neritina fuliginosa* THEOBALD, J. asiat. Soc. Bengal, 27: 315 [non VON DEM BUSCH, 1843] (near Ava, Birmah).

1867 *Neritina peguensis* BLANFORD, J. asiat. Soc. Bengal, 36: 58, pl. 1 fig. 1-16 (ad Portum Dalhousie).

- 1876 *Neritina fuliginosa*, — HANLEY & THEOBALD, Conch. Ind.: 63, pl. 157 fig. 8-9 [non VON DEM BUSCH] (near Ava, Birmah).
 1878 *Neritina peguensis*, — MARTENS, Conch. Cab., 2, 10: 188, pl. 19 fig. 10-11 (Pegu, Amrapura am Iravadi).
 1950 *Neritina peguensis*, — SUVATTI, Fauna Thailand: 41 (Bandon Blight).

Shell subglobose, dull, generally greenish or yellowish with white patches which often show a black border, or with two reddish spiral bands. The small spire is generally eroded and often covered or almost so by the upper part of the body whorl. — Septum delicately verrucose, edge slightly incised, with several small denticles and one larger tooth in between. — Operculum with well developed apophysis; peg short and knob-like, ridge curved, connecting callus high and strong.

Size A 12-14 mm; D 13-15 mm.

Type locality Iravadi near Amrapura (Port Dalhouse).

Distribution Coastal areas of Burma and the Malayan peninsula; Reported from Thailand but not found by our team.

Habitat: The species lives in the estuaries of small rivers and creeks on sandy ground or on rocks in brackish water.

Remark: Probably identical with *Neritina retifera* SOWERBY from Bengal.

Clithon (Clithon) faba (SOWERBY, 1836).

pl. 1 fig. 8.

- 1836 *Neritina faba* SOWERBY, Conch. Illustr.: 38, fig. 10 (Singapore).
 1842 *Nerita [Clithon] avellana* RÉCLUZ, Rev. Zool. Soc. Cuvier, 1842: 76 (Philippine Islands).
 1843 *Nerita interrupta* RÉCLUZ, Proc. zool. Soc. London, 1842: 173 (Pangasinan, Island of Luzon).
 1843 *Nerita pulchella* RÉCLUZ, Proc. zool. Soc. London, 1842: 175 (Pangasinan, Island of Luzon).
 1845 *Neritina columbaria* RÉCLUZ, Proc. zool. Soc. London, 1845: 21 (Ceylon).
 1850 *Neritina troscheli* RÉCLUZ, J. de Conch., 1: 155 (no locality).
 1874 *Neritina dubia*, — ISSEL, Ann. Mus. civ. Stor. nat. Genova, 6: 467 [non GMELIN, 1790] (Tangion Batu, Borneo).
 1889 *Neritina avellana*, — MORLET, J. de Conch., 37: 158 (entre Kampot et Bangkok).
 1917 *Theodoxus endeli* G. B. SOWERBY (3), Proc. malac. Soc. London, 12: 320 (Phu-Yen).

Shell subglobose, with exserted spire which is generally eroded in old specimens. The large body whorl is somewhat angled below the suture or regularly rounded. The colour pattern generally consists of whitish, black-shaded dots on an olive ground colour but specimens with spiral bands and radial flames are not rare. Furthermore the specimens may be unicoloured or they may show a blackish network. — Septum greyish, often with orange patches or partly orange-coloured, almost smooth but not very glossy; edge with 3 small, 1 large, and below it 5-6 small teeth. — Operculum with greyish, glossy outer surface with reddish margin. Apophysis yellow, peg knob-like, ridge curved, connecting callus high and thick.

Size: A 17-20 mm; D 18-22 mm.

Animal sand-coloured, with greyish sole. — Radula typical for the genus.

Type locality Singapore.

Distribution: Philippines, Formosa, Borneo, Sumatra, Malaya, Thailand and Burma. *C. faba* apud VAN BENTHEM JUTTING from Java is not this species (personal communication from Mr. MINNIS, Amsterdam). — Thailand: This species is common in lagoons and estuaries of small rivers in the Gulf of Thailand. The animals live on sandy or rocky ground in brackish water; they were never found on mud-flats.

Clithon (Clithon) sowerbyana (RÉCLUZ, 1842).

pl. 1 fig. 9.

1842 *Nerita sowerbyana* RÉCLUZ, Proc. zool. Soc. London, 10: 174 (Sinait, Prov. of North Ylocos, Luçon; Isl. of Guimaras).

1950 *Neritina sowerbyana*, — SUVATTI, Fauna Thailand: 41 (Ko Chang; Ko Sichan; Ko Samui).

Shell ovate-globose, thick, with dense lines of growth, almost dull; spire small, depressed, often eroded and partly covered by the penultimate whorl. Periderm with variable pattern of colours, predominantly yellow, reddish or black on a yellowish-green or olive ground colour. — Aperture and septum ash-coloured and smooth; edge with five small teeth, a larger denticle each above and below them. — Operculum greyish, apophysis like that of the genus.

Size A 13-16.5 mm; D 13-16 mm.

Type locality: Sinait, Luzon.

Distribution: Japan, China, Taiwan, Philippines, Indonesia, Malaya and Thailand. In Thailand rare and only locally in the gulf. Most reports may refer to the preceding species.

Habitat This species lives together with the preceding species.

Neritina LAMARCK, 1816.

Shell ovoidal, semiglobose or cap-shaped, of large or medium size. — Septum smooth, edge serrate. — Ridge of the apophysis without grooves.

Type species: *Nerita pulligera* LINNAEUS.

Distribution: Circumtropical and subtropical.

Habitat: Brackish or fresh water.

Key to the subgenera in Thailand:

- | | |
|--------------------------------|-------------------|
| 1. Shell subglobose or ovoidal | 2 |
| — Shell cap-shaped . . . | <i>Dostia</i> . |
| 2. Shell broadly auriform | <i>Neritina</i> . |
| — Shell ovoidal-conic | <i>Vittoida</i> . |

Neritina (Neritina) s. str.

Shell of rather large size, depressed, body whorl large, auriform; septum broad, edge smooth or serrate. Upper insertion of peristome not appressed.

Habitat Fluvial.

Distribution: W Africa, SE Asia, Indopacific islands. — Thailand: only the type species is known from Thailand.

Neritina (Neritina) pulligera (LINNAEUS, 1767).

pl. 1 fig. 10.

- 1767 *Nerita pulligera* LINNAEUS, Syst. Nat., ed. 12: 1253 (no locality).
1841 *Neritina petiti* RÉCLUZ, Rev. Zool., 1841: 373 (Island of Negros).
1841 *Neritina knorri* RÉCLUZ, Rev. Zool., 1841: 373 (Island of Mindanao).
1848 *Neritina iris* MOUSSON, Mitth. naturf. Ges. Zürich, 1: 269 (Java).
1849 *Neritina bruguieri* SOWERBY, Thes. Conch., 2: 512, pl. 114 fig. 159 (New Ireland).
1849 *Neritina sanguina* SOWERBY, Thes. Conch., 2: 513, pl. 114 fig. 162 (New Ireland).

Shell subglobose, back regularly rounded, front somewhat flattened, apex depressed, completely or only partly covered by the upper part of the last whorl. Ground colour brownish, with irregular pattern of black ornamentation. The specimens are normally covered with a black layer of mineral deposit. The shell is sculptured with very delicate spiral lines. — Aperture large, semicircular, parietal part greyish, septum brown, margin with 17-19 small teeth. Peristome not continuous, sharp without, somewhat thickened within, the upper insertion forming a pointed angle. — Operculum thick, calcareous, with basal nucleus; and with greyish and yellowish radiating rays crossed by the growth lines. The curved ridge and stumpy peg are not connected.

Size A 16-23.5 mm; D 22.5-29.5 mm.

Animal dark grey, with short, rounded tentacles; the eyes are placed in distinct sockets at their bases. Penial complex typical for the genus. — The central tooth of the radula is squarish; the first lateral is club-shaped and long, with an incision in the inner process and a ridge on the outer surface of the outer half, parallel to the margin. L_2 and L_3 are semicircular, the $L_{4/5}$ is hatchet-shaped, with a triangular plate and serrate handle. The lower margin of the handle shows 18 denticles. The marginals form together a carrot-shaped body. They are slowly decreasing in size towards the outer end; the shape of each single tooth is dagger-like, with the point somewhat curved.

Type locality Not designated. Type not in the Linnean collection.

Distribution Japan (? China), Formosa, Philippines and several Indopacific islands. In Thailand found in the Klong Glaeng Yai and Maenam Rayong in the province of Rayong, the first continental localities in SE Asia. Furthermore from Klong Som, Trad Province and from creeks near Grabi and from the Hin Lad Falls near Ang Tong, Ko Samui Island, Surat Thani Province.

Remark: *N. canalis* SOWERBY, 1832, from Tahiti is said to be this species. This author never found *N. pulligera* on Tahiti.

Neritina (Vittoida) BAKER, 1923.

Shell of medium size, ovoidal-conic. Septum rather narrow, serrate. Surface smooth except for the delicate microsculpture. Operculum semilunar, nucleus at the base; peg and ridge connected by a thick callus. Radula with serrate $L_{4/5}$ and marginals.

Type species: *Neritina variegata* LESSON.

Distribution: Indopacific coasts and islands in fresh and brackish water.

Only one species has been reported from Thailand. As the SMRL team never found *N. variegata* in Thailand and as no Thai material was found in any museum the report of this species from here is still doubtful.

Neritina (Vittoida) variegata LESSON, 1831.

- 1831 *Neritina variegata* LESSON in DUPERAY, Voy. Coquille, Zool., 2: 378 (Nouvelle Irlande).
1950 *Neritina variegata*, — SUVATTI, Fauna Thailand: 41 (Bandon; Pak Payun).

Shell ovoidal-conic, with small spire and large body whorl; smooth except for the delicate spiral microsculpture. Ground colour whitish or brownish; covered with a thick periderm with black variegation on yellowish, brownish or olive coloured ground. Septum narrow, smooth, white, generally with an orange-brown patch; edge delicately serrate, with 10-12 denticles of which the first and last are somewhat larger than the others. Operculum like that of the genus.

Size: A 18-23 mm; D 19-23 mm.

The radula has a simple, squarish rhachis; $L_{4/5}$ show a cutting edge with 15-18 cusps. All marginals have a serrate cutting edge.

Type locality: New Ireland.

Distribution From the Nicobar Islands to Tahiti and Japan. — Thailand: Bandon, Suratthani Province and Pak Payun (Tale Sap), Province of Pattalung, reported by SUVATTI.

Neritina (Vittoida) coromandeliana SOWERBY, 1832.

pl. 1 fig. 11.

- 1832 *Neritina coromandeliana* SOWERBY, Conch. Illustr.: fig. 52 (Coromandel).
1842 *Neritina serrulata* RÉCLUZ, Rev. zool., 1842: 76 (Sumatra).
1849 *Neritina ziczac*, — PHILIPPI, Abb. Besch., 127, pl. 1 fig. 10 [non *N. zigzag* LAMARCK, 1822] („Antillae“).
1850 *Neritina strigillata* RÉCLUZ, J. de Conch., 1: 151 (Sumatra).
1852 *Neritina triangularis* MÖRCH, Cat. Yoldi: 166 (Ind. or.).
1857 *Neritina pulcherrima* MOUSSON, J. de Conch., 6: 164 [syn. fide MARTENS] (Menado in insula Celebes).
1877 *Nertina ziczac*, — MARTENS, Conch. Cab., 2, 10: 101, pl. 10 fig. 20-24, pl. 2 fig. 6-7 (Indischer Archipel bis Polynesien) and *Neritina zigzag* of all authors [non LAMARCK] from the Far East.

Shell ovate-conoidal, with short, often eroded spire. Body whorl somewhat concave below the suture. Aperture large, oblique, semicircular, greyish within; septum grey, glossy, edge somewhat incised below the centre, with delicate dentition in the middle part (6-10 denticles). — Exterior surfaces of the operculum greyish, dirtyish-white or yellowish-brown, often with orange-coloured margin. Inner surface brownish-grey to orange. Peg broad and knob-like, ridge curved, narrow, smooth.

Size: A 20-24 mm; D 18-23 mm.

Type locality: Coromandel Coast, India. [Probably wrong.]

Distribution From Sumatra over Indonesia to Polynesia, the Philippines, and to Malayan Peninsula. In Thailand only known from Narativat Province.

As this species has often been confused with *N. zigzag* LAMARCK by later authors, the exact limits of its distribution can not be given. The occurrence in India is, inspite of the name, still doubtful.

Habitats in Thailand: A brackish water canal which connects a lagoon with the open sea. Estuarine area of small rivers.

***Neritina (Dostia)* GRAY, 1842.**

Type species *Neritina crepidularia* LAMARCK = *Nerita violacea* GMELIN.

This subgenus differs from *Neritina* s. str. by its cap-shaped shell and continuous peristome. In shape it looks more like *Neripteron* LESSON or *Septaria* FÉRUSAC than like *Neritina*. The irregularly rhomboid operculum of *Septaria*, however, renders it easy to separate that genus from *Dostia*.

The shell is shaped like a phrygian cap and is nearly symmetric. The aperture is wide, oval, the peristome connected. The real opening of the mouth is semicircular as half of it is closed by the septum, which is almost smooth without and carries minute denticles at its margin. — The operculum is semilunar, thick, calcareous, not translucent, glossy, bluish or reddish with bluish stripes particularly near the outer margin. It is paucispiral with almost basic nucleus. The curved ridge is simple without grooves, the peg is shorter than in *Neritina* s. str. and without a lateral callus.

For further description see under the type species of this subgenus. Most formerly recognized species of this group belong to one species and can not even be considered as races or local forms.

Distribution: S, SE and southern E Asia, Indonesia and several pacific islands, N Australia and Queensland.

***Neritina (Dostia) violacea* (GMELIN, 1790).**

pl. 1 fig. 12.

1790 *Nerita violacea* GMELIN, Syst. Nat., ed. 13: 3686 (no locality).

1822 *Neritina crepidularia* LAMARCK, Hist. nat. Anim. s. Vert., 6 (2): 186 (no locality).

1836 *Neritina cornucopia* BENSON, J. asiat. Soc. Bengal, 5: 748 (Bengal).

1836 *Neritina depressa* BENSON, J. asiat. Soc. Bengal, 5: 748 (Bengal).

1837 *Neritina melanostoma* TROSCHER, Arch. Naturgesch., 3: 179 (Bengalia).

1850 *Neritina exaltata* RÉCLUZ, J. de Conch., 1: 65, pl. 3 fig. 3 (l'île Negros).

1852 *Neritina tourannensis* EYDOUX & SOULEYET, Voy. Bonite, Zool., 2: 569, pl. 34 fig. 28-35 (Touranne).

1860 *Nertina melanostoma*, — MARTENS, Proc. zool. Soc. London, 1860: 14 (Siam).

1889 *N.[eritina] violacea*, — MORLET, J. de Conch., 37: 157 (de Bangkok à Chantabun).

1889 *N.[eritina] cornucopiae*, — MORLET, J. de Conch., 37: 158 (entre Kampot et Bangkok).

1950 *Neritina crepidularia*, — SUVATTI, Fauna Thailand: 40 (Thailand, several localities).

Shell of medium size for the family, cap-like, solid, nearly symmetrical, with very small, depressed spire and very large last whorl. The basic colour is a yellowish brown, but the shell is covered with a greyish-brown or blackish periostracum with irregular brown dots on the lower whorl of young specimens and with brown rays on the upper whorls. The sculpture consists of coarse growth lines and very feeble spiral striae. — Aperture very large but the entrance half closed by the septum, formed by the parietal and columellar part. The septum and the aperture within are either brownish-orange, brick-coloured or steel-coloured, rarely violet as the name suggests. The opening of the aperture is semicircular, the septum carries 9-12 small denticles.

Size A 19-23 mm (identical with the height of the aperture), D 25-28 mm; d 22-24 mm.

Type locality not designated.

Distribution Mangrove forests and nipa palm swamps on the coasts of S and SE Asia and several Indo-pacific islands. — Thailand: Common in above mentioned habitats at all coasts.

Neritiliinae THIELE, 1929.

Description of this monogeneric subfamily see below.

Neritilia MARTENS, 1879.

Shell very small, subglobose. Operculum either without apophysis or with a simple process which is not divided into peg and ridge. Radula without rhachis, L₁ without cutting edge.

Type species: *Neritina rubida* PEASE.

Distribution: Tropical belt.

Habitat: Fresh-water in lakes, creeks and rivers.

Neritilia rubida (PEASE, 1865).

pl. 1 fig. 13.

1865 *Neritina rubida* PEASE, Proc. zool. Soc. London, 1865: 514 (Tahiti).

1867 *Neritina rubida*, — PEASE, Amer. J. Conch., 3: 285, pl. 24 fig. 5 (Tahiti).

Shell small, obliquely subglobose, with 3 almost flat whorls which increase rapidly in size. Septum rather narrow, glossy, greyish; aperture semicircular, large; peristome sharp, edge of septum smooth. Operculum with a rather long, curved process which is not divided into peg and ridge.

Size: A 2.5 (2.2-3.5) mm; D 3.5 (-5.0) mm.

Type locality: Tahiti.

Distribution: Thailand: Tale Luang, Pattalung Province. Grabi Province, stream 3 km on the way to Khao Thong. — Extralimitarily known from Polynesia, New Guinea, Celebes, Java. Not yet reported from Sumatra and Malaya.

Mesogastropoda THIELE, 1929.

Base of the shell rarely siphonate, generally with operculum. Organs of right side of palliopericardial complex lost. Ctenidium monopectinate (pectinibranch), osphradium well developed, often pectinate. Nervous system more concentrated than in Archaeogastropoda. Only left kidney functional. Right kidney transformed into a genital duct. Generally with cephalic verge and internal fertilization. The radula generally consists of a central tooth (rhachis), 1 lateral and 2 marginals (taenioglossate). Heart with one auricle. With exception of few groups the Mesogastropoda are of separate sex. Most genera are marine, several are found in fresh and brackish water, some are terrestrial.

Distribution Cosmopolitan.

Key to the superfamilies:

- | | |
|---|----------------------|
| 1. Males — if present — without verge | 2 |
| — Males — if present — with verge | 3 |
| 2. Males without any intromittent organ | <i>Cerithiacea.</i> |
| — Males with secondary developed auxiliary intromittent organ | <i>Viviparacea.</i> |
| 3. A of shell always more than 15 mm | <i>Littorinacea.</i> |
| — A of shell always less than 15 mm | <i>Rissoacea.</i> |

Viviparacea GRAY, 1847.

Shell of medium size or large, globose, ovoidal-conic, rarely planorbid or pyramidal. Operculum always present, corneous or calcareous, always concentric. Males without primary verge.

Key to the families:

1. Shell generally larger than 40 mm; oviparous; operculum of Thai species nacreous, calcareous; with a pseudoverge at the pallial edge *Pilidae.*
2. Shell generally smaller than 40 mm; operculum not nacreous, corneous; right tentacles of males transformed into male intromittent organ; all species ovoviviparous *Viviparidae.*

Viviparidae GRAY, 1847.

Shell generally of medium size, only rarely rather large or comparatively small. Subglobose, ovate-conic or pyramidal, smooth or sculptured with spiral lines or ridges or tubercles. Many species show a very delicate spiral microsculpture. Embryonic whorls with spiral lines which often carry cutaneous chaetae. — Operculum corneous, rough without, inner surface glossy except for the dull muscle scar, concentric, with subcentral nucleus. — Animal with yellow or orange pigment spots. Tentacles short and pointed; right tentacles of the males transformed into a male copulatory organ. Mantle edge serrate. Foot large, with a food-groove in front. — Radula with squarish rhachis with 7 to 15 small cusps on the cutting edge. There are no basal cusps. Only *Mekongia* has marginals without a serrate cutting edge, in all other genera laterals and marginals have several cusps on their cutting edges. The jaw consists of two long and narrow plates. — The females are ovoviviparous with a uterin brood-pouch. Size and number of mature embryos may be of help to taxonomists.

Although the Indian and Burmese representatives of this family were comparatively well studied, the Thai species were neglected for a long time and when mentioned in the literature they were assigned to strange genera like *Bellamya*, *Sinotaia* or *Chlorostracia* if not simply placed in the genus *Viviparus* s. l. All species of Viviparidae found by the SMRL team in Thailand could be assigned to already known genera with few exceptions. All Thai genera can be defined conchyologically and by the radula and embryonic characteristics.

Distribution: Cosmopolitan with exception of South America.

Habitat: Fresh water of all kinds but many species prefer, or are restricted, to one habitat only.

Parasitology: As many of the species of Viviparidae are eaten by the local population and a high percentage of specimens were found to be infected

with metacercariae of Echinostomatidae representatives of this family serve as important intermediate hosts for human trematode infections.

Generic history of the family: The first SE Asian species of this family were described by LEA, MARTENS, FRAUENFELD, MORELET, MORLET, DESHAYES & JULLIEN and MABILLE & LE MESLE. All used *Paludina* as a generic name, only for the large *jullieni* DESHAYES, CROSSE & FISCHER established in 1876 the sub-generic name *Mekongia*. They overlooked the close relationship of *jullieni* with several other Paludinae already described. This subgenus is now recognized as a full genus. With exception of *Eyriesia* P. FISCHER 1885, no other generic or subgeneric name was established for any group of the very heterogeneous genus *Paludina* or as it was called later by the older name, *Vivipara* or *Viviparus* respectively, before 1901, when PILSBRY gave an own name to a local form of *P. dissimilis* O. F. MÜLLER. This species is therefore the type species of the well defined genus *Idiopoma* PILSBRY. Although most African and American Viviparidae had already received their own generic names in the last century, the Asian species were still generally assigned to *Paludina* or *Vivipara*.

In 1912 HANNIBAL named a group of Viviparidae, closely related to *Idiopoma*, *Cipangopaludina* of which *Lecythoconcha* ANNANDALE 1920 is a mere synonym. The remaining species were either assigned to the African genus *Bellamyia* or to *Sinotaia*, a genus established in 1938 by HAAS for a group of Chinese and Japanese species. In 1968 two species of Viviparidae, recently found in Thailand, were assigned to this genus by the present author and in the same year two genera were established for partly already known, partly new species. These were *Anulotaia* for *forcarti* BRANDT and *lagrandierei* BAVAY and *Siamopaludina* for *martensi* FRAUENFELD and *javanica* VON DEM BUSCH. In 1964 HABA had already created a new subgenus *Filopaludina* of *Sinotaia* for *bengalensis* LAMARCK. As *Siamopaludina* is very closely related to *Filopaludina*, the latter name is now considered as a genus and *Siamopaludina* as its subgenus. In this fauna, *Paludina trochoides* MARTENS was placed in an own genus, *Trochotaia*.

Since ROHRBACH (1937) pointed out constant anatomical differences from *Viviparus* s. str., all S, SE and E Asian species are now united with the African genus *Bellamyia* in the subfamily of Bellamyinae.

Literature PRASHAD 1828, ROHRBACH 1937.

Bellamyinae ROHRBACH, 1937.

All Thai genera of Viviparidae are placed in this subfamily.

Distribution Africa, S, SE, E Asia, Australia and Pacific islands.

Key to the Thai genera:

- | | | |
|---|-------|-----------------------|
| 1. Shell without colour bands | ..... | 2 |
| — Shell with colour bands | | <i>Filopaludina</i> . |
| 2. Shell subglobose or ovoidal | | 3 |
| — Shell depressed-conic | | 4 |
| 3. Shell generally with strong ridges, embryonic shell with peripheral keel | | 6 |
| — Shell smooth or with very weak ridges, embryonic shell rounded | | 5 |

4. Peripheral keel and shell without spiral ridges *Trochotaia*.
 — Keel with spiral peripheral ridge and two spiral ridges between keel and suture . . . *Eyriesia*.
5. Shell generally rather thin, embryonic shell with an obtuse carina; marginals with cusps *Idiopoma*.
 — Shell generally rather thick, embryonic shell without carina; marginals without cusps *Mekongia*.
6. Shell turreted, A more than 20 mm *Sinotaia*.
 — Shell subglobose, A less than 20 mm *Anulotaia*.

***Filopaludina* HABE, 1964.**

Shell of small to large size for the family, solid, with strong, greenish periderm and more or less strong brown spiral bands. The periderm may turn brownish or blackish.

Type species: *Vivipara bengalensis* LAMARCK.

Distribution S, E and SE Asia.

Two subgenera may be recognized:

1. Adult shell generally brownish or olive coloured; colour bands indistinct, restricted to the upper whorls only; spiral bands not raised on the upper whorls *Siamopaludina*.
 2. Adult shell greenish, bands strong, raised on the upper whorls *Filopaludina*.

***Filopaludina (Filopaludina)* s. str.**

Shell comparatively small, generally rather thin, with green periderm and strong brown colour bands which are profoliated on the upper whorls. Operculum thin, brownish, glossy on the inner surface, with low, roughened muscle-scar.

Distribution: S and SE Asia, Indonesia.

Literature: ANNANDALE & SEWELL 1921.

Key to the species:

1. Body whorl rounded or somewhat angled at the periphery only; umbilicus closed . . . 2
 — Body whorl shouldered between suture and periphery; umbilicus open *doliaris*.
 2. With two colour bands between suture and periphery *filosa*.
 — With four colour bands between suture and periphery *sumatrensis*.

F. polygramma (MARTENS) and *F. speciosa* (DESHAYES) belong as geographic races to the Indonesian species *F. sumatrensis* (DUNKER). *F. filosa* (REEVE) and *F. doliaris* (GOULD) which are found together in N Thailand, were both assigned under different names to the Indian species *F. bengalensis* (LAMARCK). As only one of the above named species can be a race of *bengalensis* and as both species are equally different from the Indian species *filosa* and *doliaris* are here treated as independent species.

***Filopaludina (Filopaludina) sumatrensis* (DUNKER, 1852).**

This species was first reported from Sumatra and later, often under different names, also from Java, Malaya, Indo-China and Thailand. Although the con-

tinental races seem to be very closely related to the Indonesian type form (particularly *s. speciosa*) it is more convenient to treat the continental forms under different names. There are intermediate forms between *polygramma* MARTENS and *speciosa* and between the type form and the continental races. Most studied populations from Malaya called *sumatrensis* were either *F. javanica* or *Taia polyzonata* FRAUENFELD, a species only recently introduced into Malaya and already widely distributed in that country. However, the genuine *sumatrensis* has been reported from Malaya by reliable sources and forms of this species have been found by the SMRL team in S Thailand, but we still hesitate to identify them with the typical form from Sumatra.

The shell of *F. sumatrensis* is typical for the genus. The shape is conoidal-ovate, with regularly increasing whorls. The microsculpture is much more delicate than that of *Siamopaludina*. In cases of doubt this makes the identification easy. The periderm is greenish, yellowish or brownish-olive, with strong brown or blackish spiral bands. There are at least four bands between the suture and the peripheral band. Often there are also bands on the lower half of the body whorl. The shell is more slender than that of *F. doliaris* (GOULD) and only young specimens may show a shoulder below the suture. A peripheral carina may be present.

Operculum thin, yellowish-brown, inner side glossy, with low, rough muscle scar.

Animal typical for the family, of bright grey colour with numerous orange pigment spots. — Rhachis with 9-11 cusps on the cutting edge. The outer marginals of *speciosa* carry 19-20 (like *sumatrensis* from Malaya), those of *polygramma* only 15-16 (like *filosa* and *bengalensis*).

Key to the Thai subspecies:

- | | |
|---|-----------------------|
| 1. Spiral bands only on the upper half of body whorl; periphery generally carinate, outer marginals with 19-20 cusps | 2 |
| — Spiral bands also on the lower half of body whorl; periphery generally not carinate, outer marginals with 15-16 cusps | <i>polygramma</i> . |
| 2. Spiral bands strong | <i>speciosa</i> . |
| — Spiral bands weak or missing | <i>peninsularis</i> . |

Filopaludina (Filopaludina) sumatrensis speciosa (DESHAYES, 1876).

pl. 1 fig. 14.

- 1876 *Paludina speciosa* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 142, pl. 6 fig. 17-18 (Cambodia: Peam Chelang).
- 1869 *Paludina sumatrensis*, — MORELET, J. de Conch., 17: 199 [partim, non DUNKER] (l'Indo-Chine).
- 1889 *Paludina bengalensis*, — MORLET, J. de Conch., 37: 150 [non LAMARCK] (Cambodia; Thailand).
- 1950 *Vivipara doliaris*, — SUVATTI, Fauna Thailand: 52 [partim, non GOULD] (Laem Sing).
- 1962 *Viviparus filosus*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 2 [partim, non REEVE] (Mahasarakam).

Shell conic, body whorl generally with peripheral carina, lower half of body whorl only rarely with spiral bands.

Size A 22-32 mm; D 17-24 mm.

Radula: Rhachis with 5 small cusps on either side of the larger middle cusp, rarely with 4 or 6 lateral cusps. Outer marginals with 19-24 cusps like the marginals of the type race.

Type locality Peam Chelang, Cambodia.

Distribution: Thailand: from the provinces of Kon Kaen, Kalasin, Mahasarakham, Roi Ert, Nakhon Phanom, Ubon, Buriram, Surin, Sri Saket, Chantaburi, Prachinburi and locally in the southern provinces of Nakhon Sritammarat, Patalung, Songkla, Yala, Patani, Narativat. Some populations from the latter provinces may already be attributed to the type race. — Extralimitarily: Central and S Laos; Cambodia, S Vietnam.

Habitat: This species is predominantly fluviatile but is also found in still water.

Filopaludina (Filopaludina) sumatrensis polygramma

(MARTENS, 1860).

pl. 1 fig. 15-16.

- 1860 *Paludina polygramma* MARTENS, Proc. zool. Soc. London, 28: 13 (Siam).
1863 *Paludina lineolata* REEVE, Conch. Icon., 14: pl. 9 fig. 50 [non FRAUENFELD, 1862 = *sumatrensis* DUNKER] (Siam).
1869 *Paludina sumatrensis*, — MORELET, J. de Conch., 17: 199 [partim, non DUNKER] (Cochinchina).
1907 *Vivipara lineolata*, — KOBELT, Conch. Cab., 1, 21a: 144, pl. 28 fig. 12-13 [non REEVE] (? Siam).
1950 *Vivipara bengalensis* [partim] and *V. doliaris* [partim], — SUVATTI, Fauna Thailand: 52 (Thailand, many localities).
1962 *Viviparus filosus*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 2 [partim, non REEVE] (Nontaburi).
1964 *Sinotaia (Filopaludina) bengalensis* (sic!) *filosa*, — HABE, Nature Life Southeast Asia, 3: 48, pl. 1 fig. 13-14 [non REEVE] (Bangkok).

This race is generally somewhat larger and more slender than *speciosa*. It is easily identified by having also the lower half of the body whorl banded. There are 4 or 5 bands between suture and periphery (*filosa* has only 2) and there is no subsutural shoulder. The periphery may be carinated but rarely so in completely adult specimens. This race differs from *speciosa* furthermore by having only 15-16 cusps on the cutting edge of the outer marginals, like *filosa* and *bengalensis*.

Size: A 20-34 mm; D 14-27 mm.

Type locality: "Siam", probably Bangkok.

Distribution: Thailand: Central and S Thailand. This species is not found north of a line from Tak to Nakhon Sawan and east of Korat. Locally found in the province of Nong Khai, Udorn and Kon Kaen. — Extralimitarily known from Rangoon and S Burma.

Parasitology: Several cercariae of unidentified trematodes have been obtained from both races of *sumatrensis*. As this species is eaten in certain areas and generally infected with metacercariae of Echinostomatidae it serves as an important intermediate host for representatives of that trematode family.

Filopaludina (Filopaludina) sumatrensis peninsularis n. subsp.

pl. 1 fig. 17.

Diagnosis: A subspecies of *F. sumatrensis* (DUNKER) which differs from the type race by its bright yellowish, glossy shell and the faintly coloured, profiled colour bands.

Description: Shell rather small for the subgenus, thin, but solid, transparent, yellowish-green, glossy, the apex dark violet, the postnuclear whorls brownish red. The 6 convex whorls increase evenly in size and are separated by a rather deep suture. All whorls show an obtuse subsutural shoulder and a carina on the periphery and several weak spiral ridges. The microsculpture consists of rather strong, wavy spiral lines which are regular on the upper and less densely set and irregular on the lower whorls. Umbilicus narrow but open. Colour bands are either completely missing or very weak; often the colour is restricted to the ridges only. — Operculum thin, reddish-brown. — Aperture oval, with a thin bluish-white callus behind the peristome. Peristome almost continuous, thin, black in adult specimens.

Size: A 23-27 mm; D 17-19 mm.

Radula: Rhachis with 4 cusps on either side of the broad middle cusp, L with the formula 3-1-3, inner marginals like the laterals, outer marginals with 19-20 cusps.

Type locality Bok Karani waterfall, Pang Nga Province.

Distribution: Known from few localities in S Thailand only.

Material: Holotype SMRL 245/A; paratypes 245/20. — SMRL 3152/2-Ban Puk in Nakon Sritammarat Province.

Filopaludina (Filopaludina) doliaris (GOULD, 1844).

pl. 1 fig. 18-19.

1844 *Paludina doliaris* GOULD, Proc. Boston Soc. nat. Hist., 1: 144 (Burma).

1869 *Paludina digona* BLANFORD, Proc. zool. Soc. London, 37: 445 (Iravadi).

1908 *Vivipara amandalei* (sic!) KOBELT, Conch. Cab., 1, 21a: 296, pl. 57 fig. 11-12 (South India).

1908 *Vivipara amandalei halophila* KOBELT, Conch. Cab., 1, 21a: 297, pl. 59 fig. 17-20 ("Salt Range").

1921 *Vivipara bengalensis* race *doliaris*, — ANNANDALE, Rec. Ind. Mus., 22: 273, pl. 1 fig. 9 (Iravadi, Siltang, Salwen).

1921 *Vivipara bengalensis* phase *amandalei*, — ANNANDALE, Rec. Ind. Mus., 22: 276, pl. 2 fig. 5-8 (Calcutta, Hyderabad).

1950 *Vivipara doliaris*, — SUVATTI, Fauna Thailand: 52 [partim] (? Chieng Mai).

This species differs from the races of the preceding species by its larger shell, thinner texture, more inflated body whorl, open umbilicus and subsutural shoulder.

The shell is of the type of *Filopaludina*, with regular, conic spire, greenish periderm and brown colour bands. The whorls are separated by a deep suture and more or less distinctly shouldered.

Even fully adult specimens of this species are thinner than those of *sumatrensis*, *filosa* and *bengalensis*. The colour bands are prominent on the post-nuclear whorls. There are normally two strong bands between the band on the

periphery and the suture and four thinner bands on the lower half of the body whorl around the narrow, but open umbilicus. Between the main bands there may sometimes be very thin accessory bands. The aperture is oval, the peristome is connected by a very thin, bluish-white callus. — Operculum thin, corneous, transparent, concentric, with subcentral, reddish-brown muscle scar.

Size A 28-34 mm; D 18-21 mm.

The animal is light greyish with dark grey pigment spots and dusted with many fine yellow pigment dots all over the body except the sole which is lead-coloured. The rostrum is trunc-shaped and gets darker towards the tapering front. The eyes are placed on distinct stalks about $\frac{1}{3}$ of the length of the tentacles. — The radula is similar to that of the other species of *Filopaludina*, the outer marginals, however, have only 11 cusps. Those of *bengalensis* have 16, those of *filosa* 15 and that of *s. polygramma* and *s. speciosa* have 15-24.

ANNANDALE & RAO had already placed *V. digona* BLANFORD in the synonymy of *F. doliaris* (GOULD). An examination of KOBELT's types of *annendalei* and *a. halophila* proved without doubt that KOBELT's species is nothing but an individual form of *doliaris*.

ANNANDALE & RAO considered this species to be a race of *F. bengalensis* (LAMARCK). *F. bengalensis* is not represented in Thailand. In a later monograph on the SE Asian Viviparidae the differences in the anatomy between *bengalensis* and *doliaris* will be dealt with in details.

Type locality: Burma; no exact locality designated.

Distribution: India (? S India; Bengal); Burma; N Thailand. In Thailand the species was found in the provinces of Mae Hongson, Chiang Mai and Lampang only. *F. doliaris* was reported by SUVATTI from many provinces of Thailand. Most of these reports refer to *F. (Siamopaludina) martensi* (FRAUENFELD) and its races.

Filopaludina (Filopaludina) filosa (REEVE, 1863).

pl. 1 fig. 20.

1863 *Paludina filosa* REEVE, Conch. Icon., 14: pl. 6 fig. 31 (no locality).

1869 *Paludina sumatrensis*, — MORELET, J. de Conch., 17: 199 [partim] (l'Indo-Chine).

1889 *Paludina bengalensis*, — MORLET, J. de Conch., 39: 235 [non LAMARCK] (Chiang Mai).

1909 *Vivipara bengalensis* var. *nepalensis* KOBELT, Conch. Cab., 1, 21a: 414, pl. 77 fig. 10 (Nepal: Chonebal).

1952 *Bellamyia filosa*, — HAAS, Bull. nat. Hist. Siam Soc., 15: 25 (Ping River at Wang Pratart Farm).

This species differs from the type species by its smaller size and more slender shape. It is still smaller than *F. s. polygramma* (MARTENS) and also considerably more slender. It never has more than two colour bands between periphery and suture, generally altogether four bands on the body whorl; sometimes there is a fifth around the base.

Size: A 20-28 mm; D 13-17 mm.

Animal like that of the subgenus; the foot, however, when completely stretched, is more slender than that of *sumatrensis* and *doliaris*. The ground colour is generally lighter than in any of the other species of this genus. — Radula: The rhachis is typical for the subgenus with 5 small cusps on either side of the

middle cusp of the cutting edge. The marginals have 15-16 cusps like *s. polygramma* and *bengalensis*.

Type locality not designated.

Distribution: In Thailand north of a line from Nakon Sawan to the Burmese border and west of the mountain range between Maenam Pasak and Maenam Nan. An isolated locality in the province of Ang Tong near Mahathai village has to be verified as it is situated in the area of distribution of *s. polygramma*. These two species are vicarious. This suggests a close relationship. The species is known from the Provinces of Nan, Prae, Chieng Rai, Lampang, Lampun, Nakon Sawan, Tak, Chieng Mai, Pitchit, Pitsanulok and Mae Hongson. Extralimitarily known from Burma, N Laos, Nepal and NE India.

This species was often confused with forms of *F. sumatrensis* (DUNKER) and most of its reports from SE Asia refer to that species.

***Filopaludina (Siamopaludina)* BRANDT, 1968.**

This subgenus differs from *Filopaludina* s. str. by its thicker and darker periderm, rugose microsculpture, not raised colour bands on the postnuclear whorls and by having few large embryos in the uterine brood pouch only. The colour bands may be missing completely.

Type species *Paludina martensi* FRAUENFELD.

Distribution: Burma, SE Asia, Java, Sumatra, Philippines, S China, ? Taiwan.

Key to the Thai species:

- | | |
|---|-------------------|
| 1. Upper whorls with 4 pale colour bands | 2 |
| — Upper whorls with 2 strong coloured spiral ridges | <i>maekoki</i> . |
| 2. Generally not larger than 32 mm, periderm thin, umbilicus open | <i>javanica</i> . |
| — Generally larger than 35 or 40 mm, periderm thick, umbilicus closed | <i>martensi</i> . |

***Filopaludina (Siamopaludina) javanica* (VON DEM BUSCH, 1844).**

pl. 2 fig. 21.

F. javanica whose typical form is known from Java, Sumatra and several other Indonesian islands is also reported from Malaysia, Thailand and Cambodia. Whilst some populations from Malaysia are almost identical with the typical race from Java those from Thailand and Indochina have to be separated from the type race as a well defined geographical race.

***Filopaludina (Siamopaludina) javanica continentalis* n. subsp.**

pl. 2 fig. 22.

1889 *Paludina javanica*, — MORLET, J. de Conch., 37: 150 (Sraeko). [non VON DEM BUSCH]

1904 *Paludina javanica*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 423 (Cochinchina). [non VON DEM BUSCH]

Diagnosis: A subspecies of *F. javanica* (VON DEM BUSCH) which differs from the typical race by showing feeble spiral colour bands on the postnuclear whorls (which are not raised like those in *Filopaludina* s. str.) and evenly rounded whorls without shoulder.

Description: Shell small or medium sized for the subgenus, solid, but not very thick, with thick, greenish, olive or brown periderm. Apex reddish-violet, the other whorls are generally ornate with 4 or 5 feeble, darker, spiral bands which may still be visible on the body whorl. Lower half of the body whorl either void of bands or with 2 to 4 bands. The 5 whorls increase evenly in size and are separated by a rather deep suture; they are well rounded and only rarely shouldered. The body whorl may show an obtuse carina; spiral ridges are missing, but the spiral microsculpture is very distinct particularly around the open umbilicus. Young specimens may show minute chaetae on these spiral lines, particularly near the aperture. There may be an obtuse carina around the umbilicus but this is never as sharp as that of the type subspecies. — Aperture ovate, slightly expanded, bluish-white within. Peristome almost continuous, not lipped, with blackish margin. — Operculum broadly ovate, thick, with almond-shaped, rough muscle scar, inner surface not glossy.

Size A 25-34 mm; D 18-27 mm.

Radula: Rhachis with 11, rarely with 9 cusps on the cutting edge, outer marginals with 15-16 cusps.

Type locality Bang Pra, Province of Chonburi.

Distribution Thailand: S, Central, E and SE Thailand, in the northern part of Central and E Thailand only locally. It has not been found north of a line from Nakhon Panom to Pitsanulok and Tak. Extralimitarily: S Laos, Cambodia, S Vietnam.

Material: Holotype SMRL 3138/A; paratypes 3138/500. — In the SMRL collection are several thousand specimens from 36 localities.

Filopaludina (Siamopaludina) martensi (FRAUENFELD, 1865).

This is a widely distributed rassenkreis which is known from Thailand (*martensi* s. str. and other races), Laos (*simonis* BAVAY) and Cambodia (*challanguensis* DESHAYES, *obscurata* DESHAYES, *vignesi* JULLIEN, *cambodiensis* MABILLE), Vietnam (*cochinchinensis* MORELET, *lurida* MORELET), Malaya (*penangensis* MARTENS, *perakensis* MARTENS, *kelantanensis* KOBELT) and Indonesia (*henrici* PRASHAD). It is found also in Tonkin and S China (*noetlingi* KOBELT) and although it has never been reported from Burma it will probably also occur there as the SMRL team collected it in the border river (Maenam Moei). A species so widely distributed and adapted to different kinds of habitats (lakes, pools, klongs, rivers and even mountain streams with fast current) is normally split into many races and forms. More than a dozen species described from SE Asia belong to this rassenkreis, partly as synonyms, partly as subspecies with well defined geographical distribution.

Although hundred years ago MORELET (1869: 192) pointed out that REEVE's *P. ingallsiana* refers to this species and not to LEA's *ingallsiana*, the name *ingallsiana* LEA was erroneously used for *F. martensi* even by most recent authors. *Paludina ingallsiana* LEA is a species of *Idiopoma*, and is based on a single juvenile specimen only.

F. martensi differs from *F. javanica* by its generally much larger size and closed umbilicus (small forms with open umbilicus are known). The texture is generally much thicker and the shell sculptured with distinct spiral ridges. The

operculum is very thick and not much retractable. The mature embryos are much larger than those of *F. javanica*.

Key to the subspecies from Thailand:

- | | |
|---|-----------------------|
| 1. Shell with weak spiral ridges or without | 2 |
| — Shell with strong spiral ridges | <i>martensi</i> . |
| 2. Shell brown, without colour bands . | <i>munensis</i> . |
| — Shell greenish, generally with bands | <i>cambodiensis</i> . |

Filopaludina (Siamopaludina) martensi martensi (FRAUENFELD, 1865).
pl. 2 fig. 23.

- 1860 *Paludina cingulata* MARTENS, Proc. zool. Soc. London, 28: 13 [non MATHERON, 1842] (Siam).
- 1863 *Paludina ingallsiana*, — REEVE, Conch. Icon., 14: pl. 7 fig. 39a, b [non LEA, 1856] ("Japan").
- 1865 *Paludina ingallsiana*, — MARTENS, Malak. Bl., 12: 145 [non LEA] (Bangkok, Petchaburi).
- 1865 *Paludina martensi* FRAUENFELD, Verh. zool. bot. Ges. Wien, 14: 588 [n. nom.] (Siam).
- 1865 *Paludina ingallsiana*, — FRAUENFELD, Verh. zool. bot. Ges. Wien, 14: 617 [non LEA] (Japan).
- 1869 *Paludina frauenfeldi* MORELET, J. de Conch., 17: 192 (Bangkok, Petchaburi).
- 1889 *Paludina chalanguensis*, — MORLET, J. de Conch., 37: 149 [partim] (Ayuthia).
- 1908 *Vivipara ingallsiana*, — KOBELT, Conch. Cab., 1, 21a: 201, pl. 41 fig. 3-6, 11-12 [non LEA, 1856] (Siam).
- 1908 *Vivipara martensiana*, — KOBELT, Conch. Cab., 1, 21a: 203, pl. 41 fig. 7-8 (Siam).
- 1908 *Vivipara martensiana* var. *costellata* KOBELT, Conch. Cab., 1, 21a: 204, pl. 41 fig. 9-10 (Salang).
- 1950 *Vivipara doliaris* [partim, non GOULD, 1844] and *V. martensi*, — SUVATTI, Fauna Thailand: 53 (Thailand: many localities).
- 1952 *Bellamya ingallsiana*, — HAAS, Nat. Hist. Bull. Siam Soc., 15 (1): 25 [non LEA, 1856] (Maenam Ping; Maenam Chao Praya).
- 1962 *Sinotaia ingallsiana*, — ITO & al., Jap. J. med. Sci. Biol., 15: 215 [non LEA, 1856] (Bangkok).
- 1964 *Sinotaia ingallsiana*, — HABE, Nature & Life Southeast Asia, 3: 45, pl. 1 fig. 12 [non LEA, 1856] (Bangkok).
- 1964 *Sinotaia ingallsiana abnormalis* HABE, Nature & Life Southeast Asia, 3: 46, pl. 1 fig. 20-21 (Bangkok).
- 1966 *Bellamya (Bellamya) ingallsiana*, — SOLEM, Spolia zool. Mus. haun., 24: 13 [non LEA, 1856] (Bangkok).

Shell large or at least of medium size, thick, solid, with olive-green periderm which turns brown or blackish with age. Protoconch generally eroded. It is smooth with exception of the delicate spiral lines and without colour bands. The first postnuclear whorls show a distinct spiral microsculpture and feeble colour bands which are not raised like in *Filopaludina* s. str. The body whorl is large, inflated, with more or less distinct spiral ridges but rarely with darker spiral bands. The microsculpture is distinct around the umbilical area and near the peristome. Umbilicus either completely closed or (rarely) somewhat open, never with a periomphalic carina. — Aperture large, broadly ovate, angled above, bluish-white within. Peristome connected by a milky-white callus,

moderately thick, somewhat expanded. — Operculum broad, very thick in adult specimens, consisting of several layers of corneous substance. Muscle scar broad, roughened, raised, the surrounding area often golden-yellowish.

Size A 31-52 mm; D 22-35 mm. — Specimens smaller than 35 mm are exceptions.

Animal grey with orange-coloured pigment spots, typical for the genus. Mature femals carry few (6-10) large embryos in the uterine brood-pouch; they measure up to 6 mm and show already $3\frac{1}{2}$ whorls. There are about 23-25 spiral lines; near the suture there may be very delicate accessory lines between the larger ones. The larger spiral lines carry chaetae. Periphery with a strong and sharp keel. — Radula: Rhachis with an average of 11 small cusps, the middle cusp is broader but not longer than the laterals cusps. L with the formula (3-4)-1-(3-4). M_1 with 7-8, M_2 with 13-14 cusps. M_1 without large middle cusp like *F. javana* and *Filopaludina* s. str.

Type locality "Siam", probably Bangkok or Petburi.

Distribution This race of *P. martensi* is found everywhere in Central and S Thailand from the Province of Chieng Mai to the Malayan border. North of Chieng Mai it is replaced by *F. maekoki* BRANDT and in the eastern and southeast provinces by other races. Extralimitarily it is known from Malaya as *kelantanensis*, *perakensis* KOBELT, and *penangensis* MARTENS, forms which are hardly different from this race.

Parasitology *F. m. martensi* has been found to harbour several kinds of cercariae and metacercariae of Echinostomatidae. As this species serves as local food, *F. martensi* is an important intermediate host for Echinostomiasis.

Filopaludina (Siamopaludina) martensi cambodjensis

(MABILLE & LE MESLE, 1866).

pl. 2 fig. 24.

1866 *Paludina cambodjensis* MABILLE & LE MESLE, J. de Conch., 14: 135, pl. 7 fig. 4 [juv.] (Moth-Kasa, Cambodia).

1866 *Paludina cochinchinensis* MORELET, Rev. Zool.: 166.

1875 *Paludina cochinchinensis*, — MORELET, Sér. Conch., 4: 299, pl. 14 fig. 3 (Stiengs).

1876 *Paludina chalanguensis* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 139, pl. 6 fig. 13-14 (Peam Chalang, Cambodia).

1876 *Paludina vignesi* JULLIEN in DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 138, pl. 6 fig. 16-17 (Ca C'ompung, Cambodia).

1884 *Paludina tiranti* MORLET, J. de Conch., 32: 394, pl. 12 fig. 3-3a (Campot; Sré Ombelle; Cambodia).

This well defined geographical race differs from the type race by its regularly increasing spire, well rounded whorls and lack of any spiral ridges. The body whorl is not inflated, the aperture hardly extended. Young specimens show the coloured spiral bands distinctly; old specimens may be of a unicoloured dark olive-brown.

Size: A 41-48 mm; D 25-32 mm.

Type locality: Moth Kasa, Cambodia.

Distribution: Thailand: in the provinces of Chantaburi, Trat and Prachinburi and in the southern parts of the provinces Buriram, Surin, Sri Saket and Ubon. Extralimitarily in Cambodia, S Laos and probably also in parts of S Vietnam. If *Paludina lurida* MORELET, of which no authentic material is known to the present author, proves to be identical with this race, the older name of MORELET has to replace the name of MABILLE & LE MESLE.

Filopaludina (Siamopaludina) martensi munensis n. subsp.

pl. 2 fig. 25.

Diagnosis: A race of *F. (S.) martensi* (FRAUENFELD) which differs from its nearest relative and neighbour, *m. cambodjensis* MABILLE & LE MESLE by its much thicker shell, chestnut brown periderm and the round aperture with a thick-lipped peristome.

Description: The shell is either completely void of spiral ridges or it shows a distinct spiral thread on the periphery. Even young specimens only rarely show traces of coloured spiral bands. The thread-like peripheral spiral ridge and the rounded aperture with the expanded lip are typical for this race. The race is much shorter than *m. cambodjensis* but of the same diameter and therefore looks much stouter.

Size A 28-37 mm; D 21-28 mm.

Type locality Mun River at Ban Tha Tum, Province of Surin, E Thailand.

Distribution Drainage of the Mun River and in the Kham River.

Material Holotype SMRL 50/A; paratypes 50/100 and in USNM, ZMH, TASC and SMF. — SMRL 2894/50-Maenam Kham at Tat Panom, Nakon Panom; 2896/40-Lam Chi River at Ban Fang Daeng, Roi Ett; 2898/50-Gud Pak Ko Nog, Ubon; 2905/5-Huai Dom Yai, Ubon; 2906/10-Ban Glaeng, Ubon; 2909/30-Ban Kog Sian, Ubon; 2616/30-Nang Pae, Ubon.

Filopaludina (Siamopaludina) maekoki (BRANDT, 1968).

pl. 2 fig. 26.

1968 *Siamopaludina maekoki* BRANDT, Arch. Moll., 98: 217, pl. 8 fig. 3, textfig. 3 (N Thailand: Chieng Mai, Mae Hongson, Chieng Rai, Nan).

This species differs from the type species by its very thin shell and operculum and by having generally only 3 raised coloured ridges on the shell. It is of rather large size for the genus, but of average size for the subgenus. The postnuclear whorls show 2 weak, not raised, colour bands which grow stronger and more deeply coloured on the following whorls. — The operculum differs from that of *F. martensi* by its thin texture.

Size A 29-34 mm; D 20-25 mm.

Animal typical for the genus with numerous orange pigment spots dusted all over the body. — Rhachis with 4-5 small cusps on either side of the middle cusp on the cutting edge. Laterals with the cusp formula 3-1-4, inner marginals 4-1-4, outer marginals with 21-22 small cusps. — The uterine brood-pouch contains on the average eight large embryonic shells. These are greatly keeled at the periphery and show many fine spiral lines of which the two largest carry chaetae.

Type locality: Ban Mae Chai, 2 km W of Fang.

Distribution: Known from the northernmost parts of the Thai provinces of Mae Hongson, Chieng Mai, Chieng Rai and Nan. Extralimitarily known from Burma. The author collected this species at Mandaley.

Habitat: The species lives in trenches, ponds, swamps with much vegetation and in rivers. It has not been found in mountain streams and creeks with strong current.

Relationship The species seems to connect *F. martensi* with the Indian "*Vivipara*" *crassispiralis* ANNANDALE which also belongs into this subgenus as it is closer related to *martensi* than to *doliaris* with which it was compared by the author.

Sinotaia HAAS, 1939.

Shell with greenish periderm, generally carinate and shouldered, often with spiral ridges. These are never coloured. Colour bands missing. Operculum thin. Animal typical for the subfamily.

Type species *Paludina quadrata* BENSON.

Distribution: Japan, China, Tonkin, Thailand and Laos.

The two endemic species from Thailand can be identified by the following characteristics:

1. Shell larger than 26 : 21 mm, spiral ridges obtuse *mandahlbarthi*.
2. Shell smaller than 26 : 20 mm, spiral ridges sharp *arturrolli*.

Sinotaia mandahlbarthi BRANDT, 1968.

pl. 2 fig. 27.

1968 *Sinotaia mandahlbarthi* BRANDT, Arch. Moll., 98: 218, pl. 8 fig. 4, textfig. 4 (Mekong and several Thai tributaries to the Mekong).

Shell rather solid or, when old, even thick; young specimens are subglobose conoidal, adult specimens are elongately conoidal. The apex is generally eroded, the 6½ whorls are hardly rounded; they are ornate with five strong but obtuse spiral ridges, one on the periphery, two between suture and periphery and two on the base. The umbilicus is either completely closed or only a narrow chink. Young specimens may show a weak carina around the umbilicus. Under strong magnification delicate, wavy spiral lines are visible. This spiral microsculpture is crossed by the fine growth lines. — Aperture milky-white within; peristome continuous, not lipped, appressed to the penultimate whorl. — Operculum much thinner than that of *Siamopaludina* but thicker than that of *Mekongia*.

Size: A 27-34 mm; D 21-27 mm.

Uterus of females with few (2 to 5) fully mature embryos and about 20 eggs. The embryos are sharply keeled. The yellow pigmentation of the animals is weak compared with that of *Siamopaludina*. — Rhachis with 9 cusps, outer marginals with 14 cusps.

Type locality: Huai Mae Un, a tributary to the Songkram River (a branch of the Mekong), N of Nakon Panom.

Distribution: Known from the Mekong between Sri Songkram and Tat Panom, from the Songkram River and its tributaries, from the Huai Tuai and Kham River in the Province of Nakon Panom.

The species is similar to *Sinotaia quadrata guangdungensis* (KOBELT), erroneously placed by YEN (1939) in the synonymy of *Taia polyzonata* (FRAUENFELD). It is possible that reports of *Taia polyzonata* from Laos and Tonkin refer to this species.

Sinotaia arturrolli BRANDT, 1968.

pl. 2 fig. 28.

1968 *Sinotaia arturrolli* BRANDT, Arch. Moll., 98: 220, pl. 8 fig. 5, textfig. 5 (Maenam Kham, S of Tat Panom, Thailand).

This species which lives together with the preceding species, is much smaller than *S. mandahlbarthi* and has much sharper spiral ridges. There are two strong spiral ridges between suture and peripheral ridge and generally three weaker ridges on the base of the body whorl. The microsculpture consists of delicate, wavy spiral lines. The narrow umbilicus is surrounded by a carina. — Peristome not continuous, connected by a bluish-white callus.

Size A 22-26 mm; D 16-19 mm.

The pigmentation of the animal is much stronger than that of the previous species. — The rhachis has 13-15 cusps, the outer marginals have only 9 to 10 cusps. — Uterus of the females with few embryos and eggs. Embryonic shell with a peripheral and two subsutural ridges.

Type locality Maenam Kham at Tat Panom.

Distribution: Mekong and some Thai branches as Huai Tuai, Maenam Kham and Maenam Songkram, all in Nakon Panom Province.

Anulotaia BRANDT, 1968.

This genus differs from *Sinotaia* HAAS by its subglobose shape and short spire. Three species are assigned to this genus, *A. forcarti* BRANDT as type species, *A. mekongensis* BRANDT and the Laotian *A. lagrandierei* (BAVAY) (pl. 2 fig. 29) which has not yet been found in Thailand.

Anulotaia forcarti BRANDT, 1968.

pl. 2 fig. 30.

1968 *Anulotaia forcarti* BRANDT, Arch. Moll., 98: 216, pl. 8 fig. 2, textfig. 2 (Maenam Mun, Thailand).

This species differs from the Laotian relative, *A. lagrandierei* (BAVAY) by its much smaller size and more subglobose shape.

Shell subglobose-conoidal, rather solid, with thick greenish periderm, sculptured with 6 strong spiral ridges and delicate spiral lines which are crossed by rather strong growth lines. Umbilicus open, surrounded by a distinct carina. Aperture large, dilated, bluish-white within. — Peristome not continuous, connected by a distinct callus, thick, but not lipped, somewhat expanded. — Operculum thin, but strong, with large, low muscle scar.

Size: A 14-19 mm; D 16-18 mm; d 11-14 mm.

Animal with fine orange and larger black pigment spots. The black spots are particularly strong on the tentacles and the rostrum. — Rhachis generally with 11 cusps. M₁ with 7, M₂ with 5 cusps (*lagrandierei* has 10 cusps on the outer marginals). — The uterus contains only a few eggs and embryos. The embryonic shell is obtusely keeled and shows two spiral ridges without chaetae between suture and keel.

Distribution: Known from the Maenam Mun in E Thailand only.

Type locality: Maenam Mun at Rasi Salai.

Anulotaia mekongensis BRANDT, 1970.

pl. 2 fig. 31.

1970 *Anulotaia mekongensis* BRANDT, Arch. Moll., 100: 183, pl. 13 fig. 1, textfig. 1 (Mekong and Sekong River at Stung Treng).

This species differs from the type species by its much larger size and from *A. lagrandierei* (BAVAY) by its thicker texture and more globose shape. Its spiral ridges are weaker.

Size: A 27-32 mm; D 24-28 mm.

The cutting edge of the radula has 9 cusps, that of *A. lagrandierei* 7, that of *A. forcarti* 11.

Type locality Mekong near Stung Treng in Cambodia.

Distribution: Mekong in Thailand, Laos and N Cambodia. Sekong River near Stung Treng.

In Thailand only a few dead shells were collected near Nakon Panom. These were much larger and thicker than the specimens from the type locality.

Trochotaia n. gen.

A genus of Viviparidae (Bellamyinae) which differs from all other genera of this subfamily by having a depressed pyramidal adult shell and an elongately conical embryonic shell like a *Basilissa*. The peripheral keel has no ridge like that of *Eyriesia*. There are no spiral ridges or colour bands.

Monotype *Paludina trochooides* MARTENS.

For further description and distribution see below.

Trochotaia trochooides (MARTENS, 1860).

pl. 2 fig. 32-33.

1860 *Paludina trochooides* MARTENS, Proc. zool. Soc. London, 28: 12 (Siam).

1863 *Paludina umbilicata*, — REEVE, Conch. Icon., 14: pl. 7 fig. 40 [non LEA] (Siam).

1865 *Paludina umbilicata*, — MARTENS, Malak. Bl., 12: 146 [non LEA] (Bangkok; Petchaburi).

1869 *Paludina trochooides*, — MORELET, J. de Conch., 17: 195 (Ayuthia).

1886 *Paludina trochooides*, — MORLET, J. de Conch., 34: 264 (Siam; Tonkin).

1889 *Paludina trochooides*, — MORLET, J. de Conch., 37: 151 (Siam; Cambodia).

1891 *Paludina trochooides*, — MORLET, J. de Conch., 39: 236 (Maenam Ping near Chieng Mai).

1908 *Vivipara trochooides*, — KOBELT, Conch. Cab., 1, 21a: 218, pl. 44 fig. 8-16 (Hinlap, Thailand).

1955 *Eyriesia* (?) *trochooides*, — ZILCH Arch. Moll., 84: 73.

1964 *Sinotaia umbilicata*, — HABE, Nature & Life SE Asia, 3: 47 [non LEA] (Bongkok).

This species is easily identified by its regularly pyramidal shape. Apex mammilate and like the postnuclear whorls violet, the remaining whorls greenish. The whorls are almost flat; suture bordered by a brownish zone. Body whorl with a more or less sharp keel but without any spiral ridges. Base flattened; umbilicus narrow or closed. — Aperture broad, oblique, bluish-white within. — Operculum thick, similar to that of *F. martensi*.

Size: A 20-31 mm; D 22-28 mm.

Radula: Rhachis with 13 cusps, outer marginals with 14-16 cusps. — Mature females carry only a few large embryos in the uterine brood pouch. The embryonic shells are very long and slender, with concave spire. This is a surprise as the adult shell is shorter than the shells of most species of this family. The embryonic shell has 4-5 whorls. There are 8 spiral lines on the 2nd and 3rd whorls and 13 on the 4th and 5th.

Type locality: "Siam"

Distribution: From Central Thailand in the S to Petburi Province and in the N to Tak and Chiang Mai. The species was not found in the neighbourhood of the Burmese border. Therefore it is doubtful that it lives in Burma. It is found in the NE, E and SE of Thailand and is reported from Tonkin and Cambodia. In Laos it has been found near Vientiane.

Eyriesia P. FISCHER, 1885.

Shell large, depressed, with strong peripheral keel and 1 or 2 spiral ridges between suture and periphery. For further details and distribution see below under the monotype.

Monotype *Paludina eyriesi* MORELET.

This genus is not congeneric with *Trochotaia*, a new taxon for *Paludina trochoides* MARTENS. It is larger, thinner, with thin operculum and with 1 or 2 distinct spiral ridges between suture and periphery.

Eyriesia eyriesi (MORELET, 1865).

pl. 2 fig. 34.

1865 *Paludina eyriesi* MORELET, J. de Conch., 13: 227 (Cochinchina).

1866 *Paludina eyriesi*, — MABILLE & LE MESLE, J. de Conch., 14: 136 (Battambang, Cambodge).

1866 *Paludina fischeriana* MABILLE & LE MESLE, J. de Conch., 14: 136, pl. 7 fig. 3 (Marais des parties sud de Grand Lac, à peu distance de Houdong, Cambodge).

1909 *Vivipara eyriesi*, — KOBELT, Conch. Cab., 1, 21a: 409, pl. 77 fig. 1-3 (in Waldsümpfen bei Battambang in Kambodscha).

1928 *Mekongia eyriesi* and *Dactylochlamys fischeriana*, — PRASHAD, Mem. Ind. Mus., 8: 174 (no localities).

Shell large, rather thin but solid, depressed-conical, with sharp peripheral keel and 1 or 2 spiral ridges between suture and periphery. The greenish periderm shows a delicate spiral microsculpture, particularly so on the base of the body whorl. — Aperture oblique, piriform, bluish-white within. Peristome rather thick, somewhat expanded, brown, continuous. — Operculum thin, small, corneous, brittle, copper-brown; external face glossy, internal face puckered. — Animal and soft parts unknown.

Size: A 21-31 mm; D 16-23 mm.

Type locality: Battambang in Cambodia.

Distribution In Cambodia south of the Tonle Sap between Battambang and Udong. A single specimen from the collection of JAECKEL is said to be collected by C. HONEUS in a swamp of elephant grass near Ban Bunaham (= ? Ban Bang Rakam) in the Thai province of Pitsanulok, near the River Yom. As this area is known as a focus of schistosomiasis in Thailand this team surveyed carefully the surrounding of

Bang Rakam but no *Eyriesia* was found. This, however, does not prove that *Eyriesia* does or did not live in that area, as the author had already screened carefully the surroundings of Battambang and Udong for *Eyriesia* without any success.

Idiopoma PILSBRY, 1901.

Shell ovoidal- or subglobose-conoidal, with violet, whitish or yellowish ground colour and greenish, yellowish or brownish periderm. The shell is either unicoloured or shows a brownish zone each above and below the periphery with the periphery being pale. There are no brown spiral bands, but the periderm is sculptured with minute spiral lines which often carry chaetae when in fresh condition. The umbilicus is more or less open and often surrounded by a distinct carina. — Old specimens show a blackish peristome. — The operculum is corneous, thin, transparent, with subcentral nucleus and low muscle scar.

The animal is very dark and dusted with orange pigment spots. The uterine brood-pouch of the females carries numerous embryonic shells and eggs in all stages of development. The embryonic shell is globose with an obtuse angle at the periphery. It is never keeled. The fine spiral lines do not carry chaetae, only the two main spiral lines. The shells may be completely void of chaetae. — The radula is typical for the family. The rhachis has 7-15, the outer marginals have 5-20 cusps.

Type species *Idiopoma benzadensis* PILSBRY = *Idiopoma dissimilis* (O. F. MÜLLER) forma.

Distribution: India, Ceylon, Burma, N Thailand, Cambodia, Laos and Vietnam; probably also S China.

All Thai forms of this genus can be assigned to three species:

- | | |
|---|---------------------|
| 1. Umbilicus closed or moderately opened, not surrounded by a strong carina, whorls very convex | <i>dissimilis.</i> |
| — Umbilicus funnel-shaped, surrounded by a carina and distinct spiral lines, whorls moderately convex . . . | . . . 2 |
| Shell smooth, not shouldered; marginals with 12-13 cusps | <i>ingallsiana.</i> |
| — Shell with spiral lines, shouldered; marginals with 5-7 cusps | <i>umbilicata.</i> |

Idiopoma umbilicata (LEA, 1856).

pl. 2 fig. 35.

- 1856 *Paludina umbilicata* LEA, Proc. Acad. nat. Sci. Philad., 8: 109 (Takrong River, Siam).
- 1863 *Paludina ciliata* REEVE, Conch. Icon., 14: pl. 6 fig. 36 (Siam).
- 1867 *Paludina umbilicata*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 117, pl. 22 fig. 8 (Siam, Takrong River).
- 1889 *Paludina ciliata*, — MORLET, J. de Conch., 37: 149 (Dei Crochon, Cambodia; Ayuthia and Sutrang River, Siam).
- 1891 *Paludina umbilicata* and *P. ciliata*, — MORLET, J. de Conch., 39: 236 (Maenam Ping, Chien Mai; Thailand).
- 1908 *Vivipara basicarinata* KOBELT, Conch. Cab., 1, 21a: 279, pl. 57 fig. 18-19 (Phuc-Son, Annam).
- 1908 *Vivipara subciliata* KOBELT, Conch. Cab., 1, 21a: 280, pl. 57 fig. 16-17 (Bangkok).
- 1962 *Sinotaia subciliata*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 4 (Bangkok).
- 1964 *Sinotaia ciliata basicarinata*, — HABE, Nature & Life SE Asia, 3: 47, pl. 1 fig. 25-26 (Bangkok).

Shell small or medium-sized, the type with a peripheral carina and a sub-sutural shoulder on the body whorl. Generally with a thick, dull periderm of greenish or brownish olive-colour and with distinct but fine spiral lines which may carry chaetae. This periderm may be worn. Umbilicus open, generally with a sharp carina. The spiral lines in the umbilical pit are distinct. Apex violet, the other whorls sometimes with a brownish zone and a brighter band at the periphery. — Peristome blackish. — Operculum thin, with low muscle scar.

Size: A 15-27 mm; D 11-19 mm.

The uterine brood pouch of mature females contains many small embryos. These have a rounded shell with a very obtuse carina at the periphery. — Rhachis with 13, outer marginals generally with 5-7 cusps.

Type locality: Takrong River near Korat (Nakon Ratchasima).

Distribution From Central Thailand to the Maekok River near Fang and Nan in the N and to Ubon and Udun Provinces near NE. It has not been found S of Ratburi Province. As it is known from the Thai-Burmese border river (Maenam Moei, Taungyin River between Mae Sot and Myawadi) and in the Maekok River, the species belongs also to the Burmese fauna. It is also reported from Cambodia and was found by this author at several localities in Laos.

This species forms several different races and forms of which *Vivipara basicarinata* KOBELT from Vietnam is the most different form. This race is not found in Thailand. In the province of Pitsanulok there lives a very slender form with shallow suture and less convex whorls.

Paludina ciliata REEVE is the form with strongly developed spiral lines and chaetae, *Vivipara subciliata* KOBELT is larger than the type, *V. basicarinata* is the largest.

Idiopoma ingallsiana (LEA, 1856).

pl. 2 fig. 36.

1856 *Paludina ingallsiana* LEA, Proc. Acad. nat. Sci. Philad., 8: 110 (Siam).

1867 *Paludina ingallsiana*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 117, pl. 22 fig. 8 (Siam).

1869 *Paludina ingallsiana*, — MORELET, J. de Conch., 17: 192 (Siam).

This species was based on a single specimen which is probably not even quite adult. The present author hesitated for a long time whether to place this species into the synonymy of *I. umbilicata* or to recognise it as a different species. Since it has now been found together with *umbilicata* at one locality and shows constant differences in shell and anatomy, there seems to be no doubt that this species which was collected again after more than a century by this author, deserves an own place within the genus.

The species differs from the preceding species by its smaller size, narrower umbilicus, weaker periomphalic keel and almost smooth surface. It shows either very delicate spiral lines without shoulders and chaetae or it is completely smooth. The whorls are less convex, the suture is therefore shallower. It is either olive-coloured or somewhat brownish.

Size: A 12-19 mm; D 8-13 mm.

Small and comparatively smooth specimens of *I. umbilicata* differ from similar specimens of *I. ingallsiana* by the number of cusps on the outer margin.

nals. This species has always 12-13 cusps, the outer marginals of *umbilicata* have 5-7. The rhachis of this species has only 11 cusps on the cutting edge.

Type locality "Siam"

Distribution Known from the provinces of Mae Hongson, Tak, Chieng Mai and Pitsanulok. Extralimarily known from Laos.

Idiopoma dissimilis (O. F. MÜLLER, 1774).

pl. 2 fig. 37-39.

- 1774 *Nerita dissimilis* O. F. MÜLLER, Verm. Hist., 2: 184 (no locality).
1837 *Paludina obtusa* TROSCHEL, Arch. Naturgesch., 1837: 173 (Bengal).
1847 *Paludina remosseii* PHILIPPI, Abb. Besch., 2: 134, pl. 2 fig. 3 (Maywar, Bengal).
1862 *Paludina variata* FRAUENFELD, Verh. zool.-bot. Ges. Wien, 12: 1163 (Pondicherry).
? 1863 *Paludina fulva* REEVE, Conch. Icon., 14: pl. 10 fig. 64 (Cambodia).
1863 *Paludina viridis* REEVE, Conch. Icon., 14: pl. 4 fig. 20 (no locality).
1865 *Paludina heliciformis* FRAUENFELD, Verh. zool.-bot. Ges. Wien, 15: 532, pl. 22 ("Central Africa").
1869 *Paludina decussatula* BLANFORD, Proc. zool. Soc. London, 1869: 445 (Pondicherry).
1884 *Paludina siamensis* var. *burmanica* NEVILL, Handlist, 2: 26 (Irawady).
1901 *Idiopoma benzadensis* PILSBRY, Proc. Acad. nat. Sci. Philad., 53: 188, pl. 5 fig. 1 (Henzada, Burma).
1908 *Vivipara variata pseudohelicina* KOBELT, Conch. Cab., 1, 21a: 293, pl. 59 fig. 5-8 (Pegu).
1909 *Vivipara variata peguensis* KOBELT, Conch. Cab., 1, 21a: 378, pl. 58 fig. 7-8 (Moulmein in Pegu).

This species differs from the preceding species by its larger average size (small forms, however, are not rare) and regularly rounded whorls. Only young shells may show traces of chaetae on the fine and irregular spiral lines. There is never any trace of a shoulder and fully adult specimens rarely show an obtuse angle at the periphery. Umbilicus either somewhat open or closed, never so far open as in *I. umbilicata*, either without or with a very weak carina. — Operculum thin, with low muscle scar.

Size: A 23(11)-35 mm; D 18(10)-26 mm.

The uterine brood pouch of the adult female contains many small embryonic shells which are subglobose and have only a very obtusely angled periphery. — The radula is very variable. The rhachis has generally 11 cusps and the outer marginals 16. There are populations in which the rhachis has 7 and such in which it has 13 cusps. The outer marginals may have up to 20 cusps but there are also populations in which they show only 13. No other group of Viviparidae shows such a broad variability of the number of cusps of its radula teeth.

Locustypicus: India.

Distribution: Ceylon; east part of India; Burma; N Laos; N Thailand. In Thailand the species is not found south of Mae Sot — Tak — Pitsanulok and not west of the province of Loei. The report from Cambodia is doubtful.

Although there is a large variety of forms on which the different synonyms are based, no real geographic races are acknowledgeable. *P. heliciformis* and

variata FRAUENFELD are slender forms, the type and *remosse* are rather broad. *P. burmanica* and *benzadensis* as well as *peguensis* are comparatively small and thin as these species are found in small ponds without much vegetation. All these forms are found in Thailand locally without any well defined borders of distribution which might suggest the development of geographical races.

***Cipangopaludina* HANNIBAL, 1912.**

Type species *Paludina malleata* REEVE, 1857.

This genus is so closely related to *Idiopoma* PILSBRY that it could be assigned to that genus as a subgenus. It differs by its larger shell, more inflated body whorl and by showing — normally — above and below the periphery of the body whorl no traces of brownish zones.

The shell is large, thin, ampulliform, with large, inflated body whorl and short, conic spire. The ground colour is whitish or bluish-white, rarely violet, the periderm is of olive-green which turns brownish or blackish with age. — The aperture is piriform, the peristome appressed to the penultimate whorl and mostly blackish. — The operculum is thin; it closes the shell completely but is retractable.

The radula is typical for the family. The rhachis of all examined species shows the cusps formula (4-6)-1-(4-6). There are 2 laterals as the inner marginal is nearly identical in shape and dentition with the lateral. The outer marginal has 9-16 cusps. — The uterus of the females contains several small embryos. The embryonic shell shows an obtuse angle on the periphery and numerous spiral lines. The stronger lines carry very delicate cutaneous chaetae.

The following species are assigned to this genus: *C. malleata* (REEVE, 1857) from Japan. *C. chinensis* (GRAY, 1834) with the subspecies *aubryana*, *fluminalis*, *longispira* HEUDE and *hainanensis* KOBELT from China and Tonkin (imported also into Malaya), *C. japonica* (MARTENS, 1860) from Japan, *C. laosiensis* (MORLET, 1892), *C. ampulliformis* (EYDOUX & SOULEYET, 1852) and *C. lecythoides* (BENSON, 1856) from the archipelago of Chusan. Several more species may belong to this genus. The Indian authors from THEOBALD to ANNANDALE reported *ampulliformis* from India and Burma and identified it with *lecythis* BENSON. If both species were identical, the name of BENSON would have to be replaced by the older name of EYDOUX & SOULEYET, but these two species are not conspecific. *C. ampulliformis*, first described from Touranne in Annam, is only known from Vietnam and S Laos. — Only one species is known from Thailand.

***Cipangopaludina annandalei* BRANDT, 1968.**

pl. 2 fig. 40.

1968 *Cipangopaludina annandalei* BRANDT, Arch. Moll., 97: 221, pl. 8 fig. 6 textfig. 6 (Province of Chieng Rai, Thailand).

Shell of medium size for the family and rather small for the genus; globosely conoidal, thin, of milkish-blue ground colour and with an olive-green periderm. This shows under strong magnification delicate wavy spiral lines. There are no

bands or brownish zones on the shell. The apex is always somewhat corroded and covered with a secondary layer of shell substance. The 4 whorls are less convex than those of *C. chinensis* (GRAY) and *C. malleata* (REEVE) and the shell is much smaller than that of all known other species of this genus. *C. chinensis* has a distinct carina around the umbilicus, here the umbilical pit is similar to that of *C. lecythis* (BENSON). This species, however, is also much larger than the Thai species and has a much more inflated body whorl. — The operculum of *C. annandalei* differs from that of the other species by being much darker, of a reddish-brown colour and by showing a distinct, well outlined muscle scar.

Size A 28-34 mm; D 24-28 mm.

The rhachis has 4 small cusps on either side of the middle cusp on the cutting edge. *C. malleata* has 6 cusps on either side. *C. lecythis* has 12, *malleata* only 9 cusps on the cutting edge of the outer marginals, this species has 16.

Type locality Maekok River near Chieng Rai.

Distribution: Known from the locus typicus and from the Maenam On at Ban Pong near Ngao only.

Mekongia CROSSE & FISCHER, 1876.

Shell subglobose, ovoidal-conic or somewhat turreted, solid or very thick, young specimens, however, thin and fragile. The ground colour is of a dirtyish-white, with a broad violet zone around the periphery. Several species show a dark violet apex. The surface is either smooth or sculptured with some obtuse spiral ridges. The spiral microsculpture is restricted to the periderm only. This is green, yellowish or olive-coloured. — Operculum brownish, corneous, diaphanous, concentric, with low muscle scar.

The animal is greyish or sand-coloured, with numerous yellow or orange pigment spots and generally with blackish pigmentation on back and head. — The uterine brood-pouch of the female contains, when mature, few large embryonic shells and several small embryos and eggs in all stages of development. The embryonic shell is subglobose, without a keel around the periphery. It is sculptured with fine spiral lines with or without chaetae. Only the embryonic shell of the type species shows a very obtuse carina around the periphery. — The radula differs from those of all other species of the family by having outer marginals without any cusps. Normally also the inner marginals have a smooth, pointed cutting edge.

Type species: *Paludina jullieni* DESHAYES.

Distribution Petburi River; Mae Klong River and tributaries; Prachinburi River (= Klong Pra Satung, Klong Sraeko, Klong Pra Phrong, Maenam Bang Prakong); Chao Praya River and tributaries; drainage of Mekong and of the Tale Sap Lake and Red River in Tonkin (fide MORLET).

This genus was established by CROSSE & FISCHER as a monotypical subgenus of *Paludina* for *P. jullieni* DESHAYES. The other species described in that paper, which are now also assigned to this genus, were not recognized as congeneric with *jullieni*.

In 1889 MABILLE described several species from the Petburi River in Thailand, he created for them a genus *Chlorostracia* and placed this genus into the family of Melaniidae near *Paludomus*. Although MORLET (1892: 326) already suggested the

relationship with *Paludina* and FISCHER & DAUTZENBERG (1904: 422) had placed *Chlorostracia* as a separate genus in the family of Paludinidae (Viviparidae), later authors (THIELE, WENZ) still recognized this genus as thiarid until ZILCH (1955: 73) eventually corrected that mistake. ZILCH, however, considered *Glaucostracia* ANCEY from New Guinea synonymous with *Chlorostracia* and placed, therefore, *G. paulucciana* TAPPARONE-CANEFRI in this genus. The distribution of *Chlorostracia* is restricted to SE Asia and is not to be expected on New Guinea. *Glaucostracia* has therefore to be recognized as a separate genus.

In the description of the genus *Chlorostracia* MABILLE wrote: “ *Chlorostracia* comprend quelques coquilles . . . recueillies . . . dans les eaux douces des environs de Phetschaburi, ” For his first species, however, *bocourti*, he gave as a habitat: “Vit dans les eaux plus ou moins saumâtres des environs de Phetschaburi” Both other species, *jousseaumi* and *bourguignati*, are said to live together with *bocourti*. No *Mekongia* (and no SE Asian Viviparidae) lives in more or less brackish water and no *Mekongia* has ever been found in still water. The species of the genus *Mekongia* are exclusively fluviatile and are found, with exception of the Tale Sap, in rivers only. They never go into brackish water of the estuarine area. Dead shells, however, may be found on sand banks near the estuary. No species similar to the type specimens of MABILLE's species of *Chlorostracia* in Paris have ever been found by this team.

All Thai species of *Mekongia* show a green or yellowish periderm, that of *jullieni* and *turbinata* is of a dark olive-colour. All *Mekongia* species with exception of *jullieni* have a round embryonic shell without any trace of keel or carina and the spiral microsculpture is of equal strength on all three embryonic whorls. The embryonic shells of *jullieni* have an obtuse carina around the periphery, and the spiral lines are very weak or obsolete on the first two whorls, but strong on the third. There are also few stronger spiral lines between suture and periphery and the whole embryonic shell is of reddish-brown, not of vitreous colour. The embryonic shell of *jullieni* and *turbinata* are much larger in comparison to the size of the adult shell than those of the other *Mekongia* species. But unless other anatomical data justify a separation, the splitting of this taxon would be based on characteristics of the embryonic shell only.

The first two species of Asian Viviparidae which are now assigned to the genus *Mekongia*, were described by ISAAC LEA in 1856 and figured in 1867: *swainsoni* and *hainesiana*. For both species LEA gave “Siam” as type locality. *M. swainsoni* was collected by T. R. INGALLS, *hainesiana* by S. R. HOUSE, two American missionaries. HOUSE has travelled in Thailand from Bangkok over Korat (now Ratchasima) to the Mekong and had collected in the area of Nakhon Phanom. There is no proof that INGALLS had ever visited the Mekong valley. Therefore *swainsoni* originates either from the Chao Praya or MaeKlong River. Specimens which are completely identical with paratypes in Washington¹⁾, have been found in the surrounding of Bangkok. Among tenths of specimens, no specimen with the shape of *hainesiana* has been found in the Chao Praya drainage. It may therefore be assumed that *hainesiana* originates from the Mekong drainage as many species collected by HOUSE and described by LEA came from E Thailand.

¹⁾ The holotype has disappeared several decades ago.

The third species of this genus was described by FRAUENFELD (1865) as *Paludina siamensis*. Synonymous to this species is *V moreleti fruhstorferi* KOBELT published in 1908. DESHAYES' *Paludina frauenfeldi*, renamed by CROSSE & FISCHER *P. rattei* as the name was preoccupied by *P. frauenfeldi* MORELET (= *Siamopaludina martensi* FRAUENFELD), seems to be closely related to *M. hainensis* (LEA). In the same publication (dated 1874 but issued in 1876) DESHAYES described five other species of *Mekongia*: *jullieni*, *turbinata*, *moreleti*, *lamarcki* and *sphaericula*. *M. braueri* (KOBELT 1908) is the natural type of *M. swainsoni* from the Maeklong and Chao Praya but this species has to carry the older name of LEA although *swainsoni* is only an individual form. *M. kmeriana* (MORLET, 1890) is restricted to Cambodia and the Prachin River in Thailand.

Key to the species of *Mekongia* from Thailand:

- | | |
|---|----------------------------|
| 1. Apical whorls dark violet | 2 |
| — Apical whorls not violet | 3 |
| 2. Adult shell not larger than 20 mm | <i>pongensis</i> . |
| — Adult shell larger than 25 mm . | 6 |
| 3. Shell moderately solid, greenish | 5 |
| — Shell extremely thick, yellowish or gray | 4 |
| 4. Shell smaller than 30 mm (Maeklong) | <i>siamensis</i> . |
| — Shell larger than 30 mm (Mekong) | <i>swainsoni flavida</i> . |
| 5. Shell subglobose, umbilicus closed | <i>swainsoni</i> . |
| — Shell ovate-conoidal, umbilicus open | .. <i>rattei</i> . |
| 6. Last whorl twice as high as penultimate whorl; shell elongate | <i>lamarcki</i> . |
| — Last whorl three times as high as penultimate whorl; shell subglobose | <i>sphaericula</i> . |

Mekongia siamensis (FRAUENFELD, 1865).

pl. 3 fig. 41.

- 1865 *Paludina siamensis* FRAUENFELD, Verh. zool.-bot. Ges. Wien, 15: 531, pl. 22 (Siam).
 1908 *Vivipara moreleti fruhstorferi* KOBELT, Conch. Cab., 1, 21a: 211, pl. 43 fig. 5-8 (Ost-Siam).
 1950 *Vivipara siamensis*, — SUVATTI, Fauna Thailand: 54 (Siam).
 1955 *Mekongia moreleti fruhstorferi*, — ZILCH, Arch. Moll., 84: 73, pl. 5 fig. 41 (W-Siam: „Mekong“ = Maeklong).
 1966 *Bellamyia (Mekongia) moreleti fruhstorferi*, — SOLEM, Spolia zool. Mus. haun., 24: 14 (Maenam Kwae Noi).

Shell extremely thick when adult but thin when young, subglobose with depressed spire but pointed apex. Whorls rather convex, suture deep, apex only sometimes violet. Umbilicus narrow but open; aperture large, somewhat expanded; peristome thick but not lipped. — Operculum thin, corneous.

Size A 11-28 mm; D 10-25 mm; d 7-20 mm.

Animal typical for the genus. — Rhachis with 11, sometimes 9 or rarely 7 cusps; laterals hardly different from the rhachis, outer marginals without cusps.

Terra typica: Siam (for *fruhstorferi*: Maeklong River).

Distribution: Known from the Maeklong River between Ban Pong and Kanchanaburi and from one of its tributaries, the Maenam Kwae Noi only. All reports from other rivers refer to one of the following species.

Mekongia pongensis BRANDT, 1968.

pl. 3 fig. 42.

1968 *Mekongia pongensis* BRANDT, Arch. Moll., 98: 214, pl. 8 fig. 1, text-fig. 1 (Drainage of the Mun River and few other tributaries of the Mekong).

This species differs from *M. siamensis* by its smaller average size, thinner texture, malleated surface and violet-bordered suture. — Rhachis with 7 cusps.

Size: A 17.2-22.3 mm; D 16.1-19.4 mm.

Type locality: Lam Pan (Maenam Pao) at Kalasin.

Distribution: Drainage system of the Mun River; Maenam Yom; Maenam Kwae Noi at Nakon Thai; Maenam Pong; Huai Dom Yai and Mekong River.

The Rassenkreis of *Mekongia swainsoni* (LEA).

Among a small number of molluscs from Thailand LEA also described two Viviparidae which belong to this genus (1856: 109, 110). Of several other species he gave more or less exact type localities, of these, however, only "Siam" *M. hainesiana* (LEA) was received from the American missionary HOUSE, *M. swainsoni* from the physician INGALLS. HOUSE and INGALLS provided LEA with mollusks from Thailand which they partly collected themselves, partly got from other sources. The type of *swainsoni*, which was figured eleven years later as *swainsoniana* is lost but figure and description are good enough to assume that LEA's species is a subglobose form with short spire of a species widely distributed in Thailand. There is no proof that INGALLS ever visited the Mekong, therefore the type locality has to be somewhere in Central Thailand. HOUSE, however, had seen the Mekong and collected around Lakhone (today: Nakon Panom). As such slender forms of *Mekongia* like *hainesiana* are exceptionally rare in the Chao Praya and as slender forms in the Maeklong hardly attain the size of 32 : 22 mm, it has to be assumed that *hainesiana* LEA originates from the Mekong drainage. In Thailand proper no forms identical with LEA's type have been found but in some provinces of Cambodia which at times belonged to Siam, such forms are not rare. Until this assumption is proved wrong we are not going to apply this name to any Thai form.

Under the taxon *M. swainsoni* (LEA) we unite a group of forms which have the following characteristics in common: ground colour white with a broad brownish or flesh-coloured zone which leaves white only a small zone below the suture and the umbilical area. The shell is covered with a thick greenish periderm which turns brown with age. The apex is flesh-coloured or white, rarely of a pallid violet-brown. — Operculum like that of the genus, but distinctly chestnut-brown. — The rhachis has a rather straight, not triangular, cutting edge with generally 6-7 small cusps on either side of the middle cusp. The rhachis of *M. sphaericula* has a triangular cutting edge with an average of 4 cusps on either side, that of *M. pongensis* has 3 only and *M. siamensis* 4-5. Races of this species are known from several river systems, Petburi River, Maeklong, Chao Praya and its drainage, Bang Prakong (Prachin) River, Satung River and from the Mekong and several of its tributaries. From all rivers, the forms — most of them already described as species — differ sufficiently to justify separated geographic races.

The typical form of *M. swainsoni* (LEA) is subglobose with a short, conic spire. It is found in the Maeklong and in the Ping River. The predominant form of the Chao Praya, Nan and Pasak River is *M. s. braueri* (KOBELT), but both forms are found at several places together and are connected by intermediate forms; thus the latter may be considered a synonym only. Small specimens may look quite different from middle sized shells. Exceptionally large specimens such as are known from several rivers in the province of Pitsanulok, look similar to certain large forms from the Mekong drainage. The form from the Petburi River is slightly different from the type form but this difference does not justify a subspecific separation. At several localities in the Mae Klong River not only *swainsoni* and *braueri* forms are found together, but also very slender forms similar to *hainesiana*, only their body whorls are not as high as that of LEA's type (pl. 3 fig. 46).

A small form from the Prachin River seems to be completely identical with MORLET's *P. kmeriana* from Cambodia. The large form of this Rassenkreis originates from the Mekong and its tributaries but there are also populations of small size found locally in the area of the Mekong. The name *M. rattei*, either as a separate species or as a race of *swainsoni* should be applied to that form. *M. rattei elongata* from Cambodia is a very slender form of this race and may be identical with *hainesiana* LEA. This will be discussed in a later paper on the findings of the author in Laos and Cambodia. Although it is sometimes difficult to tell them apart, the two groups of *lamarckei* and *sphaericula-moreleti* cannot be assigned to this Rassenkreis.

Reports from Tonkin and N Laos have to be confirmed.

***Mekongia swainsoni swainsoni* (LEA, 1856).**

pl. 3 fig. 44-45.

- 1856 *Paludina swainsoni* LEA, Proc. Acad. nat. Sci. Philad., 8: 110 (Siam).
 1863 *Paludina hainesiana*, — REEVE, Conch. Icon., 14: pl. 8 fig. 4 [non LEA, 1856] (Siam).
 1867 *Paludina swainsonianana* LEA, J. Acad. nat. Sci. Philad., (2) 6: 116, pl. 22 fig. 7 (Siam).
 1891 *Paludina siamensis*, — MORLET, J. de Conch., 39: 236 [non FRAUENFELD] (Maenam Ping).
 1891 *Paludina moreleti*, — MORLET, J. de Conch., 39: 236 [non DESHAYES] (Xieng-Moi).
 1908 *Vivipara swainsonianana*, — KOBELT, Conch. Cab., 1, 21a: 212, pl. 43 fig. 13-14 (Siam).
 1950 *Vivipara* (near *hainesiana*), — SUVATTI, Fauna Thailand: 52 (Ratburi; Pak Chong; Pasak River).
 1952 *Bellamyia siamensis*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 25 [non FRAUENFELD] (Ping River).

Shell of medium size for the genus, subglobose with more or less elevated spire, rather solid, with dark greenish periderm; whorls rather convex, apex without periderm, whitish or flesh-coloured. Umbilicus narrow but distinct. — Operculum chestnut-brown. — Rhachis with 7-9 cusps.

Size A 22-35 mm; D 20-28 mm. Specimens with a height of more than 28 mm are rare and are only found locally.

The lost holotype of LEA was an exceptionally short specimen. To judge from the figure, the spire must have been deeply eroded. Specimens which look

exactly like LEA's figure are not rare; they are found among almost all populations just as is a form which approaches *M. hainesiana*. The biological type, however, is the form, described much later by KOBELT as *braueri*. This differs from the type form by its higher spire and more dilated aperture.

Type locality „Siam“ It is not quite sure whether this species was collected by INGALLS or by HOUSE and handed over through INGALLS to LEA. INGALLS has never, as far as we found out, visited the Mekong basin. It has therefore to be assumed that this species originates from the drainage of the Chao Praya River. An exact type locality will later be designated after the travels of INGALLS have been studied more carefully.

Distribution Petburi River in Petburi Province; Chao Praya and several klongs around Bangkok and Thonburi; Maenam Ping between Tak and Nakon Sawan; Maenam Nan between Uttaradit and Nakon Sawan; Maenam Pasak N of Saraburi, and several small tributaries of these rivers.

Mekongia swainsoni braueri (KOBELT, 1908).

pl. 3 fig. 43, 47-48.

1908 *Vivipari* (sic) *braueri* KOBELT, Conch. Cab., 1, 21a: 214, pl. 43 fig. 15-16 (Siam).

This race differs from the typical race by its more elevated spire. The shape of the shell is therefore more ovate-conoidal. — Animal and anatomy do not differ from those of the typical race.

Size: A 27-31 mm; D 19-22 mm. — Exceptionally large specimens may measure 36 : 26 mm and with this size reach that of the larger forms of the Mekong drainage.

Type locality: „Siam“, probably lower reaches of the Mae Klong River at Ratburi as KOBELT described in the same issue of the MARTINI-CHEMNITZ *M. siamensis* (FRAUENFELD) again under a new name. *M. siamensis* is restricted to the upper and middle reaches of the Mae Klong and its tributaries and was received by KOBELT from the same source.

As among populations of *M. s. swainsoni* a percentage of specimens looks like *s. braueri* and as among populations of *s. braueri* many specimens with a very short spire are found, it would be advisable to unite these two races with a revised description. The predominant form is the latter. Among populations of this race, turreted specimens, similar to *M. hainesiana* were found.

Mekongia swainsoni kmeriana (MORLET, 1890).

pl. 3 fig. 49.

1889 *Paludomus conicus* MORLET, J. de Conch., 37: 1 [non GRAY] (Prec-Thenot à Compong Toul).

1890 *Paludina kmeriana* MORLET, J. de Conch., 38: 119 (Compong-Toul, dans le Prec Thenot; Cambodia).

This race differs from the type and the forms from the Mekong by its small size and shape which resembles a hazel-nut but there are also specimens in the populations which look like very small specimens of the type form .

Size: A 14-22 mm; D 10-17 mm.

Radula: The rhachis has only 13, the lateral 5 cusps.

Type locality Compong-Toul, dans le Prec Thenot, Cambodia.

Distribution: Cambodia and E Thailand in the Prachin River near Kabinburi.

Mekongia swainsoni flavida n. subsp.

pl. 3 fig. 50.

A new subspecies which differs from its downstream neighbour, *M. rattei* (CROSSE & FISCHER) by its subglobose shape with very small and depressed spire, large inflated body whorl and yellow periderm. — Operculum typical for the species.

Size A 32-37 mm; D 25-29 mm.

Radula with squarish rhachis. Cutting edge of the rhachis straight, generally with a long mesocone on the upper and lower and a small mesocone on the middle rows; there are 7-11 cusps on either side of it. The formula of the lateral is (2-4)-1-(4-7), the inner marginal has generally 5, the outer marginal no cusps.

Type locality Mekong at Ban Nong Saeng, 3 km N of Nakon Panom, E Thailand.

Distribution Mekong between Ban Lao Luang in the Sege District and Nakon Panom in the province of the same name.

Material: Holotype SMRL 151/A, paratypes 151/100. — SMRL 3173/20-Mekong at Ban Bao Luang; 3180/20-Mekong at Nakon Panom.

It is even possible that this form deserves specific rank as it is sharply outlined against the neighbouring small form of *rattei* as it is found opposite Nakon Panom at Takek on the Laotian side of the river.

Mekongia rattei (CROSSE & FISCHER, 1876).

pl. 3 fig. 51-52.

1876 *Paludina frauenfeldi* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 134, pl. 7 fig. 23-24 [non MORELET, 1869] (Mekong, Cambodia).

1876 *Paludina rattei* CROSSE & FISCHER, J. de Conch., 24: 317 (Stung Chinit, Cambodia).

1889 *Paludina rattei*, — MORLET, J. de Conch., 37: 150 (Pnom Penh; Pum Po-Bong; Cambodia).

1904 *Paludina rattei*, — FISCHER & DAUTZENBERG, Miss. Pavie Indo-Chine, 3: 4242 (Tonle Sap; Saigon; Chu; Vietnam).

This species is generally much larger than that from the Chao Praya and Maeklong although individually large specimens from the Nan River and its tributaries may attain the size of this species. — The young specimens of *rattei* look similar to adult specimens of the slender form of the type subspecies.

The spire is more or less conic, generally deeply eroded. The body whorl is large and inflated, sometimes somewhat flattened at the periphery and with a deep, canaliculated suture. The colour of the periderm is green but turns brownish with age. The aperture is milkish-blue within, the peristome sharp. The apex is normally dirtyish-white or flesh-coloured but at some localities there may be specimens with violet nuclear whorls similar to that of the following species.

Size: A 32-39 mm; D 24-28 mm.

The animal is typical for the species. — The rhachis with generally 7-9 small cusps on either side of the mesocone on the cutting edge and bright apex are the easiest characteristics for identification, but there are sometimes specimens with a tinted apex.

Terra typica: Cambodia, in the Mekong River, probably from Kas-Lo Nghieu island.

Distribution: Mekong from Nakon Panom to Kratie and several tributaries.

Mekongia lamarcki (DESHAYES, 1876).

1876 *Paludina lamarckii* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 134, pl. 7 fig. 25-26 (Île "Ca-Lgniou" = Kas-Lo Nghieu island).

1876 *Paludina hainesiana* var. B, — CROSSE & FISCHER, J. de Conch., 24: 317 (Île Ca-Lniou).

1904 *Paludina hainesiana*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 423 [partim].

The adult shell is rather solid and ovoidal conical, the young shell, however, is thin and subglobose. The apex is dark violet and the postnuclear whorls have a violet-bordered suture. The suture is deep, the apex more pointed than that of the preceding species. The surface is sculptured with delicate spiral lines on the bright green periderm and corser irregular spiral lines on the body whorl, often the last two whorls are malleated like those of *M. pongensis*. The operculum differs from those of *M. swainsoni* and *M. sphaericula* by being rounder and of straw colour like that of *M. pongensis* and *M. siamensis*.

Size A 28-40 mm; D 22-27 mm.

Rhachis with 7-9 cusps.

Type locality: Kas-Lo Nghieu island in the Mekong River in Cambodia.

Distribution: Mekong between Nakon Panom and Kratie and several tributaries in Thailand, Laos and Cambodia.

The specimens from Thailand and Laos never attain the size of those from Cambodia. It seems that the small populations live upstream and the larger in the south. At Nakon Panom and Tat Panom, this species was found together with populations of *M. sphaericula*.

The Rassenkreis of *Mekongia sphaericula* (DESHAYES).

This group differs from *M. swainsoni* and *M. rattei* by its dark violet apex which is obtuse. Only the first 2-2½ whorls are coloured, in *M. lamarcki* the apex is pointed and at least 4 whorls are coloured. *M. sphaericula* has the same chestnut-brown operculum as *rattei*, that of *lamarcki* is straw-coloured.

Key to the races in Thailand:

- | | |
|-----------------------------------|----------------------|
| 1. Shell subglobose | 2 |
| — Shell ovoid-conoidal | <i>extensa</i> . |
| 2. Shell almost smooth | <i>sphaericula</i> . |
| — Shell with obtuse spiral ridges | <i>spiralis</i> . |

Mekongia sphaericula sphaericula (DESHAYES, 1876).

pl. 3 fig. 53-54.

1876 *Paludina sphaericula* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 136, pl. 7 fig. 27 (Mékong près Pnom Penh, Cambodge).

1876 *Paludina moreleti* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 137, pl. 7 fig. 28-29 (Mékong près Pnom Penh, Cambodge).

Shell subglobose with short, depressed spire and large, inflated body whorl. The somewhat eroded, obtuse apex is violet, the other whorls are covered with a thick, dark greenish periderm. The shell is either smooth or sculptured with irregular spiral lines. The periderm shows a delicate spiral microsculpture. — Operculum almond-shaped, chestnut-brown, inner margin slightly incised below the upper angle.

Size: A 25-36 mm; D 20-29 mm.

Type locality: Mekong at Pnom Penh.

Distribution: Mekong downstream from Nakon Panom and several tributaries as Maenam Songkram: Huai Mae Om; Huai Thuai; Kham River near Tat Panom; Mun River from Ban Ta Thom to Bandan.

Mekongia sphaericula spiralis n. subsp.

pl. 3 fig. 55.

Diagnosis: A subspecies of *Mekongia sphaericula* (DESHAYES) which differs from the type form by its strong but obtuse spiral ridges.

Size: A 25-32 mm; D 19-25 mm.

Type locality: Lam Chi River at Selaphum, E of Roi Ett.

Distribution: Known from the Lam Chi River only.

Material: Holotype SMRL 141/A; paratypes 141/100.

FISCHER & DAUTZENBERG (1904: 423) reported *M. hainesiana* (LEA) from this river (Nam-Si). As only this *Mekongia*-form is known from the Chi River and *M. moreleti* was also mentioned, their report can not refer to this race.

Mekongia sphaericula extensa n. subsp.

pl. 3 fig. 56.

Diagnosis: A subspecies of *Mekongia sphaericula* (DESHAYES) which differs from the type form by its elongate shell. This race stands in the same relation to the type form as *M. hainesiana* to *M. swainsoni*.

Size: A 28-32 mm; D 18-21 mm.

Type locality: Maenam Songkram, 17 km NE of Ta Uthen, Nakon Panom Province.

Distribution: Known from the Songkram River only.

Material: Holotype SMRL 3213/A; paratypes 3213/100.

DESHAYES' name, *moreleti*, has often being applied wrongly to other forms. KOBELT and MORLET attributed a globose form of *M. swainsoni* from the Chao Praya drainage, and BAVAY & DAUTZENBERG a very large Cambodian race of *M. pongensis* to this species. The subglobose race from the Chi River, however, was correctly assigned to *M. moreleti* = *sphaericula*.

Sometimes there are found very large specimens of *swainsoni* (Nan River, Kwae Noi River at Pitsanulok, Kaek River) which attain the size of *sphaericula* and when they have an eroded apex, those specimens can hardly be distinguished from specimens from the Mun River. The rhachis of those from the Mekong drainage, however, show only 9 cusps on the cutting edge, those of the form *swainsoni* 14-17.

? *Mekongia bocourti* (MABILLE, 1889).

- 1889 *Chlorostracia bocourti* MABILLE, Bull. Soc. malac. France, 6: 311, pl. 8 fig. 1-3 (Phetschaburi).
1889 *Chlorostracia jousseaumi* MABILLE, Bull. Soc. malac. France, 6: 312, pl. 8 fig. 10-12 (Phetschaburi).
1889 *Chlorostracia bourguignati* MABILLE, Bull. Soc. malac. France, 6: 313, pl. 8 fig. 4-9 (Phetschaburi).

This species differs from all other species of *Mekongia* by its large, inflated body whorl, small spire and natica-like shape.

Size A 24-31 mm; D 22-29 mm.

Type locality Phetschaburi in Thailand.

Distribution: Known from Petburi in Thailand only.

In the Petburi River this team only found typical *M. swainsoni*. In the next river to the south, the Pranburi River, no *Mekongia* have been found. No specimens identical to the types of above three taxa in Paris have been found around Petburi. The species is only placed into this genus, as a very similar species, *C. massiei* MORLET, is described from a river in Laos.

Ampullariidae GRAY, 1847.

(Pilidae).

Shell dextral or sinistral, large or very large, rarely of middle size for the superfamily. Operculum concentric, corneous or calcareous. Shell ovoidal, subglobose, rarely discoidal.

Animal with short rostrum which carries a tentacle-like process (pseudopodia) on either side. Tentacles very long and thin, the eyes are placed on separate stalks beside the tentacles. Mantle cavity separated into two parts by a septum; the right side contains the gill, the left side serves as a lung. The well developed jaw consists of corneous, fibrous layers. Radula with 7 teeth in one row; rhachis with 2 or 3 pointed cusps on either side of the large mesocone, laterals and marginals with few cusps only. — The male organs do not show a genuine verge, but a pseudoverge, formed by a part of the mantle edge. — On further details on the anatomy see below.

Distribution: Circumtropical.

Habitat: Amphibious.

Only one genus is represented in S and SE Asia.

Pila RÖDING, 1798.

Shell ovoidal conic or subglobose, dextral, with strong greenish or olive-brown periderm. Operculum calcareous, with nacreous inner surface.

Animal typical for the family. Both pseudopodia are well developed; the left is elongated into a tubular siphon during aerial respiration. Ctenidium and osphradium well developed.

The male sexual organs show cream-coloured testes of platelike structure attached to the digestive glands. Fine vasa efferentia unite into the vas deferens, which leads into the vesicula seminalis. The thick spermatheca duct shows a thick glandular portion, which leads to the mantle cavity. The mantle edge bears a glandular flap, whose free end is rolled into the penis-sheath, which is only a simple process of the inner surface of the mantle. During copulation the genital papilla, into which the spermatheca duct ends, forms a connection with the male genital opening and the copulatory organ.

Type species: *Helix ampullacea* LINNAEUS.

Distribution: Tropical area of Africa and Asia, Australia and the Indo-Pacific islands.

Literature ANNANDALE 1920, BAVAY 1873, BLAINVILLE 1887, PRASHAD 1925.

History: The first two species of this genus, reported from Thailand, were *turbinis* LEA and *gracilis* LEA, 1856. The first species is a form of *ampullacea* LINNAEUS which differs from the type form by its flattened spire, the second is closely related to *scutata* MOUSSON and may be a race of that Indonesian-Malayan species. In 1860 MARTENS reported three species, collected by MOUHOT, from Thailand, *globosa* var. *corrugata* SWAINSON, *celebensis* QUOY & GAIMARD and *polita* DESHAYES. The first species is identical with the form later described by ANNANDALE from Bangkok as *angelica*. *P. celebensis* refers to *ampullacea* and the third is the first report of this widely distributed species from Thailand. *Pila borneensis* (PHILIPPI) and *P. conica* (GRAY), both reported by MORELET in 1875 from Thailand, refer to *pesmei* and *scutata*. MORELET's *pagoda* is synonymous with *polita*. In 1889 MORLET described two new species from Cambodia and reports one of them, *pesmei*, from the Sraokeo River in Thailand. In 1903 BLANFORD described an *Ampullaria dalyi* which is a large form of *ampullacea*. The first monographic paper on *Pila* in Thailand was published by ANNANDALE 1920. He described several new races of *turbinis* LEA (= *ampullacea*) or reported new forms of this species from Thailand, *subampullacea* NEVILL, and *lacustris* ANNANDALE. He described a large form of MORLET's *pesmei* as *angelica* and reports *pesmei*, *begini* and *winkleyi* PILSBRY from Thailand. Later publications do not add any new knowledge to ANNANDALE's publication.

The present collection of the SMRL comprises several thousand specimens from about 150 localities. The large number of forms can be assigned into five species: *P. ampullacea* (LINNAEUS), *polita* (DESHAYES), *gracilis* (LEA), *scutata* (MOUSSON) and *pesmei* (MORLET).

Key to the Thai species:

- | | |
|--|---------------------|
| 1. Periderm moderately glossy, shell globose or conical; inner surface of operculum whitish-nacreous | 2 |
| — Periderm very glossy, shell ovoidal; inner surface of operculum steel-blue | <i>polita</i> . |
| 2. Shell subglobose or reversedly conical | 3 |
| — Shell ovate-conical | 4 |
| 3. Shell with a thick orange lip | <i>pesmei</i> . |
| — Shell with a thin, generally white lip | <i>ampullacea</i> . |
| 4. Shell very thin, without bands | <i>scutata</i> . |
| — Shell moderately thick, with spiral bands | <i>gracilis</i> . |

Pila polita (DESHAYES, 1830).

pl. 3 fig. 57.

- 1830 *Ampullaria polita* DESHAYES, Encycl. meth., 2: 31 (Vers) (1) (no locality).
1860 *Ampullaria polita*, — MARTENS, Proc. zool. Soc. London, 28: 12 (Siam).
1865 *Ampullaria pagoda* MORELET, J. de Conch., 13: 227 (Monst.).
1866 *Ampullaria callistoma* MORELET, Rev. zool., 1866: 166 (Battambang).
1889 *Ampullaria polita*, — MORLET, J. de Conch., 37: 151 (Pnom Penh).
1891 *Ampullaria polita*, — MORLET, J. de Conch., 39: 237 (Rivière du Ménam Pinh et ses marais à Xieng-Moi).
1892 *Ampullaria brohardia* GRANGER, Le Naturalist, 1892: 97, with fig.
1939 *Pila polita*, — SUVATTI, Moll. Siam: 18 (several localities).
1950 *Pachylabra polita*, — SUVATTI, Fauna Thailand: 56 (several localities).
1966 *Pila polita*, — SOLEM, Spolia zool. Mus. haun., 24: 14 (between Loei and Udon, Mekong River at Vientiane).

This species is easily identified by its ovate form, glossy green periderm, thin orange lip and the steel-blue nacre of the inner side of the operculum.

Size: A 47-80 mm: D 40-60 mm.

Radula. Rhachis with 1 large, triangular mesocone and 3 smaller cusps on either side. Laterals with 4 pointed cusps, marginals with 2.

Type locality Not designated.

Distribution: Although only known from 26 provinces of Thailand: Nakhon Ratchasima, Buriram, Rayong, Chonburi, Prachinburi, Nong Khai, Udon, Mae Hongson, Nan, Tak, Chiang Mai, Chiang Rai, Chantaburi, Sukothai, Pitsanulok, Nakhon Panom, Sakon Nakhon, Loei, Lopburi, Kon Kaen, Mahasarakham, Roi Ert, Lampang and Lampun, this species seems to be distributed over all N, NE and E provinces of Thailand. It has not yet been found in the Central provinces and it is rare in the South. — Two populations are remarkable: From Ban Nong Tshabo in Udon Province a population was found which shows a reddish-violet periderm and small size. Specimens from Ban Tabo Jarama in Udon Province show a very short and small spire and look similar to *P. ampullacea*. Extralimitarily known from Malaya, Indonesia, Laos, Cambodia, Vietnam, Burma, but has not yet been reported from India and Ceylon.

Parasitology: The species was found to harbour metacercariae of a Trematode species, *Echinostoma ilocanum*.

Pila ampullacea (LINNAEUS, 1758).

pl. 4 fig. 58-59.

- 1758 *Helix ampullacea* LINNAEUS, Syst. Nat., ed. 10: 771 (Asia).
1805 *Ampullaria fasciata* ROISSY, SONNINI'S BUFFON, Moll., 5: 374 [fide SOWERBY 1910] (Inde).
1811 *Pomacea orbata* PERRY, Conchology: pl. 38 no. 5 (no locality).
1834 *Ampullaria celebensis* QUOY & GAIMARD, Voy. Astrolabe, Zool., 3: 167 (Celebes).
1851 *Ampullaria sumatrensis* PHILIPPI, Conch. Cab., 1, 20: 59, pl. 19 fig. 1-2 (Fluß Danuluas, Sumatra); *A. linnaei* PHILIPPI: 62, pl. 20 fig. 6 (no loc.); *A. magnifica* PHILIPPI: 60, pl. 21 fig. 1 (Java); *A. gruneri* PHILIPPI: 37, pl. 9 fig. 8 (no loc.).
1856 *Ampullaria turbinis* LEA, Proc. Acad. nat. Sci. Philad., 8: 110 (Siam).
1860 *Ampullaria celebensis*, — MARTENS, Proc. zool. Soc. London, 1860: 12 (Siam).
1867 *Ampullaria turbinis*, — LEA, J. Acad. nat. Sci. Philad., 6: 113, pl. 22 fig. 2 (Siam).
1884 *Ampullaria turbinis* var. *subampullacea* and *subglobosa* NEVILL, Handlist, 2: 6 (Malaya, Siam).

- 1903 *Ampullaria dalyi* BLANFORD, Proc. malac. Soc. London, 5: 281, pl. 7 fig. 1 (Pitsanulok, Siam).
- 1920 *Pachylabra turbinis* and races *subampullacea*, *dalyi* and *lacustris*, — ANNANDALE, J. nat. Hist. Siam Soc., 4: 15, 17, 18, 20; pl. 1 fig. 5-8, pl. 2 fig. 4 (Siam; Pitsanulok, Songkla, Lampan).
- 1938 *Ampullaria (Pila) ampullacea*, — SUVATTI, Moll. Siam: 17 (sev. loc.).
- 1950 *Pachylabra celebensis, turbinis* et varr. *dalyi, subampullacea* and *lacustris*, — SUVATTI, Fauna Thailand: 54, 56, 57 (sev. loc.).
- 1952 *Pila turbinis*, — HAAS, J. nat. Hist. Siam Soc., 15: 24 (Me Nam River at Nam Nam, and on the Me Ping River at Wang Pratart Farm; also near Kwam-Don in Setul prov.).
- 1966 *Pila ampullacea*, — SOLEM, Spolia zool. Mus. haun., 24: 14 (Kwae Noi River, S of Ban Kao: Kanchanaburi Prov.).

Shell large (type form, *subampullacea*) or very large (*dalyi, lacustris*), subglobose, with low, conical or almost flat (*turbinis*) spire; body whorl large, inflated, often reversedly conic (*turbinis*). Periderm olive-green, unicoloured or with greenish or brown spiral bands. Peristome connected by a thin callus, either without or with a rather thin lip within; this lip is whitish or somewhat yellowish-orange. It is never as thick and as orange as that of *P. pesmei angelica*. — Operculum thick, with dirtyish-white nacre on the inner surface.

Size: A 60-105 mm; D 50-100 mm.

Radula: Rhachis with 2 small cusps on either side of the mesocone; laterals with 4 pointed cusps, marginals with 2.

Terra typica: "Asia".

Distribution: In Thailand known from almost all provinces except Mae Hongson. Nowhere rare. The species is eaten like the preceding species and as it also harbours metacercariae of *Echinostoma ilocanum*, serves as important intermediate host for this Trematode. — Extralimitarily known from Malaya, Indonesia, Borneo, Laos, Cambodia and Vietnam.

HABE places *P. globosa* (SWAINSON) from India, *perakensis* and *wellesleyensis* MORGAN from Malaya and although he does not quote that species, also *angelica* ANNANDALE into the synonymy of this species. Picture and description refer to the latter, not to *Pila ampullacea*. ANNANDALE's *Pila angelica* (= *pesmei*) is closely related to *globosa* but as we have no intermediate forms it is still advisable to treat both as different species. The two Malayan forms of MORGAN are synonymous with *scutata* MOUSSON, not with this species.

The two preceding species, although represented in a large number of forms, offer no difficulties for the taxonomist. The large number of forms of *Pila* from Thailand which cannot be assigned to any of the preceding species are more difficult to judge, and they may be assigned to two, three, or more species. If we sort out a group of forms with a yellow or orange thick lip (*angelica* ANNANDALE, *begini* and *pesmei* MORLET and *erythrocheila* BAVAY & DAUTZENBERG) and those which are more or less typical *gracilis* LEA and *scutata* MOUSSON we still have a large number of populations whose place is doubtful. These forms are connected by intermediate forms with all above named species. It is proved without doubt that *scutata* and *pesmei* are two different species as they were found together; they differ also anatomically and have no intermediate forms. Those forms whose place is still doubtful, will be discussed later.

Pila pesmei (MORLET, 1889).

pl. 5 fig. 70-71.

- 1860 *Ampullaria globosa*, — MARTENS, Proc. zool. Soc. London, 1860: 12 [non SWAINSON] (Bangkok).
1889 *Ampullaria pesmei* MORLET, J. de Conch., 37: 185, pl. 8 fig. 2 (Phnom Penh, Cambodge).
1889 *Ampullaria begini* MORLET, J. de Conch., 37: 184, pl. 8 fig. 1 (Mékong).
1904 *Ampullaria pesmei*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 369 (Srakeo River, Siam).
1905 *Ampullaria turbinis* var. *erythrocheila* DAUTZENBERG & FISCHER, J. de Conch., 53: 428 (Mekong à Chaudoc).
1920 *Pachylabra pesmei*, — ANNANDALE, J. nat. Hist. Siam Soc., 4 (1): 21, 23, pl. 1 fig. 11-12, pl. 2 fig. 1, 3 (Lat Bua Kao; Ko Samesan).
1920 *Pachylabra angelica* ANNANDALE, J. nat. Hist. Siam Soc., 4 (1): 11, pl. 1 fig. 9-10, pl. 2 fig. 5 (Bangkok).
1950 *Pila angelica*, *P. globosa* and *P. pesmei*, — SUVATTI, Fauna Thailand: 54, 55, 56 (several localities).
1964 *Pila ampullaria* (sic!), — HABE, Life & Nature SE Asia, 3: 49 [partim], pl. 1 fig. 28 [non *ampullacea* LINNAEUS] (Bangkok).

This is an extremely variable species which differs mainly from the other species by the thick, yellow or orange lip of the peristome. Large specimens (*angelica*) which are not completely adult and therefore have a thin lip differ from similar forms of *ampullacea* by the well rounded body whorl which is only rarely reversedly conical (*erythrocheila*). The colour is of a dark olive green or rarely yellowish-green. The shells are generally unicoloured, but specimens with greenish spiral bands are not rare. However, strong spiral bands like those of *P. gracilis* are exceptional. — The elongately oval aperture is large, the peristome connected by a thick callus of the colour of the lip. — The inner surface of the thick operculum is of dirty-white nacre.

Size: A 25-76 mm; D 21-68 mm.

Radula: Rhachis with 2 or 3 small, pointed cusps on either side of the large, triangular mesocone. Laterals with 4 pointed cusps, marginals with 2 or rarely 4.

Type locality: Mekong River in Cambodia.

Distribution: In Thailand from the Chao Praya plains to the N and NE. Through all eastern and southeastern provinces into Cambodia and Laos, in the S to the province of Yala. Probably also in parts of Burma. Also reported from S Vietnam and collected by the author at various localities in Laos.

The species, cited above in the synonymy, can not even be regarded as races as those forms may be found in one population. DAUTZENBERG & FISCHER assigned their *erythrocheila* to *turbinis* LEA (a form of *ampullacea*). It is in reality a reversedly conical form of this species which lives together with *ampullacea* in the province of Pitsanulok. Small forms like *pesmei* may be found together with large forms like *angelica*. Forms with a conic spire and those with a flat spire may be found in one population.

Pila gracilis (LEA, 1856).

pl. 6 fig. 84.

- 1856 *Ampullaria gracilis* LEA, Proc. Acad. nat. Sci. Philad., 7: 110 (Siam).
1867 *Ampullaria gracilis*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 113, pl. 22 fig. 1 (Siam).

- 1920 *Pachylabra gracilis*, — ANNANDALE, J. nat. Hist. Siam Soc., 4 (1): 11, pl. 1 fig. 4. ("Siam"; Lampun).
 1950 *Ampullaria gracilis*, — SUVATTI, Fauna Thailand: 55. (Several localities).
 1952 *Pila gracilis*, — HAAS, J. nat. Hist. Siam Soc., 15: 24. (From the Me Ping River at the Wang Pratart Farm, and from near Kwan-Don, Setul^uprov.).

Shell oval with obtuse apex and somewhat convex spire; rather thin; olive coloured, with several brown spiral bands, rarely unicoloured. The very delicate spiral lines are only visible under strong magnification. They are crossed by fine growth lines. The 5 or 6 whorls are somewhat convex and separated by a modestly deep suture. The umbilicus is rimate or closed. — Aperture large, ovate, dark brown within, with the bands well visible. — The peristome is continuous or shortly interrupted, angled above and well rounded at the outer and lower margin. — Operculum with bright nacre on the inner surface.

Size: A 28-52 mm; D 25-45 mm.

Type locality: Siam.

Distribution: In E, SE and Central Thailand; extralimitarily known from Laos, Cambodia and S Vietnam.

Pila scutata (MOUSSON, 1848).

pl. 6 fig. 85.

- 1828 *Ampullaria conica* GRAY in WOOD, Index Test. Suppl.: 29, pl. 7 fig. 22 [non LAMARCK, 1822 foss. spec].
 1848 *Ampullaria scutata* MOUSSON, Mitth. naturf. Ges. Zürich, 1: 268 (Java).
 1849 *Ampullaria orientalis* PHILIPPI, Z. Malak., 5: 192 (Insula Java, Philippinae, China).
 1851 *Ampullaria borneensis* PHILIPPI, Conch. Cab., 1, 20: 31, pl. 8 fig. 3 (Borneo).
 1858 *Ampullaria javanica* REEVE, Conch. Icon., 10: pl. 20 fig. 96 (Java).
 1875 *Ampullaria borneensis*, — MORELET, Sér. Conch., 4: 290 (Bangkok).
 1886 *Ampullaria perakensis* MORGAN, Bull. Soc. zool. France, 10: 418, pl. 8 fig. 12 (Malaya: Perak).
 1886 *Ampullaria wellesleyensis* MORGAN, Bull. Soc. zool. France, 10: 419, pl. 8 fig. 12 (Malaya: Wellesley).
 1889 *Ampullaria malabarica*, — MORLET, J. de Conch., 37: 151 [non PHILIPPI, 1851] (Mekong).
 1920 *Pachylabra conica*, — ANNANDALE, J. nat. Hist. Siam Soc., 4 (1): 9, pl. 1 fig. 3, pl. 2 fig. 2 (Pitsanulok, Lampun).
 1950 *Pachylabra conica* and *P. borneensis*, — SUVATTI, Fauna Thailand: 54, 55 (Bangkok, Chiang Mai, Pitsanulok, Lampun).

This species differs from the two preceding species by its ovate-conoidal shape, thin texture and thin lip. The colour of the periderm is greenish or yellowish olive, bands are either missing or are very weak. — Peristome hardly lipped, whitish or uncoloured. — Operculum with milky-blue nacre on the inner surface.

Size: A 28-48 mm; D 21-36 mm.

Rhachis with 3 cusps on either side of the mesocone, the 2 laterals cusps being very small.

Terra typica Java.

Distribution: Indonesia, Philippines, Malaya, Thailand, Burma and Indo-China doubtful. In Thailand widely distributed in the S, locally in W and N Thailand, not in Central or E Thailand.

Littorinacea GRAY, 1847.

Shell generally conical, with corneous, spiral operculum.

Animal with short, broad proboscis and long, thin tentacles. The eyes are placed in separate sockets beside the bases of the tentacles. — Penis large, placed behind the right tentacle.

Radula: Rhachis with 3-5 cusps and no basal cusps, often with lamellae at the sides.

Distribution: Cosmopolitan.

Habitat: Marine, brackish water or terrestrial.

Littorinopsis MÖRCH, 1876.

Shell rather thin and middle-sized for the family, high-conical with pointed apex and almost flat whorls. Sculptured with spiral lines and generally with colour patterns. — Operculum paucispiral.

Radula: Rhachis with 3 or 5 cusps and lateral lamellae, laterals with 4 or 5, inner marginals with 4, outer marginals with several cusps and a more or less broad lamella.

Distribution: In the coastal areas of the tropical and subtropical belt.

Type species: *Littorina angulifera* LAMARCK.

Parasitology: No cercariae have been found in species of this genus.

Key to the Thai species:

- | | |
|---|----------------------|
| 1. Aperture dark brown within | 2 |
| — Aperture of shell-colour within | 3 |
| 2. Spiral ridges tuberculated, A of aperture about $\frac{1}{2}$ A of shell | <i>scabra</i> . |
| — Spiral ridges rather smooth, A of aperture about $\frac{1}{3}$ of A of shell | <i>undulata</i> . |
| 4. Penultimate whorl with 2-5 ridges | <i>carinifera</i> . |
| — Penultimate whorl with 10-11 ridges | <i>intermedia</i> . |
| 5. Base rounded; with brown parietal patch, keel missing or weak | <i>melanostoma</i> . |
| — Base flattened; with peripheral keel, aperture and parietal area white | <i>conica</i> . |

Littorinopsis scabra (LINNAEUS, 1758).

pl. 4 fig. 60-61.

- 1758 *Helix scabra* LINNAEUS, Syst. Nat., ed. 10: 770 (no locality).
 1790 *Buccinum foliorum* GMELIN, Syst. Nat., ed. 13: 3493 (India).
 1831 *Littorina novae-hiberniae* LESSON, Voy. Coquille, Zool., 2 (1): 338 (Nouvelle Irlande).
 1832 *Littorina filosa* SOWERBY, Gen. Shells, 37: fig. 5 [fide TRYON] (Island of Cebu).
 1834 *Littorina angulifera* QUOY & GAIMARD, Voy. Astrolabe, Zool., 2: 770, pl. 33 fig. 2-3 (Celebes).
 1845 *Littorina sieboldii* PHILIPPI, Proc. zool. Soc. London, 1845: 142 (Japan).
 1857 *Littorina arboricola* REEVE, Conch. Icon., 10: pl. 5 fig. 27 (Singapore).
 1857 *Littorina philippiana* REEVE, Conch. Icon., 10: pl. 5 fig. 22a, b (Philippine Islands).
 1889 *Littorina filosa*, *L. philippiana*, *L. sieboldii* and *L. scabra*, — MORLET, J. de Conch., 37: 147 (Kampot, Gulf of Siam).
 1950 *Littorina filosa*, *philippiana*, *scabra* and *sieboldii*, — SUVATTI, Fauna Thailand: 46, 47 (Gulf of Siam).

Shell conic, solid, with pointed apex and 8 somewhat convex or almost flat whorls, with brownish pattern on grey or whitish ground colour. The sculpture consists of 7-11 spiral ridges which are separated by spiral grooves. Intermediate grooves may divide several or rarely all ridges. On the body whorl the ridges may become irregularly tuberculate. The peripheral ridge on the keel is the largest; there are about 10-13 spiral lines on the base. — Aperture large, about $\frac{1}{2}$ of the height of the shell, broadly ovate, brown or violet within. Peristome sharp and regularly curved, connected by a thick, tinted columellar callus.

Size: A 20-30 mm; D 15-20 mm. Specimens of 35 mm height are known but specimens from local populations rarely attain 30 mm.

Type locality: India.

Distribution Mangrove and nipa palm flats of the gulf of Thailand and the Indian Ocean. Extralimitarily known from E Africa over all coasts of the Indian Ocean to China and Australia and to Hawaii and the Society Islands.

Littorinopsis intermedia (PHILIPPI, 1845).

pl. 4 fig. 62.

1845 *Littorina intermedia* PHILIPPI, Proc. zool. Soc. London, 1845: 141 (Negros).

1847 *Littorina intermedia*, — PHILIPPI, Abb. Besch., 2: 223, pl. 5 fig. 7-9 (Negros).

1937 *Littorina intermedia*, — SERENE, Inst. Ocean Indochine, 30: 38 (Gulf of Siam).

1950 *Littorina intermedia*, — SUVATTI, Fauna Thailand: 46 (many localities in Thailand).

Closely related to the preceding species and probably only a form of it. It differs by its slender shape and much smaller aperture, lesser and coarser spiral ridges and by the bright colour of the aperture within. The size is generally less than that of *L. scabra*.

Size: A 14-22 mm; D 8-12 mm.

Type locality: Negros, Philippines.

Distribution: Similar to that of the preceding species. In Thailand found together with *L. scabra* and therefore — as there are no intermediate forms known — still treated as a different species, albeit with hesitation.

Littorinopsis undulata (GRAY, 1839).

1839 *Littorina undulata* GRAY, Zool. BEECHY'S Voy.: 140 (no locality).

1847 *Littorina undulata*, — PHILIPPI, Abb. Besch., 2: 225, pl. 5 fig. 18 (Insulae Societatis, Insulae Philippinae; Java; Ceylon).

1889 *Littorina undulata*, — MORLET, J. de Conch., 37: 147 (Gulf of Thailand).

1937 *Littorina undulata*, — SERENE, Inst. Ocean. Indochine, 30: 38 (Gulf of Thailand).

1950 *Littorina undulata*, — SUVATTI, Fauna Thailand: 47 (Gulf of Thailand).

Differs from *L. scabra* by its smaller size, more slender shape, smaller aperture and often thicker texture. The spiral sculpture is weaker and not so tuberculate. The columella is tinted wine-red.

Size: A 16-22 mm; D 11-14 mm.

Type locality: not designated.

Distribution: Gulf of Thailand in mangrove and nipa palm swamps together with *L. scabra*, of which it may be a form only. Extralimitarily known from the Red Sea over India to Australia, the Philippines, Formosa and the Pacific Islands.

Littorinopsis melanostoma (GRAY, 1839).

pl. 4 fig. 63.

- 1839 *Littorina melanostoma* GRAY, Zool. BEECHEY'S Voy.: 140 (Indian Ocean).
1847 *Littorina melanostoma*, — PHILIPPI, Abb. Besch., 2: 224, pl. 5 fig. 16 (Oceanus Indicus; Java; Ceylon; Mergui).
1889 *Littorina melanostoma*, — MORLET, J. de Conch., 37: 147 (coast between Chantaburi and Kampot, Gulf of Siam).
1950 *Littorina melanostoma*, — SUVATTI, Fauna Thailand: 46 (Ko Chang; Pak Poon).

This species differs from the preceding species by its dark brown parietal callus and upper part of the aperture of the same colour. The surface is rather smooth, the whorls are almost flat. There are 8-9 distinct spiral grooves on the visible part of the penultimate and about 20 spiral grooves on the body whorl. The body whorl is ovate and without a keel when the specimens are completely adult. Yellowish or dirty-white, generally with oblique radial lines of small brown dots.

Size A 16-22 mm; D 9-15 mm.

Type locality Indian Ocean.

Distribution: Less widely distributed than the preceding species. In Thailand only known from the coast of the province of Chonburi, but probably more widely distributed. Extralimitarily known from India (Bengal) and Burma. Reports from Java and Borneo need verification.

Littorinopsis conica (PHILIPPI, 1845).

pl. 4 fig. 64.

- 1845 *Littorina conica* PHILIPPI, Proc. zool. Soc. London, 1845: 141 (Java).
1847 *Littorina conica*, — PHILIPPI, Abb. Besch., 3: 9, pl. 6 fig. 1-2 (Java; Mergui).

This species differs from the preceding species by its sharp keel and much lower body whorl and by its colourless aperture. Shell regularly conical with completely flat whorls. These are generally of yellowish or greyish ground colour but sometimes ornate with a brownish colour pattern. The sculpture consists of very weak spiral grooves, weaker than in all other known species of this area. There are about 16-22 lines on the visible part of the penultimate whorl and more than 22 on the base of the body whorl below the sharp keel.

Size: A 15-22 mm; D 8-15 mm.

Terra typica: Java.

Distribution: From Indonesia to the Philippines and China and over Burma, Thailand and Malaya to Bengal, Nicobar and Andaman Islands.

Several authors suggested that this species has to be considered a race of *L. scabra* only. Specimens from Thailand which we doubtfully assign to this species seem to corroborate the suspects.

Littorinopsis carinifera (MENKE, 1830).

- 1830 *Phasianella carinifera* MENKE, Synopsis, (2): 51, 141 (Patriam ignoro).
1832 *Littorina perdix* KING & BRODERIP, Zool. J., 5: 345.

This species differs from all other species of this genus by its few strong spiral ridges. Its colour is greyish, dotted with reddish-brown.

Size A 18-25 mm; D 13-16 mm.

Type locality: not designated.

Distribution In Thailand not rare in mangrove forests of the Gulf. Extralimitarily known from India to the South Pacific Islands.

Rissoacea H. & A. ADAMS, 1854.

Shell small to very small, rarely of medium size, turreted, conic, ovate- or subglobose conic, rarely neritoid, trochoid or planispiral. Smooth or sculptured with spiral lines or/and axial ribs, sometimes with spiral microsculpture. — Operculum generally corneous and paucispiral, rarely calcareous and concentric, sometimes with ridges on the inner surface.

The animals have either well developed, round and long tentacles or only stumpy ommatophores. There is a strong rostrum which is not retractable. Almost all genera show distinct blackish pigmentation, some also yellowish pigment dots of different shade. Male reproductive organs always with intro-mittant organ. The animals are dioecious. The females are oviparous, sometimes parthenogenetic; at least one species is proved to reproduce over the stage of veliger larvae. Verge with or without appendage; its tip sometimes carries a stylet.

The species of this superfamily are marine or live in fresh- or brackish water. Some are amphibious, few completely terrestrial. Their distribution is cosmopolitan.

If we omit the marine and terrestrial groups we find that almost all families are represented in Thailand, although only a few have been formerly reported. Hydrobiidae, Assimineidae and Truncatellidae are cosmopolitan, Stenothyridae, Iravadiidae and Tornidae are restricted to S, SE and E Asia. As *Fairbankia* BLANFORD, formerly placed in the Micromelaniidae, is now assigned to Iravadiidae, the Micromelaniidae are now restricted to the Palaearcticum.

There is no doubt that future studies of this superfamily will result in many changes of the systematic position and contents of its families and genera. Too many species are still anatomically unknown and no full agreement has yet been attained in the judgment of the taxonomic value of the anatomical characteristics.

Key to the Thai families:

- | | |
|--|-----------------------|
| 1. Operculum spiral | 3 |
| — Operculum concentric | 2 |
| 2. Operculum calcareous | <i>Bithyniidae.</i> |
| — Operculum corneous | <i>Iravadiidae.</i> |
| 3. Aperture generally very constricted, inner surface of operculum with ridges | ..... |
| — Aperture not constricted, operculum without ridges | <i>Stenothyridae.</i> |
| 4. Animals with long tentacles | 4 |
| — Animals with stumpy tentacles | 5 |
| 5. Animal with pallial processes; gills external | <i>Assimineidae.</i> |
| — Animals without pallial processes; gills internal | <i>Tornidae.</i> |
| | <i>Hydrobiidae.</i> |

Bithyniidae WALKER, 1927.

Shell ovate-conoidal or subsphaeric-conical, with regularly tapering spire and more or less inflated body-whorl. Surface either smooth or with delicate spiral lines or spiral ridges, rarely with ribs. — Aperture rounded or ovate. — Operculum calcareous, mostly with a paucispiral nucleus.

Animal greyish, with melanin pigment dots and interspersed yellowish pigmentation like that of Viviparidae or Lithoglyphinae. The tentacles are long and thin, the eyes are placed at their bases in slight swellings. — The middle tooth of the radula is similar to that of many Rissoacea but differs by having numerous cusps at either side of the large middle cusp on the cutting edge. Facial cusps 2-4 on either wing, very rarely 5-6.

The systematic position of this family is still doubtful. As already pointed out (TAYLOR 1966) there are many characteristics in common with Rissoacea and with Viviparacea. No hydrobioid species shows a calcareous, concentric operculum as *Bithynia* does. The yellow pigment granules are known in Viviparidae and Pilidae, only species of Lithoglyphinae of Hydrobiidae show a yellow pigmentation beside the typical melanin pigment dots. The Hydrobiidae and their relatives have no nuchal lobes like Viviparidae and Bithyniidae. The radula seems to show relationship with the Hydrobiidae, the presence of an epitania and an associated foot-groove points to Viviparidae. The verge has several ducts like many hydrobiid species, but a pallial innervation like Viviparacea, it carries a finger-shaped or truncate appendage. At the present level of our knowledge it would be best to place Bithyniidae in a separate superfamily between Viviparacea and Rissoacea.

Distribution All continents with exception of America and on numerous Indo-pacific islands.

No strongly sculptered representatives of this family are known from Thailand.

Key to the genera from Thailand:

- | | |
|-----------------------------------|----------------------|
| 1. Peristome without varix | 2 |
| — Peristome with varix | <i>Hydrobioides.</i> |
| 2. Peristome greatly sinuate | <i>Wattebledia.</i> |
| — Peristome feebly or not sinuate | <i>Bithynia.</i> |

Bithynia LEACH, 1818.

Shell conic or ovate-conoidal, brownish, corneous or olive-coloured; mostly with very delicate spiral lines but never with a strong sculpture. Without a varix parallel to the peristome and the peristome not or only feebly sinuate. — Operculum, animal and soft parts like those of the family.

Distribution: Like that of the family.

Type species *Helix tentaculata* LINNAEUS.

The typical subgenus does not live in Thailand, but it is still doubtful whether the two subgenera listed below really deserve a separation from *Bithynia* s. str.

Subgenera of *Bithynia* in Thailand:

- | | |
|---|----------------------|
| 1. Shell without umbilicus, base of peristome rounded | <i>Gabbia.</i> |
| 2. Shell with umbilicus, base of peristome angled | <i>Digoniostoma.</i> |

***Bithynia (Digoniostoma)* ANNANDALE, 1921.**

This subgenus differs from *Bithynia* s. str. and other subgenera by its having a more or less strong carina around the umbilicus and an angled base of the peristome. — Animal, soft parts and radula like those of the genus.

Distribution: S, E, SE Asia and several Indo-pacific islands.

Type species: *Paludina cerameopoma* BENSON.

Key to the species from Thailand:

- | | |
|--|--------------------|
| 1. Umbilicus very narrow, carina weak or missing | ... 2 |
| — Umbilicus funnel-shaped, carina very strong | <i>funiculata.</i> |
| 2. Whorls well rounded, aperture not angulate . . | <i>pulchella.</i> |
| — Whorls little rounded, aperture angulate at the base | <i>siamensis.</i> |

***Bithynia (Digoniostoma) funiculata* WALKER, 1927.**

pl. 4 fig. 65.

1891 *Bithynia goniomphala*, — MORLET, J. de Conch., 39: 235 [non MORELET, 1866] (Maenam Pinh).

1927 *Bithynia funiculata* WALKER, Amer. J. Hyg., (Monogr.) 8: 237, pl. 14 fig. 23 (Maenam Ping; Chieng Mai).

This species differs from all other *Bithynia*e from Thailand by its open, funnel-shaped umbilicus which is surrounded by a thread-like keel.

It has been confused by several authors with *B. siamensis goniomphalos* but as it is found together with a form of that Rassenkreis its specific validity is beyond any doubt. Beside the open umbilicus and the stronger carina around it, it differs furthermore by the more inflated body-whorl.

The shell is large for the subgenus, conoidal-ovate, with short, conic, truncate spire and large, inflated body-whorl. It is rather solid, not or barely transparent and nearly dull. Under strong magnification, it shows very delicate waving spiral lines. The ground colour is olive brown, but it is covered by a reddish periderm whose colour is later adopted, and not caused by a deposit of minerals as seen in *B. s. goniomphalos*.

Size A 10.2-14.8 mm; D 6.8-9.6 mm.

Animal, radula and soft parts like that of the genus.

Type locality: Maenam Ping ("Pinh") at Chieng Mai in N Thailand ("Xieng Moi in Laos occidental").

Distribution: In the northern provinces of Thailand: Chieng Mai, Mae Hong-son; Tak (around Mae Sot only); Lampun and Chieng Rai. In Chieng Mai, Mae Sot, Lampun it was found together with *B. siamensis* LEA.

Parasitology: Specimens from Chieng Mai and Lampun have been proved to be infected with cercariae of *Opisthorchis tenuicollis* RUDOLPHI (= *viverrini* POIRIER).

***Bithynia (Digoniostoma) siamensis* LEA.**

This is a wide-spread Rassenkreis as members of it have not only been reported from Thailand but also from Malaya, Indonesia, Indo-China and Burma.

The races of this species differ from *B. funiculata* by the more slender shape and narrower umbilicus with much weaker carina. The body whorl is less inflated, otherwise *funiculata* is so similar to this species that some former authors united both species.

From Indonesia this species was reported as *Bithynia truncata* EYDOUX, from Malaya as *kintata* MORGAN and *pulchella* BENSON, from Vietnam it is known under two names, *subcarinata* and *dautzenbergiana* WATTELED and from Burma as *iravadica* BLANFORD. In spite of the large number of forms only two widely spread geographical races can be recognized in Thailand which are generally known under the names *goniophalos* and *laevis* MORELET. Unfortunately LEA picked as a type of *siamensis* a specimen with exceptionally rounded whorls thus misleading later authorities, not to recognize the identity of *laevis* with *siamensis*. A small endemic form from Lampun and Chieng Mai is of great taxonomic value as it lives partly together with *funiculata* WALKER and another *Bithynia* which is here assigned to *B. pulchella*, thus proving that the latter species are justifiedly separated from *B. siamensis*. This form from the north, however, does not differ sufficiently to justify an own name. The forms from Burma, as far as available, were carefully studied. Those from the south were identical with the neighbouring Thai forms and in the north two species were found, *funiculata* and *siamensis iravadica* BLANFORD.

Key to the subspecies:

1. Shell generally much eroded when old, periderm brownish-olive, size more than 12 : 7
averagely, dull *goniophalos*.
2. Shell only slightly eroded when old, periderm greenish-olive or straw-coloured,
somewhat glossy, average size 10 : 5.5 mm *siamensis*.

***Bithynia (Digoniostoma) siamensis siamensis* LEA, 1856.**

pl. 4 fig. 66-67.

- 1856 *Bithynia siamensis* LEA, Proc. Acad. nat. Sci. Philad., 8: 110 (Siam).
1867 *Bithynia siamensis*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 118, pl. 22 fig. 11
(Siam).
1875 *Bithynia laevis* MORELET, Ser. Conch., 4: 313, pl. 13 fig. 2 (Siam).
1889 *Bithynia goniophalus* [partim] and *B. laevis*, — MORLET, J. de Conch., 37: 149
(Cambodia; Siam: Pekim, Ayuthia).
1891 *Bithynia laevis*, — MORLET, J. de Conch., 39: 235 (Maenam Pinh: Xien Moi).
1915 *Digoniostoma laevis*, — PRESTON, Fauna Brit. Ind., Moll.: 75 (Burma: Damotha:
Moulmein).
1927 *Bithynia siamensis*, — WALKER, Amer. J. Hyg., (Monogr.) 8: 236, pl. 14 fig. 22
(Siam).
1927 *Bithynia laevis*, — WALKER, Amer. J. Hyg., (Monogr.) 8: 241, pl. 14 fig. 28 (Siam).
1950 *Bythinia iravadica* [non BLANFORD] and *B. laevis*, — SUVATTI, Fauna: 51
(Maeklong).
1964 *Digoniostoma siamense*, — HABE, Nature & Life SE Asia, 3: 50, pl. 3 fig. 1, 14, 18
(Bangkok).

Shell ovate-conoidal, with rather sharp apex which is generally somewhat eroded with age, straw-coloured or greenish-olive, somewhat glossy, with

delicate spiral microsculpture. Umbilicus very narrow, periomphalic carina very weak, often not visible.

Size: A 7.4-11.0 mm; D 3.0-6.8 mm.

Radula: Rhachis with 4 rounded cusps on either side of the mesocone and generally with 6 basal cusps which grow larger from the margin to the centre, laterals with 2 endo- and 3 ectocones on either side of the large, pointed middle cusp, marginals with 14-16 small cusps. — Reproductive organs like those of the subgenus.

Type locality: Takrong River near Nakon Ratchasima (Korat).

Distribution: On the whole Malaccan peninsula, Central, W, N and SE Thailand. Cambodia and S Vietnam and in Burma at Mandalay and south of it.

Parasitology: *B. s. siamensis* LEA has been found naturally infected with cercariae of *Opisthorchis viverrini* (= *tenuicollis*). The most important intermediate host, however, is the following subspecies.

Bithynia (Digoniostoma) siamensis goniomphalos (MORELET, 1866).

pl. 4 fig. 68.

- 1860 *Bithynia truncata*, — MARTENS, Proc. zool. Soc. London, 1860: 13 [non SOULEYET] (Siam).
1866 *Paludina goniomphalos* MORELET, Rev. Mag. Zool., 1866: 167 (Cochinchine).
1875 *Bithynia goniomphalos*, — MORELET, Sér. Conch., 4: 311, pl. 13 fig. 4 (Cochinchine).
1876 *Bithynia goniomphalos*, — CROSSE & FISCHER, J. de Conch., 24: 319 (Cambodge; Cochinchine).
1886 *Bithynia dautzenbergiana* WATTEBLÉ, J. de Conch., 34: 64, pl. 3 fig. 6 (Hué).
1886 *Bithynia subcarinata* WATTEBLÉ, J. de Conch., 34: 63, pl. 3 fig. 7 [juv.] (Hué).
1889 *Bithynia goniomphalos*, — MORLET, J. de Conch., 37: 148 [partim] (Cambodge: Tonle Sap; Mekong).
1927 *Bithynia goniomphalos*, — WALKER, Amer. J. Hyg., (Monogr.) 8: 231, pl. 14 fig. 17 (Burma; Siam; Cambodia; Indo-China).
1927 *Bithynia dautzenbergiana*, — WALKER, Amer. J. Hyg., (Monogr.) 8: 234, pl. 14 fig. 21 (Annam; Tonkin).
1962 *Digoniostoma funiculata*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 7 [non WALKER] (Maharakam; Udon).
1965 *Bithynia [Digoniostoma] goniomphalos*, — WYKOFF & al., J. Parasitol., 51: 209, fig. 2 (Thailand; Udon).

This race differs from the type race by its larger size, thicker texture, reddish-brown colour and deeply eroded apex. The umbilicus is generally somewhat wider than that of the preceding form.

Size A 10.2-14.9 mm; D 5.6-8.5 mm.

Terra typica: Cochinchina (S Vietnam).

Distribution: W of the water-shed between Ping River and Loei River and W of Korat. It reaches in the N to Tonking and probably to S China (*robusta* H. ADAMS is so close to this form that it may have to be united with it). In the S the border with *s. siamensis* is a diagonal line from Korat to S Vietnam. The exact limit of its distribution is not known. All populations from S Cambodia and from the Mekong delta were typical *siamensis*, those from the Tonle Sap and from Annam belonged to this race.

Parasitology: *B. s. goniomphalos* is the first intermediate host of the liverfluke from SE Asia (*Opisthorchis tenuicollis*).

***Bithynia (Digoniostoma) pulchella* BENSON, 1836.**

pl. 4 fig. 69.

1836 *Bithynia pulchella* BENSON, J. asiat. Soc. Bengal, 5: 746 (Sylhet, India).

1876 *Bithynia pulchella*, — HANLEY & THEOBALD, Conch. Ind.: pl. 38 fig. 5-6 (India).

1921 *Digoniostoma pulchellum*, — ANNANDALE in ANNANDALE & al., Rec. Ind. Mus., 22: 541 (Manipur, Assam).

1929 *Digoniostoma pulchellum*, — RAO, Rec. Ind. Mus., 31: 282 (Burma: Kamaing).

It was with some hesitation that I identified several lots of *Bithynia* from Chiang Mai and Lampun Provinces with this species. Burmese populations of this species which is found in Thailand only locally in two of the northernmost provinces were identified by the Zoological Survey of India with this Indian species.

B. pulchella BENSON differs from *B. siamensis* by its thinner texture, greenish-grey colour and more convex whorls.

Size: A 6.5-8.8 mm; D 4.0-4.7 mm.

Type locality: Sylhet, India.

Distribution: Manipur, Assam (Kutch of Rann), Burma, N Thailand. In Thailand only known from the town-moat and river Ping near Chiang Mai, from the town-moat of Lampun and few other localities in these provinces. The localities suggest importation by men.

This form would have been considered as a race of *B. siamensis* if it were not found together with that species. Exceptionally rounded *siamensis*, such as the type of LEA, look very similar.

B. pulchella has been reported from various places in SE Asia. These reports refer partly to *B. siamensis* forms, partly to *B. minuta* GHOSH.

Parasitology: A large number of specimens was collected in the town moat of Chiang Mai opposite the Chien Mai Hotel. None was infected with cercariae of *Opisthorchis*. Thanks to the pollution of the water this population seems now to be extinct.

Bithynia (Gabbia) TRYON, 1865.

Shell mostly small, without umbilicus, peristome straight, without varix. — Operculum with large, paucispiral nucleus. — Radula with 3 or 4 lateral cusps beside the mesocone of the central tooth and the same number of basal cusps.

Distribution: Africa, S, E and SE Asia, Australia and several Indo-pacific islands.

Three species are known from Thailand, one of which is very common and two are comparatively rare.

Key to the species from Thailand:

- | | |
|---------------------------------------|------------------|
| 1. Shell larger than 7 : 4 mm | <i>walkeri</i> . |
| 2. Shell of average size 4.6 : 3.2 mm | <i>wykoffi</i> . |
| 3. Shell smaller than 3.6 : 2.6 mm | <i>pygmaea</i> . |

***Bithynia (Gabbia) wykoffi* BRANDT, 1968.**

pl. 5 fig. 72.

- 1950 *Bithynia* sp., — SUVATTI, Fauna Thailand: 52 (Thailand: several localities).
1962 *Allocimma* spec., — ITO & al., Jap. J. Med. Sci. Biol., 15: 250, fig. 16 (Thailand: Bangkok; Chiang Mai).
1964 *Alocinma pygmaea*, — HABE, Nature and Life in SE Asia, 3: 53, pl. 2 fig. 2 [non PRESTON] (Bangkok).
1968 *Bithynia (Gabbia) wykoffi* BRANDT, Arch. Moll., 98: 224, pl. 8 fig. 9, textfig. 8 (Thailand: many localities).

Shell small, ovate-conoidal, with short, conical spire and large, often inflated body-whorl. The colour is either yellowish corneous or olive-green. The very fine growth lines are crossed by delicate spiral lines. The growth lines are stronger and often riblet-like near the peristome. The 4-4½ whorls are moderately convex, the last whorl measures sometimes more than ⅔ of the height of the shell. — The aperture is pear-shaped with a distinct angle at the upper margin. The peristome is somewhat thickened, continuous and appressed at the penultimate whorl. — The operculum has a large, paucispiral nucleus.

Size: A 3.8-5.2 mm; D 2.9-3.8 mm.

Central tooth of the radula with 3 (-4) lateral cusps beside the large mesocone and 4 basal cusps on the face, the innermost of which are the largest.

Type locality: Swampy paddy-field 2 km N of Uthong, Prov. Supanburi, Central Thailand.

Distribution: Known from Thailand only: from Petburi through Central Thailand to Lampang, Lampun and Chiang Mai. In E Thailand known from Korat only and not found E or N of Korat. — At Chonburi a population with overgrown specimens was found. These specimens had ½ a whorl more than normal and as the additional part of the body whorl is separated by a deep suture they look quite different from typical specimens.

Parasitology: Although several cercariae have been found in this species it does not seem to be of any parasitological importance.

***Bithynia (Gabbia) pygmaea* PRESTON, 1908.**

pl. 5 fig. 73-74.

- 1908 *Bithynia pygmaea* PRESTON, Rec. Ind. Mus., 2: 45, fig. 3 (Myetmyo, Burma).
1915 *Bithynia pygmaea*, — PRESTON, Fauna Brit. Ind., Moll.: 76 (Myetmyo, Burma).

Shell very small, generally much smaller than *B. wykoffi*, with 4 regularly increasing whorls, the last one not very much inflated, the whorls more convex than in *B. wykoffi*, below the suture nearly horizontal, with very deep suture. Corneous or olive coloured, somewhat glossy, sculptured with delicate lines of growth, but without spiral lines. — Aperture piriform, peristome somewhat thickened, continuous, appressed to the penultimate whorl.

Size: A 2.6-3.5 mm; D 2.0-2.5 mm.

Type locality: Myetmyo, Burma

Distribution Burma, Central and N Thailand. — Represented in the SMRL Collection only from the provinces of Pitchit, Petchabun and Chiang Mai.

The Thai populations are only tentatively assigned to this species.

HABE already recorded this species from Thailand, but his record refers to *B. wykoffi*. The smaller size, the deeper suture and the lack of spiral lines of this species make distinction easy. PRESTON's description of this species is not very accurate. The form is not fusiform but ovate-conoidal, the operculum is not spiral, as he stated, but concentric with a paucispiral nucleus. The shell cannot be called umbilicate, although a chink may sometimes be seen beside the columellar margin of the peristome.

Bithynia (Gabbia) walkeri BRANDT, 1968.

pl. 5 fig. 75.

1968 *Bithynia (Gabbia) walkeri* BRANDT, Arch. Moll., 98: 223, pl. 8 fig. 8, textfig. 7 (Thailand: Supanburi).

This species is much larger than the two preceding species and it is doubtful whether it really belongs into this subgenus, into which it is only placed tentatively because of the completely closed umbilicus.

Shell rather large for the subgenus, with $4\frac{1}{2}$ rather convex whorls. Body whorl large, inflated. Sculptured with delicate spiral lines and of bright corneous colour. — Peristome of the large aperture continuous, appressed to the penultimate whorl.

Size A 7.2-8.5 mm; D 4.1-5.3 mm.

Rhachis with 7 cusps on the cutting edge and 5 basal cusps on either side.

Type locality Propaya tap-water supply station, Supanburi.

Distribution: Known only from two localities in Supanburi Province. Importation by men possible as both localities are artificial water reservoirs.

This species has been carefully compared with all known species of *Bithynia* of that size and shape. The radula is very different from that of *B. longicornis* as figured by WALKER (1927: textfig. 6). *B. morleti* WATTEBLED has a much longer spire and less inflated body whorl, *B. moreletiana* is much stouter, *B. shuttleworthi* FRAUENFELD and *B. tonkiniana* MORLET are considered to be synonymous with the first and the last named species respectively.

Wattebledia CROSSE, 1886.

This genus was established by CROSSE for *Bithynia crosseana* WATTEBLED as a monotypical genus. In 1902 MOELLENDORFF added the second species, *W. siamensis*, to this genus. In 1956 VAN BENTHEM JUTTING described the third species from Java, *W. insularis*, and reported the type species also from that island, copying the reports of former authors. As it was doubted that the continental species proved to be indetical with that from Java, the present author studied the Javanese material carefully and found his doubt justified. The fourth species was dedicated to the first collector, C. TH. CRIBBS. A fifth species of this genus was detected by Dr. BASCH in N Malaya. Since the description of *W. baschi* was in press, this Malayan species was found in several localities in the Thai provinces Grabi and Nakon Sritammarat, about 250 km N of the original locality.

The shell of *Wattebledia* differs from that of *B. (Digoniostoma)* by having, like *Gabbia* and *Hydrobioides*, a completely closed umbilicus. From these groups

it differs by its conspicuously sinuous outer margin of the peristome which may be moderately so in *Digoniostoma*. It has no preperistomal varix.

Key to the species from Thailand:

1. Peristome very sinuous, but without basal incision; whorls more or less convex 2
— Peristome with deep incision at the base, whorls almost flat . . . *baschi*.
2. Average size 6·8 : 3·4·5 mm, olive coloured, dull, whorls slightly convex *crosseana*.
— Average size 4·5·5 : 2·5·3·7 mm, corneous, glossy, whorls very convex *siamensis*.

Wattebledia crosseana (WATTEBLED, 1886).

pl. 5 fig. 76-77.

1884 *Bythinia crosseana* WATTEBLED, J. de Conch., 32: 127, pl. 6 fig. 2 (L'arroyo du blockhaus, près Long-Xuyen).

1886 *Wattebledia crosseana*, — CROSSE, J. de Conch., 34: 76.

1962 *Wattebledia crosseana*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 8 (fig. reversed) (Ubon Thani).

Shell olive-coloured, dull, with moderately convex whorls. Outer margin of peristome greatly sinuous.

Size: A 6·0-8·5 (5·5-9·4) mm; D 2·8-4·6 (5·2) mm. — An exceptionally large specimen of 9·4 : 5·2 attains the size of *Digoniostoma*.

Type locality "L'arroyo du blockhaus, près du post du Long-Xuyen", Cochinchina).

Distribution NE and E Thailand, Laos, parts of Cambodia and in Vietnam. The distribution is similar to that of *B. s. goniomphalos* with which it is often found at the same localities. The report of this species from Bangkok by HABE (1964: 52) refers to the following species, the report from Java to *W. cribbsiana* BRANDT.

Parasitology: Several hundred thousand specimens were examined for cercariae of *Opisthorchis tenuicollis* as this species lives together with the main intermediate host of that trematode but no infected snails were found. Attempts to infect this species in the laboratory with miracidia of *Opisthorchis* were not successful. *Wattebledia* may therefore be excluded as a potential intermediate host of the liver-fluke in Thailand. In the parts of Thailand not mentioned above, the following species represents the genus *Wattebledia*.

Wattebledia siamensis MOELLENDORFF, 1902.

pl. 5 fig. 78-79.

1902 *Wattebledia siamensis* MOELLENDORFF, Nachr. Bl. dtsh. malak. Ges., 34: 160 (Siam).

1964 *Wattebledia crosseana*, — HABE, Nature and Life SE Asia, 3: 52, pl. 2 fig. 3, 15, 19 [non WATTEBLED] (Bongkok).

Generally this species is much smaller than the type species; it is corneous, glossy, has greatly convex whorls and its peristomal sinus is almost flap-like.

Size A 4·2-5·8 (6·1) mm; D 2·6-4·1 mm.

Radula: Rhachis with 5 cusps on the cutting edge and 3 long basal cusps on either side of the plate. Laterals with 7 cusps, marginals with 8 or 14 respectively. — Animal sand-coloured, dusted with black pigment dots particularly on

the back and on the margins of the sole. The tentacles have a line of pigment dots within. Verge of the male reproductive organs with a finger-shaped (not truncate) appendage.

Terra typica: Siam.

Lectotype SMF 193380.

Distribution Thailand, from the Malayan border (Satun) to Chiang Mai Province; in the E it reaches to Kon Kaen and at Ubon invades the territory of the preceding species. As it is found at the Burmese, Malayan and Cambodian border, it is highly probably that these three countries include *W siamensis* in their faunas.

Wattebledia baschi BRANDT, 1968.

pl. 5 fig. 80.

1968 *Wattebledia baschi* BRANDT, Arch. Moll., 98: 227, pl. 8 fig. 11, textfig. 9 (Perlis, Malaya).

Since the description of this species in the previous year, several localities of *W baschi* were detected by Mr. PRASONG TEMCHAROEN in Thailand about 250 km N of the Malayan border.

W baschi differs from *W siamensis* by its still smaller size, stouter shape, less convex whorls and by having a deep incision in the peristome below the typical flap-like sinus at the outer margin.

Size A 2.2-2.7 mm; D 1.8-2.1 mm.

This species differs furthermore from all other Bythiniidae by being able to retract the operculum into the expanded aperture.

Type locality: Kampong Pandang Malau, Perlis, Malaya.

Distribution Known from Perlis in Malaya and from Grabi and Nakon Sritammarat Provinces in Thailand.

Hydrobioides NEVILL, 1884.

This genus differs from *B. (Digoniostoma)* by having a closed umbilicus, from *Wattebledia* by the straight outer margin of the peristome and from all subgenera of *Bithynia* by its ante-peristomal varix.

Type species: *Bithynia turrata* BLANFORD.

Distribution: India, Burma, Laos and Thailand.

There are two species reported from Thailand, *H. nassa* (THEOBALD) and *H. dautzenbergi* WALKER. I can find no reason to separate them as different races. let alone as separate species.

Hydrobioides nassa (THEOBALD, 1865).

pl. 5 fig. 81.

1865 *Bithynia nassa* THEOBALD, J. asiat. Soc. Bengal, 34 (2): 275 (Burma, Shan States).

1870 *Bithynia nassa*, — THEOBALD, J. asiat. Soc. Bengal, 39 (2): 404, pl. 18 fig. 8 (Shan States).

1891 *Bithynia siamensis* var., — MORLET, J. de Conch., 39: 235 (Chiang Mai, Ping River).

1918 *Hydrobioides nassa* et subsp. *lacustris*, *rivulicola*, *distoma* ANNANDALE, Rec. Ind. Mus., 14: 118, pl. 13 fig. 1-7, pl. 14 fig. 4 (Southern Shan States).

- 1918 *Hydrobioides avarix* ANNANDALE, Rec. Ind. Mus., 14: 120, pl. 14 fig. 1-2 (Southern Shan States).
- 1925 *Hydrobioides nassa* and "phases", — ANNANDALE & RAO. Rec. Ind. Mus., 27: 114 (Inle watershed, Burma).
- 1927 *Hydrobioides dautzenbergi* WALKER, Amer. J. Hyg., (Monogr.) 8: 223, pl. 14 fig. 10-10a (Thailand: Chieng Mai).
- 1927 *Hydrobioides nassa*, — WALKER, Amer. J. Hyg., (Monogr.) 8: 224, pl. 14 fig. 11 (Burma: Shan States).

Shell ovately conic, imperforate, with 5 regularly increasing whorls which are moderately convex. The shell has great similarity with that of *B. siamensis* LEA. Corneous or straw-coloured, somewhat glossy, smooth except of the fine growth lines and the delicate spiral microsculpture. There is a distinct varix parallel to the outer margin of the peristome which is either separated by a groove from the peristome or forms a part of the expanded peristome. Umbilicus completely closed or rarely a very narrow chink. — Aperture large, ovate, bluish-white within.

Size A 6.2-11.8 mm; D 4.4-7.0 mm.

Radula: Rhachis trapezoidal, with flap-like process at the lower margin. Cutting edge always with 7 cusps, the number of basal cusps varies from 3 to 6, generally there are 4 or 5. Laterals with the formula (2-4)-1-(3-5), inner marginals with 15-18 cusps, outer marginals with 17-22. Our findings differ a little from those of ANNANDALE.

Type locality Burma, Shan States.

Distribution: Burma, Laos and Thailand. No verified populations from India are known. In Thailand found in the provinces of Mae Hongson, Tak, Chieng Mai, Lampun, Lampang, Chieng Rai and Sukothai. It has not yet been found S of Mae Sot or Sukothai and not W of above named provinces. It was reported from the Mekong without exact locality. These specimens may have been washed downstream from northern provinces.

No *Hydrobioides* species was found to harbour cercariae of *Opisthorchis*.

Hydrobiidae TROSCHEL, 1857.

Rissoacea with corneous operculum (contrast Bithyniidae), without ridges on the internal surface of the operculum (contrast Stenothyridae, Irvadiidae), which may be paucispiral or multispiral. Males with a genuine verge which may be a simple prong or which may have one or more appendages. The central tooth (rhachis) of the radula has generally one or more basal cusps on either side.

The shell varies from planispiral to aciculate, thin to thick; the length generally varies from 1 to 6 mm and rarely exceeds 12 mm. The apex is not plugged internally like that of Truncatellidae. The calcareous part of the shell is generally devoid of colour patterns. Shells may be smooth or sculptured with axial ribs, spiral ridges or carinae, reticulation, nodules or spines.

The animal has a strong foot which is truncate anteriorly and rounded posteriorly. Movement is performed by gliding (contrast Truncatellidae which move like "measuring worms"). There are no pallial processes (contrast Tornidae). The tentacles are long and filiform (contrast Assimineidae). The pigmentation consists of diffuse melanin, only the Lithoglyphinae of this family have also

yellow pigmentation. The fecal pellets are ovoidal, not spiral (contrast Bithyniidae). — Reproduction is oviparous, sometimes parthenogenetic.

Distribution: Cosmopolitan.

Habitat Marine, brackish and freshwater.

Literature: J. THIELE 1928, D. W. TAYLOR 1966.

Key to the Thai subfamilies:

1. Operculum paucispiral, with 2-3 windings; shell not planorboid, height always more than 1.5 mm 2
- Operculum multispiral with 4-5 windings; shell planispiral, height less than 1 mm *Cochliopinae*.
2. Verge simple, without appendages; in freshwater only 3
- Verge with 1-2 appendages; in brackish or tidal water *Rehderiellinae*.
3. Animal with yellow pigmentation; without suprapedal groove *Lithoglyphinae*.
- Animal without yellow pigmentation, with suprapedal groove *Triculinae*.

Triculinae ANNANDALE, 1924.

Hydrobiid snails with receptacular duct in females opening at the rear of the mantle cavity. The verge of the male reproductive organ is a simple prong and has only one duct. Suprapedal fold not strongly developed and omniphoric groove faint. For further description see below under the only genus.

Distribution: S, SE and E Asia.

There is only one genus recognized in this subfamily.

Tricula BENSON, 1843.

Freshwater snails with glassy shell. The shell is turreted, 3-6 mm in length, with smooth surface and more or less convex whorls. The umbilicus is closed or a narrow chink. — Aperture ovate to subquadrate; peristome continuous. — Operculum thin, paucispiral, corneous.

Foot elongate, truncate in front and broadly rounded behind. Tentacles elongate and broadly rounded at their tips. The eyes are placed at their outer bases in moderate swellings. For further description of the anatomy see DAVIS (1968).

Type species: *Tricula montana* BENSON.

Distribution: NE India, N and E Burma, N Thailand (Chieng Mai, Sakon Nakhon and Loei Prov.), N Laos, Tonkin, S China and (?) Yonaguni, Riu Kiu Islands.

Habitat: The species live in mountain streams. In Thailand they are only found in limestone areas.

Parasitology: Their parasitological importance does not derive from the fact that they may serve as intermediate hosts for trematodes of man and mammals but that they have often been confused with species of *Oncomelania*. Several *Tricula* reported from Japan, Formosa and the Philippines were wrongly placed in this genus. The report of a *Tricula* from Indonesia refers to another genus.

Key to the Thai species:

1. Whorls at the suture crenulated, shell with cancellate microsculpture; head-foot area not pigmented *burchi*.
2. Whorls at the suture smooth; shell without any trace of spiral microsculpture; head-foot area pigmented *bollingi*.

Tricula burchi DAVIS, 1968.

pl. 5 fig. 82.

1968 *Tricula burchi* DAVIS, Arch. Moll., 98: 296, figs. 1-3, 13-18 (Chieng Dao District: Huai Mae Kut at Ban Tham).

Shell elongate, turreted, with 5-5½ whorls. The suture is impressed and the whorls are moderately convex. Whorls crenulated at the suture. The spiral microsculpture is crossed by numerous fine growth lines. Umbilicus closed or chink-like. — Aperture ovate to subquadrate; peristome continuous, appressed, columellar lip moderately thick, somewhat reflected over the umbilical pit. — Operculum typical for the genus.

Size: A 2.5-2.8 mm; D 1.25-1.35 mm.

The head-foot region of the animal is devoid of black pigmentation. Behind each eye and on the neck is a strip on each side of yellow pigment granules. The gill has 19-23 leaflets. For detailed anatomy see DAVIS (1968: 297-303). — The radula has a trapezoidal rhachis; its cutting edge has generally 2 small cusps on either side of the large and pointed central cusp. There are 2 to 3 basal cusps on either side which arise from a thickened ridge. There is a squarish basal process at the lower margin which is somewhat tapering to its base. The laterals have the cusp formula (2-4)3-1-3(4), the inner marginals have 13 (11-15) cusps, the outer 9-12.

Type locality Huai Mae Kut at Ban Tham, near Chieng Dao Cave, Chieng Mai Province.

Distribution: Known from the type locality and from the Nam Phung River near Ban Dan Du, Dan Sai District in Loei Province.

A careful survey of the creeks in the remote limestone hills in N Thailand will definitely reveal more localities.

Tricula bollingi DAVIS, 1968.

pl. 5 fig. 83.

1968 *Tricula bollingi* DAVIS, Arch. Moll., 98: 304, figs. 5-12, 19-20 (Pang Makham Pom Village and Wat Tamtabtao, Fang District, Chieng Mai).

This *Tricula* differs from the preceding species by its less convex whorls, by having a smooth, not crenulated suture and by its lack of spiral microsculpture. The animal is distinctly pigmented.

Shell elongate, turreted, the whorls are only slightly convex and the suture is rather shallow. The whorls are not crenulated at the suture. The sculpture consists of orthocline growth lines only. — Aperture like that of the preceding species; peristome and operculum typical for the genus.

Size: A 3.0-3.6 mm; D 1.5-1.6 mm.

The head-foot area of the animal is pigmented. The verge is not ciliated at the tip as in *T. burchi* and the bursa copulatrix is not fused to the pallial oviduct. Otherwise the anatomy is not different from that of *burchi*. — The radula, however, differs somewhat from that of *burchi*. The cutting edge of the rhachis has the formula 3-1-3, rarely 2-1-2. There are generally 3 basal cusps on either side, rarely only 2. Laterals with the cusp formula (2-4)3-1-3(2-5), inner marginals with 10-16 cusps, outer with 9-17.

Type locality: A swampy creek, about 2 km W of Ban Pang Makham Pom at the high-way Fang to Chieng Mai, about 38 km S of Fang.

Distribution Known from the type locality, from Wat Tam Tab Tao and a creek along the high-way 37 km S of Fang, all in Fang District, Chieng Mai. One single specimen was found in the seepage on the Songkram River at Wanonivat in Sakon Nakhon Province. It seems to originate from the limestone area of the Phu Pa Hak hills S of the road from Udon to Sakon Nakhon.

Cochliopinae TRYON, 1866.

Hydrobiid gastropods with trochoid or planispiral shell, often with spiral sculpture and with a varix parallel to the peristome. Operculum with 3-5 whorls and central or subcentral nucleus. Verges with 1-2 or without processes or glandular lobes.

Literature: W. TAYLOR 1966.

In above cited publication TAYLOR created a separate tribe, Clenchiellini, for the genus *Clenchiella* ABBOTT, 1948.

Clenchiella ABBOTT, 1948.

Shell small to very small, planispiral, with brownish periderm and generally with spiral lines and varix parallel to the peristome. Operculum thin, corneous, with 3-4 whorls and central nucleus. Verges with 1 or 2 glandular lobes.

Type species *Clenchiella victoriae* ABBOTT.

Distribution: Bengal, Burma, Thailand, (? Malaya), New Guinea, Philippines, S Vietnam and probably also Indonesia.

Literature ABBOTT 1948, 1949; VAN BENTHEM JUTTING 1963.

Clenchiella microscopica (NEVILL, 1877).

pl. 6 fig. 86.

1877 *Valvata* (?) *microscopica* NEVILL, Cat. Moll. Ind. Mus., (E): 21 (Port Canning, Bengal).

1884 *Valvata minutissima* WATTEBLÉ, J. de Conch., 32: 131, pl. 6 fig. 8 (L'arroyo de Long-Xuyen).

1963 *Clenchiella papuensis* VAN BENTHEM JUTTING, Nova Guinea (Zool.), 20: 438, fig. 6a-c (Robinson River Plantation near Cloudy Bay, E of Port Moresby).

Shell very small, planispiral, thin but rather solid, with 4 convex whorls which increase rapidly in size, almost flat above and excavated below. The shell is covered with a brownish periderm and sculptured with distinct spiral lines. — The round aperture is rather large; peristome with a varix parallel to its outer margin. — Operculum round, corneous, with about 4 whorls and central nucleus.

Size A 0.4-0.5 mm; D 1.2-1.6 mm.

Animal grey with few darker pigment spots, particularly on the rostrum. This is broad and cleft in front. The round tentacles are rather long, they are obtusely rounded at the tips. The left tentacle is ciliated. The eyes are placed in the bases of the tentacles without any noticeable swellings. They are surrounded by some orange or yellow pigment spots. The verges is short and blunt.

It differs from that of the type species furthermore by having only one large, but low glandular lobe. The duct is only moderately coiled. — Rhachis with 9 cusps on the cutting edge and 1 finger-shaped basal cusp on either side at the basal margin beside the finger-shaped wings. Laterals with 2-1-4 cusps, inner marginals with 13, outer with 14, much less than in *C. victoriae*.

Type locality: Port Canning in Bengal.

Distribution Thailand in Klongs in and around Bangkok and Thonburi and in the coastal mud-flats of the provinces of Chantaburi, Rayong, Trad and Suratthani. Extralimitarily also known from Papua on New Guinea, India and S Vietnam. Probably widely distributed in S and SE Asia and the Western Pacific.

Habitat: Canals with almost freshwater and drains of the mud-flats with brackish water. It is easy to keep this species in freshwater tanks.

Rehderiellinae n. subfam.

Hydrobiid gastropods with an ovate-conic to turreted (contrast Cochliopinae) shell, with brown periderm and delicate spiral lines (contrast Lithoglyphinae, Triculinae). — Operculum corneous, paucispiral (contrast Cochliopinae, Lyogyrinae, Nymphophylinae), it lacks ridges or processes on the inner surface. Aperture bluish-white within, peristome simple or with external varix.

Central tooth (rhachis) of the radula with 1 basal cusp on either side arising from the face, not from the lateral angle. The animal is void of patches of orange pigmentation (contrast Lithoglyphinae). The females lack a receptacular duct (contrast Triculinae) or spermathecal duct (contrast Pomatiopsinae). The verge of the males has one duct and 1 or 2 globular lobes or processes (contrast Lithoglyphinae). The animals lack a suprapedal fold; tentacles long and thin, rounded, with melanin rings. The eyes are placed in slight swellings at the outer base of the tentacles (contrast Pomatiopsinae). The animals move by a smooth glide.

Distribution Thailand, S Vietnam, Cambodia, Malaya, Borneo.

Habitat: Drains of mud-flats and rivers in the tidal area. Slightly brackish or freshwater.

The animals and shells have a similarity with *Fairbankia* or *Iravadia*, the anatomical differences, however, show their place in the Hydrobiidae.

Rehderiella n. gen.

Shell ovate-conic or turreted, covered with a brown periderm and sculptured with delicate, regular, spiral lines. Aperture ovate, bluish-white within. Peristome thin or with external varix. Operculum paucispiral, with subcentral nucleus. — Animals with melanin pigment spots and with one pigment ring on each tentacle. Verge with 1 or 2 lobes or processes. Females without receptacular duct or spermathecal duct. — Radula like that of the subfamily.

Type species: *Pachychilus parvum* LEA.

Distribution and habitat like those of the subfamily.

Key to the species:

1. Ovate-conic, rather sturdy, 7 : 4 mm
2. Turreted, rather thin, 4 : 2 mm

parva.
siamensis.

Rehderiella parva (LEA, 1856).

pl. 6 fig. 87.

- 1856 *Pachychilus parvum* LEA, Proc. Acad. nat. Sci. Philad., 8: 145 (Siam).
1860 *Melania crassilabrum* REEVE, Conch. Icon., 12: pl. 30 fig. 221 (Siam).
1864 *Paludomus cyanostomus* MORELET, J. de Conch., 12: 288 (Preck-Scholl, Cochinchine).
1867 *Pachychilus parvum*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 120, pl. 22 fig. 14 (Siam).
1875 *Melania parva*, — BROT, Conch. Cab., 1, 24: 55, pl. 6 fig. 10-10a (Siam).
1889 *P.[achydrobia] parva*, — MORLET, J. de Conch., 37: 148 (Cambodge).

Shell ovate-conic, with short and pointed spire and large, oval body whorl, which measures $\frac{3}{5}$ of the height of the shell. Sturdy, not transparent, with a strong, brown periderm but generally covered with a black layer of mineral deposit; sculptured with exception of the smooth protoconch, with fine, regular spiral lines. — Aperture large, about $\frac{2}{3}$ of the length of the body whorl, ovate, somewhat expanded, bluish-white within; peristome thin, continuous, appressed to the penultimate whorl, with external varix.

Size A 6.5-7.8 mm; D 3.8-4.7 mm.

Exposed parts of the animal yellowish with dark grey pigmentation, front of the truncate foot darker, rostrum almost black. The tentacles carry a blackish ring at the proximal third. The eyes are placed in moderate swellings at the outer bases of the tentacles. — Radula with rhomboid rhachis. Its cutting edge shows a large middle cusp and 2 smaller cusps on either side; there is 1 basal cusp on either side beside the finger-shaped wings. Laterals with the formula 1-1-3, inner marginals with 10, outer with 8 cusps.

Type locality "Siam"; as there is no doubt that LEA's original specimen were collected at Bangkok, the Klong Premprachakon, an easily accessible locality, is herewith designated as type locality.

Distribution: Lower reaches of the Chao Phraya River ("Menam") and Klongs in and around Bangkok and Thonburi. Extralimitarily this species has been reported from Sarawak in Borneo, from Cambodia and from the Mekong delta at Long-Xuyen in Vietnam. Reports from Battambang and from the upper Mekong refer to other species.

Habitat: The species lives in brackish water and in freshwater under tidal influence.

Rehderiella siamensis n. sp.

pl. 6 fig. 88.

Diagnosis: A species of *Rehderiella* n. gen. which differs from the type species *R. parva* (LEA) by its much smaller size, thinner texture and turreted chape.

Description: Shell small, turreted, with $4\frac{1}{2}$ convex whorls; apex smooth and greyish, the other whorls are covered with a brown periderm and sculptured with fine, regular spiral lines. The body whorl measures $\frac{5}{8}$ of the length of the shell. Umbilicus closed or chink-like. — Aperture oval, not angled above, not extended, with a very thin bluish-white layer within. Peristome

sharp, not lipped, barely expanded, without or with a trace of an external varix. — Operculum oval, thin, translucent, paucispiral with subcentral nucleus.

Size: A 3.7-4.3 mm; D 1.8-2.1 mm.

Animal greyish with diffuse pigment spots particularly on the back and the head. These black pigment spots form lines on the tentacles and on the rostrum. Tentacles moderately long, thin, round; rostrum of about half the length of the tentacles. The eyes are placed at the outside of the bases of the tentacles in very delicate swellings. — Radula with large, trapezoidal rhachis; its cutting edge has 2-3 small cusps on either side of the middle cusp. There is only one large basal cusp on each side. Laterals with the cusp formula 3(2)-1-2, inner marginals with 12-13 cusps, outer with 8-9. — Male reproductive organs with short, plump verge. The appendage varies from a bulbous swelling to a rather long glandular appendage with narrow collum.

Type locality: Klong Bang O in Thonburi.

Distribution In the delta area of the Chao Praya from Ayuthia to Bangkok and Thonburi.

Habitat In slightly brackish water and in freshwater within the tidal zone.

Material: Holotype SMRL 3395/A; paratypes 3395/20 and 10 specimens each in USNM, ZMH and SMF. — SMRL 3397/20-trench along the road to Bang Pa In; 5091/10-Klong Dao Id, Thonburi; 5092/10-Klong Bang Plue, Thonburi; 5093/10-Klong Mun, Thonburi.

Lithoglyphinae P. FISCHER, 1885.

Shell moderately large to very small, subglobose-conoidal, ovoid-conoidal, turreted, cylindrical, fusiform, planispiral or neritoid, smooth or with spiral lines or axial ribs, often with tubercles or spiral microsculpture. — Aperture generally rather large, rarely expanded; peristome thin, moderately lipped or very thick, sometimes extended. In two genera the columellar part of the peristome forms a compressed septum as in Neritidae. — Operculum thin, translucent, corneous, paucispiral; its nucleus is placed near the lower half of the columellar margin.

The size never exceeds 17 mm, but is sometimes less than 2 mm.

The animal is of greyish colour, rarely sand-coloured. All species which were observed alive showed black and yellowish pigmentation (contrast: all other subfamilies) which varies from whitish over sand-coloured and lemon to orange. The yellow pigment easily dissolves when the animals are preserved in alcohol. The verge of the males is simple, blade- or finger-shaped, often prong-like (contrast: Rehderiellinae, Cochliopinae). It has a single duct and no appendages. — The radula has a trapezoidal, rarely squarish or triangular rhachis. Its cutting edge is either smooth or serrated. There are always 1-5 basal cusps.

In 1924 ANNANDALE established a new family Delavayidae based on the fact that in the only anatomically examined genus *Fenouilia* HEUDE, no intromittant male organ was found. If this were true it would be a unique exception in the Hydrobiidae. But as the type genus of this family is the genus *Delavaya* and as this genus is definitely closely related to *Lithoglyphus*, Delavayidae have to be considered a synonym of Lithoglyphinae FISCHER. This subfamily differs mainly from all other subfamilies by its yellowish pigmentation.

Distribution Central and E Europe, Siberia, China and SE Asia.

Key to the Thai genera:

1. Shell neritoid; the compressed columella forms a more or less broad septum *Lacunopsis.*
- Shell not neritoid; columella does not form a septum 2
2. Shell with spiral sculpture 3
- Shell smooth or with axial sculpture 6
3. Shell ovate-conoidal, subglobosely conoidal, or semispherical; lip extremely thick 4
- Shell turreted or elongately conic; lip thin or moderately thick *Paraprososthenia.*
4. Elongately conoidal-ovate *Hydrorissoia.*
- Hemispherical or subglobosely-conic 5
5. Shell semispherical; columella compressed; rhachis with simple cutting edge *Wykoffia.*
- Shell subglobose-conoidal, columella not compressed; rhachis with serrated cutting edge *Jullienia.*
6. Peristome sharp or with thin lip 7
- Peristome with very thick lip 9
7. Always sculptured with axial ribs; turreted or cylindrical; peristome not expanded but outer margin sinuous *Hubendickia.*
- Generally smooth*); ovate, ovate-conoidal or cylindrical; peristome expanded, outer margin thin-lipped or sharp, not sinuously protracted 8
8. Ovate, ovate-conoidal or cylindrical; cutting edge of rhachis with several cusps ..
- Subglobose-conoidal; rhachis with simple, triangular cutting edge *Manningiella.*
9. Shell always smooth; rhachis with simple cutting edge; A smaller than 4 mm
- Shell generally radially sculptured; cutting edge with several cusps; A larger than 6 mm *Pachydrobiella.*
- Shell generally radially sculptured; cutting edge with several cusps; A larger than 6 mm *Pachydrobia.*

*) *Manningiella dubiosa* shows a weak axial costulation.

Pachydrobia CROSSE & FISCHER, 1876.

Shell ovate-conoidal, thick or at least solid, of medium to large size for the subfamily, corneous or whitish with thick yellowish or olive-green periderm. Generally sculptured with more or less strong axial ribs or striae. Often with dorsal tubercle or several tubercles or "bosses" at the body whorl. The dorsal tubercle may be produced into a sharp spine. Often the ventral face of the body whorl is more or less flattened. — Aperture oval. Peristome very thick, appressed to the penultimate whorl, showing distinctly the growth lines. — Operculum ovate, thin, paucispiral; its nucleus is placed near the lower half of the columellar margin.

The size never exceeds 16 11 mm and is rarely less than 7 : 4 mm.

Animal greyish with black and sand-coloured pigmentation. The studied species never showed orange or lemon-coloured pigmentation as many of the species of other genera of the subfamily did. Rhachis always with basal cusps and several cusps on the cutting edge, generally 3 on either side. The verge is blade-shaped, compressed, simple, with single duct and without appendages. The animal has round tentacles of medium size. The eyes are placed at their bases in moderate swellings. The truncate rostrum is of about half the length of the tentacles.

Radulae of *Pachydrobia*:

Species	Rhachis	Laterals	M ₁	M ₂
<i>bavayi</i>	$\frac{2-1-2}{(3)4 \quad 4(3)}$	(2)3-1-4(3)	(7-8)	(11-12)
<i>crooki</i>	$\frac{4-1-4}{4 \quad 4}$	2-1-5	(16-18)	(13-14)
<i>mcmulleni</i> *)	$\frac{2-1-2}{3 \quad 3}$	3-1-4(3)	7	5
<i>munensis</i>	$\frac{3-1-3}{3 \quad 3}$	—	—	—
<i>paradoxa</i> *)	$\frac{3-1-3}{4 \quad 4}$	3-1-4	(13-14)	(7-8)
<i>prasongi</i>	$\frac{4-1-4}{4 \quad 4}$	2-1-4(5)	(15-16)	(9-11)
<i>siamensis</i>	$\frac{3-1-3}{3 \quad 3}$	1-1-5	(16-18)	(15-17)
<i>spinosa</i>	$\frac{3-1-3}{5 \quad 5}$	4-1-5	9	8
<i>variabilis</i>	$\frac{4-1-4}{5 \quad 5}$	4-1-5(4)	(20-23)	(14-16)
<i>wykoffi</i>	$\frac{3-1-3}{3 \quad 3}$	1-1-5	(14-15)	(10-12)
<i>zilchi</i>	$\frac{3-1-3}{3 \quad 3}$	2-1-4	(15-16)	(11-12)

*) only found in Cambodia. — I am indebted to Dr. GEORGE DAVIS for the information that *P. mcmulleni* BRANDT is synonymous with *P. acuminata* ANCEY.

Remarks: Soft parts and radulae of *P. fischeriana* POIRIER, *dubiosa* POIRIER and *harmandi* POIRIER are still unknown as only dead shells were collected in Laos at the type localities of above species.

P. poirieri BRANDT, which was only tentatively placed in this genus, has a quite different radula. The cutting edge of the rhachis has 7 cusps at either side like the rhachis of *Jullienia*. The inner marginals are shaped like the laterals and the outer marginals have 21-22 cusps.

Type species: *Pachydrobia paradoxa* CROSSE & FISCHER.

Distribution: Middle reaches of the Mekong and some of its tributaries. Only one species is known from outside the drainage-system of the Mekong, *P. siamensis* BRANDT from the Mae Klong in W Thailand. *Rebderiella parva* (LEA), described as a *Pachychilus* and placed by later authors into the genus *Pachydrobia*, does not belong

to Lithoglyphinae. Several Lithoglyphinae from Tonkin, Yunnan and N Laos (*P. pallida*, *messageri*, *krempfi*, *duporti* and *boettgeriana*), described by BAVAY & DAUTZENBERG, have to be eliminated from this genus and may tentatively be placed in the genus *Manningiella*.

Biology: The species of this genus live on sandy ground at quiet parts of the rivers and feed on decaying organic matter.

Parasitology: This genus is of great parasitological importance since *P. bavayi* BRANDT has been proved to harbour cercariae of *Schistosoma japonicum* in the Mekong valley in Laos and Cambodia and as this species has also been found in the Thai part of the Mekong.

Key to the Thai species:

- | | | |
|---|----|---------------------|
| 1. Shell sculptured with axial ribs or striae | .. | 2 |
| — Shell without any axial sculpture . . . | | <i>bavayi</i> . |
| 2. Back with more or less distinct tubercle or spine | | 3 |
| — Back without tubercle or spine | | 6 |
| 3. Tubercle or spine strong | | 4 |
| — Tubercle very weak | | 8 |
| 4. Back with tubercle | | 5 |
| — Back with sharp spine | | <i>spinosa</i> . |
| 5. Body whorl with pad-like ventro-lateral boss | | <i>zilchi</i> . |
| — Body whorl without pad-like ventro-lateral boss, but sometimes with a weak sub-sutural tubercle | | <i>prasongi</i> . |
| 6. Species known from the Mae Khlong in W Thailand only | | <i>siamensis</i> . |
| — Species known from the Mekong drainage only | | 7 |
| 7. Shell larger than 10 mm, with few strong ribs | | <i>variabilis</i> . |
| — Shell smaller than 10 mm, with many weak riblets | | <i>munensis</i> . |
| 8. Shell elongate, moderately thick, ventral face not flattened, D less than 7 mm | | <i>crooki</i> . |
| — Shell stout, very thick, ventral face flattened, D more than 7 mm | | <i>wykoffi</i> . |

Pachydrobia spinosa POIRIER, 1881.

pl. 6 fig. 89.

- 1881 *Pachydrobia spinosa* POIRIER, J. de Conch., 29: 14, pl. 2 fig. 1 (Mekong, Cambodge [Île de Kong]).
- 1889 *Pachydrobia spinosa*, — MORLET, J. de Conch., 37: 148 (Mekong, Cambodge, Île de Khong).
- 1904 *Pachydrobia spinosa*, — FISCHER & DAUTZENBERG, Mission Pavie, 3: 420 (Îles de Kong, Cambodge, Île Denn, Bassac).

Shell ovate-conoidal, rather solid but not thick, translucent, greenish-corneous when young, but of white ground colour and covered with a greenish periderm when old. The 5½-6 whorls are somewhat convex; embryonic whorls smooth, the remaining whorls sculptured with closely set riblets. Body whorl large, ovate, flattened in front. The back carries a sharp spine which points upwards. The ventral face is always smooth. — Aperture, peristome and operculum typical for the genus.

Size: A 7.6-8.5 mm; D 4.7-5.2 mm.

The animal is grey with few black and many whitish pigment spots. There are some large pigment patches on the mantle edge which are seen through the translucent shell. — Radula with trapezoidal rhachis; its cutting edge has

7 cusps; there are 5 basal cusps on either side, the innermost being the largest. Laterals with the cusp formula 4-1-5, inner marginals with 9 cusps, outer with 8.

Type locality Mekong at Khong Island, probably at Houa Khong Lem, a sand-bank at the northernmost tip of the island. It has been proved that HARMAND, the first collector, had visited this locality, the only place on Khong Island, where this species is still found in abundance.

Distribution Mekong between Kemmarath and Khone.

Remark Although this species has been found in abundance between Pakse and Khone in Laos, only few specimens were found in the Thai part of the Mekong at Kemmarath and Bandan.

***Pachydrobia bavayi* BRANDT, 1970.**

pl. 6 fig. 90.

1970 *Pachydrobia bavayi* BRANDT, Arch. Moll., 100: 192, pl. 13 fig. 11, textfig. 11 (Mekong between Khong Island and Kratie).

This species differs from all other species of the genus by its lack of axial ribs and striae and by its slender, elongately ovate-conoidal shape.

Shell small for the genus, slenderly ovate-conoidal. Covered with a thick olive or straw-coloured periderm. Apex eroded in adult specimens. The sculpture consists of fine growth lines and traces of a spiral microsculpture only. There are neither ribs nor tubercles. This fine microsculpture gives young specimens a silky lustre. Sometimes there is a weak subsutural spiral sulcus. — Aperture large, ovate, whitish within. Peristome thick, yellowish when young but brownish in very old specimens. — Operculum typical for the genus.

Size A 5.0-7.8 mm; D 2.8-3.4 mm.

The animal is typical for the genus. Cutting edge of the rhachis with 2 cusps on either side. There are 3 or 4 basal cusps on either side. The laterals have the cusp formula 3-1-4, but specimens with 1 or 2 endocones and 3 ectocones are not rare. Uter marginals with 1 or 2 endocones and 3 ectocones are not rare. Outer marginals with 11 cusps, inner with 7-8.

Type locality Mekong at Kratie in Cambodia.

Distribution Found in the Mekong at Bandan, Khong Island, Sambor and Kratie.

Biology: As all *Pachydrobia* species, *P. bavayi* lives on sandy parts of the river with little current, either buried in the sand or attached to wood. It feeds on decaying matter found in the sand. The eggs are deposited singly in brownish capsules with calcareous shell.

Parasitology: This is the only species of snails found around the schistosomiasis focus of Kratie which was accepted by miracidia of *Schistosoma japonicum* from the Mekong valley.

***Pachydrobia munensis* BRANDT, 1968.**

pl. 6 fig. 91.

1968 *Pachydrobia munensis* BRANDT, Arch. Moll., 98: 229, pl. 8 fig. 13 (Mun River, E Thailand).

Similar to *P. bertini*, but smaller, of thinner texture and with weaker costulation which becomes even obsolete on the body whorl. The ventral face

of the body whorl is not flattened and there are neither dorsal tubercles nor "bosses" — Aperture and operculum typical for the genus, peristome less thickly lipped.

Size A 7.3-9.4 mm! D 4.2-5.1 mm.

The rhachis has only 7 cusps at the cutting edge and 3 basal cusps.

Type locality: Mun River at Ban Tha Tum, Surin Prov.

Distribution Middle and lower reaches of the Mun River in E Thailand, lower reaches of the Chi River. Lower reaches of the Songkram River. This population is much smaller and looks similar to *P. bertini* POIRIER.

Pachydrobia variabilis POIRIER, 1881.

pl. 6 fig. 92.

1881 *Pachydrobia variabilis* POIRIER, J. de Conch., 29: 16, pl. 2 fig. 5 (Mekong, Îles de Kong, Cambodia).

This species differs from all other species of *Pachydrobia* from Thailand by its few thick ribs. It has the slender shape of *P. crooki* but a smaller aperture. There are generally 8-9 tubercle-like ribs on the body whorl.

Size A 12-15 mm; D 6.3-8 mm.

Radula with trapezoidal rhachis. Its cutting edge carries 9 cusps; there are 5 basal cusps on either side. Laterals with the cusp formula 4-1-4(5), inner marginals with 18 large cusps and 4 small, outer marginals with 15 cusps.

Type locality: Mekong, Khong Island, Laos.

Distribution: Mekong from Bandan to Sandan in Cambodia.

Pachydrobia siamensis BRANDT, 1968.

pl. 6 fig. 93.

1968 *Pachydrobia siamensis* BRANDT, Arch. Moll., 98: 230, pl. 8 fig. 15, textfig. 12 (Maenam Kwae Noi and Mae Khlong at Kanchanaburi).

Shell rather small for the genus, ovate-conoidal, of a bright yellowish or greenish olive-colour, rather thin, translucent. The embryonic whorls are smooth, the other whorls are sculptured with obtuse, axial ribs which grow weak near the peristome and on the lower half of the body whorl. There are about 28 ribs on the penultimate whorl and about 18 on the first half of the body whorl. There is no dorsal tubercle nor are there any "bosses" on the body whorl. The ventral face of the body whorl is only moderately flattened. — Aperture and operculum typical for the genus.

Size: A 5.7-7.6 mm; D 4.1-5.2 mm.

The animal is bright grey with fine sand-coloured dots and blackish pigment patches. — Rhachis with 3 lateral cusps on either side of the cutting edge and with 3 finger-shaped basal cusps on each side.

Type locality: Maenam Kwae Noi at Ban Kao Pun, N of Kanchanaburi.

Distribution Known from the lower reaches of the Kwae Noi River and from the Mae Khlong River at Kanchanaburi. — This is the only species of *Pachydrobia* which has been found outside of the Mekong system.

Pachydrobia prasongi n. sp.

pl. 6 fig. 94.

Diagnosis: A species of *Pachydrobia* CROSSE & FISCHER which differs from its closest relative, *P. wykoffi* BRANDT, by its smaller size, the stronger dorsal tubercle and the distinct lateral boss at the left side of the face of the body whorl.

Description: Shell ovoidal-conic, with large body whorl and regular conic spire. The 6 whorls are somewhat convex and increase regularly in size. The protoconch is smooth, the other whorls are sculptured with obtuse, curved ribs. These are more closely set on the postnuclear whorls than on the body whorl and on the flattened ventral face of the body whorl the ribs are reduced to striae only. On the back of the body whorl there is a distinct tubercle, another tubercle is seen below the suture on the left side of the ventral face of the body whorl. The ground colour of the shell is white, but it is covered with a strong greenish or yellowish olive periderm. The growth lines are oblique and not parallel to the axial ribs. There is no spiral microsculpture. — Aperture large, semicircular, whitish within; peristome very thick, connected by a very thick, straight parietal and columellar callus. The lip and parietal callus show distinctly the growth lines. — Operculum elongately semicircular, thin, translucent, brown, paucispiral, nucleus placed near the lower half of the columellar margin.

Size: A 8.2-9.3 mm; D 4.8-5.2 mm; d 3.9-4.2 mm.

Animal sand-coloured with fine black pigment dots dusted over back and head. There are few deeply embedded whitish pigment granules at the sides of the foot, on the rostrum and at the tentacles. The tentacles are long and filiform. The eyes are placed at their bases in moderate swellings. The rostrum is about half as long as the tentacles. — The radula has a trapezoidal rhachis with a low cutting edge. This shows 7 cusps; there are 4 basal cusps on either side. The laterals have the cusp formula 2-1-5, the inner marginals have 15 cusps, the outer 10. — The male reproductive organs show a blade-like, bent verge with a single duct and without any appendages.

Type locality Se Bang Fai River in Laos near Ban Tha Deua, opposite Tat Panom.

Distribution: Mekong River between Tat Panom and Pakse. Se Bang Fai River in Laos and Lam Chi River in Thailand.

Material: Holotype SMRL 3432/A; paratypes 3432/50. — SMRL 3477/3-Lam Chi River at Tha Lalaeng, Mahasarakam Province; 3438/10-Mekong, 12 km N of Bandan, Ubon.

Remark: This species would have been easily considered as a small form of *P. wykoffi* BRANDT, if it were not found in the same area of distribution and if the radula would not have shown constant differences. The radula of the larger *wykoffi* has a rhachis with only 3 basal cusps on either side. The inner marginals have more than 20 cusps, the outer about 15. *P. wykoffi* and *P. prasongi* are never found in mixed populations but closely together.

Pachydrobia wykoffi BRANDT, 1968.

pl. 6 fig. 95.

1968 *Pachydrobia wykoffi* BRANDT, Arch. Moll., 98: 231, pl. 8 fig. 16, textfig. 13 (Mekong between Nakon Panom and Tat Panom).

This species differs from *P. prasongi* by its larger size, thicker shell and less developed dorsal tubercle. *P. spinosa* is smaller than *P. wykoffi*, thinner, and has a pointed spine on the back. *P. crooki* is more slender and less dorso-ventrally compressed.

Size: A 11-12 mm; D 7-8 mm; d 5.0-5.5 mm.

The animals from the type locality show almost no pigmentation at all. The specimens from Bandan, however, showed the typical pigmentation of the genus. Rhachis with 7 cusps on the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 2-1-4, inner marginals with about 21 cusps, outer with 15. In the figure of the radula of this species (1968: 240, textfig. 13) the marginals were exchanged by mistake.

Type locality: Mekong, sand bank about 2 km S of Nakon Panom.

Distribution: Mekong between Nakon Panom and Pakse.

Pachydrobia crooki BRANDT, 1968.

pl. 6 fig. 96.

1968 *Pachydrobia crooki* BRANDT, Arch. Moll., 98: 228, pl. 8 fig. 12, textfig. 10 (Mekong at Bandan).

This species belongs to the group of *Pachydrobia*-species which have a relatively long spire, greenish and transparent texture and lack of tubercle or spine, although sometimes a rudiment of a tubercle may be seen on the back of the body whorl. There are more than 20 ribs on the last whorl. — Aperture obliquely ovate with thick, appressed peristome. Front of the body whorl not flattened.

Size: A 9.5-13 mm; D 5.7-6.5 mm.

Rhachis with 4 small cusps on either side of the mesocone and 4 basal cusps on either side. Laterals with the formula 2-1-5, marginals with 17 or 15 cusps respectively.

Type locality: Mekong River at Bandan, Ubon Province.

Distribution: Mekong from E Thailand to S Laos.

Pachydrobia zilchi zilchi BRANDT, 1968.

pl. 6 fig. 97.

1968 *Pachydrobia zilchi* BRANDT, Arch. Moll., 98: 229, pl. 8 fig. 14, textfig. 17 (Mun River, Thailand).

This species differs from all other species of *Pachydrobia* by its two strong "bosses", one being placed below the dorsal tubercle and one on the last half of the ventral part of the body whorl. These two prominent bosses are generally connected by an obtuse carina which gives the shell a distorted appearance. The ventral side of the body whorl is flattened below the boss. The postnuclear whorls are obtusely ribbed, the body whorl is only striated. Seen from the back, the penultimate whorl appears greatly swollen.

Size: A 8.5-10.5 mm; D 7.5-8.3 mm; d 5.6-6.3 mm.

Rhachis with 7 cusps on the cutting edge and 3 basal cusps on either side. Laterals with 2-1-4 cusps, marginals with 11 and 15-18 cusps.

Type locality Mun River near Ubon Ratchathani, E Thailand.

Distribution Typical form known from the Mun River only.

***Pachydrobia zilchi reducta* n. subsp.**

pl. 6 fig. 98.

A subspecies of a tributary to the Mun River. It differs from the nominate species by its minute size and reduced bosses.

Size A 7.0 mm; D 4.0 mm.

Type locality: Lam Chi River at Gantaravichai, Mahasarakam Province.

Distribution: Known from the type locality only.

Holotype SMRL 3441/A; paratypes 3441/6.

The following genuine *Pachydrobia*-species (several more were described, but do not belong to this genus) are known from Laos and Cambodia and have not yet been found in Thailand. In case the SMRL team has overlooked them in Thailand, a short description of these species is added.

Pachydrobia bertini POIRIER, 1881 (J. de Conch., 29: 15, pl. 2 fig. 2). — The smallest species from the Mekong, of the size and sculpture of *P. siamensis*, but more slender.

Size A 6.6-8.2 mm; D 3.2-3.0 mm. — Mekong, Khong.

Pachydrobia fischeriana POIRIER, 1881 (J. de Conch., 29: 15, pl. 2 fig. 3). — A species, that differs from all other *Pachydrobia* species by its ovate shape, flat whorls and smooth surface.

Size: A 12 mm; D 7 mm. — Mekong at Khong Island.

Pachydrobia harmandi POIRIER, 1881 (J. de Conch., 29: 16, pl. 2 fig. 4). — This species resembles a small *variabilis*; it is elongately conic with few thick ribs on the upper half of the two last whorls. As it lives together with *variabilis* it is certainly a separate species as no intermediate forms are known.

Size A 10 mm; D 4.5 mm. — Mekong at Khong Island.

Pachydrobia scalaroides POIRIER, 1881 (J. de Conch., 29: 17, pl. 2 fig. 6). — This is the largest and thickest of all known species. It is short, with pointed apex and with few nodule-like ribs on the last two whorls.

Size A 16 mm; D 11 mm. — Mekong at Khong Island.

Pachydrobia dubiosa POIRIER, 1881 (J. de Conch., 29: 18, pl. 2 fig. 7). — This is a small, egg-shaped species, similar to *fischeriana*, but still shorter. The last whorl is sculptured with few subsutural nodules.

Size: A 10 mm (16 in the original description is a misprint); D 7 mm. — Mekong at Khong Island.

Pachydrobia mcmulleni BRANDT, 1970 (Arch. Moll., 100: 193, pl. 13 fig. 12). — This species is about as large as *bavayi* but differs from that species by its strong dorsal tubercle. It is bossed at the left side of the body whorl. There are no axial ribs but coarse growth lines.

Size A 8 mm; D 4 mm. — Thonle Thom at Pung Krangcham.

Jullienia CROSSE & FISCHER, 1876.

Shell of medium size for the subfamily, rather solid, barely translucent, with pointed apex and short or moderately long, conic spire and large ovate or semispherical body whorl. All species are covered with a greenish, yellowish or brownish-olive periderm. The sculpture consists of several spiral ridges or rows of tubercles which are rarely obsolete. The face of the body whorl is either flattened or well rounded. — Aperture large, semicircular; peristome very thick, appressed to the penultimate whorl. The columella is compressed but does not form a real septum as in *Lacunopsis*. — Operculum semicircular or oval, thin, paucispiral, corneous, translucent, nucleus placed near the lower half of the columellar margin.

The size never exceeds 10 mm in height or diameter.

The animal is sand-coloured or slate-grey, with black and yellow pigmentation. Rostrum broad and truncate, tentacles about twice the length of the rostrum. The eyes are placed in moderate swellings at the bases of the tentacles. The foot is truncate in front and well rounded behind. — The rhachis of most

Radulae of *Jullienia*:

Species	Rhachis	Laterals	M ₁	M ₂
<i>acuta</i>	$\frac{6-1-6}{4 \quad 4}$	2-1-4	(9-14)	(7-9)
<i>crooki</i>	$\frac{6-1-6}{3 \quad 3}$	2-1-5	12	6
<i>flava</i>	$\frac{(6-7)-1-(6-7)}{(3-4) \quad (3-4)}$	(4-5)-1-(5-7)	(11-12)	(6-8)
<i>harmandi</i>	$\frac{(8-11)-1-(8-11)}{(3-4) \quad (3-4)}$	(0-3)-1-6	(11-16)	(6-7)
<i>microsculpta</i>	$\frac{(4-5)-1-(4-5)}{4 \quad 4}$	2-1-(5-6)	14	9
<i>munensis</i>	$\frac{7-1-7}{3 \quad 3}$	2-1-6	12	8
<i>nucula</i>	$\frac{6-1-6}{3 \quad 3}$	0-1-6	(13-15)	(9-10)
<i>poirieri</i>	$\frac{4-1-4}{4 \quad 4}$	2-1-4	13	8
<i>prasongi</i>	$\frac{6-1-6}{3 \quad 3}$	3-1-3	10	(6-8)
<i>rolfbrandti</i>	$\frac{7-1-7}{3 \quad 3}$	(2-3)-1-5	10	7

of the species of this genus differs from those of other genera by having a multiserrated cutting edge with 6-11 cusps on either side. Only the small species have less cusps. — The male reproductive organ has a blade-like verge without appendages and with a single duct.

Type species: *Melania flava* DESHAYES.

Distribution: Mekong, known from Ban Khum N of Bandan to Kratie in Cambodia; several tributaries to the Mekong.

Biology: The species live on rocks in rapids and feed on algae. The eggs are deposited in single semispherical capsules.

Parasitology: Several thousand specimens of *J. acuta*, *harmandi*, *rolfbrandti* and *munensis* have been examined for cercariae. No cercariae of trematode species which cause diseases in man and mammals have been found. *J. rolfbrandti*, *nucula* and *harmandi* have been exposed to miracidia obtained from a Laotian patient with Schistosomiasis. The miracidia did not accept any snails of these species as intermediate hosts.

Key to the Thai species:

- | | |
|---|-------------------|
| 1. Shell sculptured with several strong spiral ridges | 2 |
| — Shell sculptured with tubercles or few weak spiral ridges | 3 |
| 2. A larger than D, ventral face of body whorl not flattened, generally with 7 spiral ridges | <i>acuta</i> . |
| — A of about the same size as D, ventral face of body whorl flattened, generally with 4 spiral ridges | <i>munensis</i> . |
| 3. Body whorl with 2 or 3 weak spiral ridges or rows of tubercles | <i>harmandi</i> . |
| — Body whorl with more than 4 spiral ridges or rows of tubercles | 4 |
| 4. Shell larger than 7 8 mm, with weak, granulated spiral ridges | <i>crooki</i> . |
| — Shell smaller than 6 : 6 mm, with rows of obtuse tubercles | <i>prasongi</i> . |

Jullienia acuta POIRIER, 1881.

pl. 6 fig. 99.

1881 *Jullienia acuta* POIRIER, J. de Conch., 29: 12, pl. 1 fig. 8 (Mekong, Cambodia).

1904 *Jullienia acuta*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 421 (Me-Khong, Cambodge; Me-Khong à Sambor; Khone et Lakhon, dans les rapides du Me-Khong).

1971 *Jullienia acuta*, — BRANDT & TEMCHAROEN, Arch. Moll., 101: 131 (Laos: Muang Khong; Sompamit Falls. Cambodia: Sambor, Sandan).

This species differs from the type species, *J. flava* (DESHAYES), by its smaller size and stronger spiral ridges. It belongs to the group with ovate body whorl and elevated, conic spire. The ventral face of the body whorl is not flattened. There are 2 or 3 spiral ridges on the middle whorls and 7 (5-8) on the body whorl, 3 of which — rarely 4 — are placed below the periphery.

Size: A 6.2-6.8 mm; D 4.3-4.7 mm.

Radula with trapezoidal rhachis which has a very short upper margin, thus it appears almost triangular. Cutting edge with 6 small cusps on either side. There are 4 basal cusps on either side. The wings are finger-shaped. Laterals with the cusp formula 4-1-6, inner marginals with 9 cusps, outer with 7. — Male reproductive organs with finger-shaped verge which is somewhat compressed. It is simple, without appendages and has a single duct only.

Type locality: Cambodia, Mekong. As no exact locality is given, the Mekong at Muang Khong is herewith designated as type locality. It is proved that HARMAND, the

collector of the type material, has collected at and around Khong Island. This island has been considered by the French scientists to belong to Cambodia.

Distribution Mekong from Ban Khum to Samboc in Cambodia. Lower reaches of the Mun River.

***Jullienia munensis* n. sp.**

pl. 6 fig. 1.

Diagnosis: A species of *Jullienia* CROSSE & FISCHER which differs from the type species by its smaller size, stronger spiral ridges, lower spire and flattened face of its body whorl and by its lower spire. From its closest relative, *J. rolfbrandti* TEMCHAROEN, it differs by its smaller size and stronger spiral ridges which are less numerous.

Description: Shell of medium size for the genus, solid, with short, pointed spire and large body whorl. Rather dull, somewhat translucent, with olive-green periderm. The 4 whorls are convex and separated by a deep suture; they increase rapidly in size. The protoconch is smooth, the penultimate whorl shows 2 spiral ridges and the body whorl 4 (3-5). The third spiral ridge is placed on the periphery, the fourth below it. These ridges are crossed by comparatively strong growth lines. A very weak and irregular spiral microsculpture may be seen under strong magnification. The body whorl measures about $\frac{4}{5}$ of the length of the shell. — Aperture rather large, semicircular; it measures about $\frac{2}{3}$ of the height of the shell. Peristome very thick, connected by a thick, appressed parietal callus. Columella compressed, but it does not form a real septum as in *Lacunopsis*. The parietal and peristomal callus clearly show growth lines. — Operculum semicircular, thin, translucent, paucispiral, nucleus placed near the lower half of the columellar margin.

Size: A 4.2-6.6 mm; D 4.3-5.4 mm; d 3.2-4.1 mm.

Animal grey with black and yellow pigmentation. — Radula with trapezoidal rhachis. The cutting edge of the rhachis is large and triangular. There are 7-8 very small cusps on either side of the small, pointed mesocone. The 3 basal cusps are finger-shaped. Laterals with the cusp formula 2-1-6, inner marginals with 12 cusps, outer with 8. — The male reproductive organs show a simple, blade-shaped verge without appendages and with a single duct.

Type locality: Rapids of the Mun River near Pibun Mangsahan.

Distribution: Lower reaches of the Mun River between Pibun Mangsahan and Tana Falls near Bandan.

Biology: The animals live on rocks in the rapids and feed on algae. The eggs are deposited in single, calcareous capsules.

Parasitology Several thousand specimens have been checked for cercariae. No cercariae of a trematode which infect man or mammals have been found.

Material: Holotype SMRL 3461/A; paratypes 3461/200. — SMRL 3375/10-Mun River at Tana Rapids near Bandan.

***Jullienia crooki* (BRANDT, 1968).**

pl. 6 fig. 2.

1968 *Wykoffia crooki* BRANDT, Arch. Moll., 98: 245, pl. 9 fig. 33, textfig. 24 (Mekong at Bandan and Cham Passak).

This species is in shape very similar to *J. munensis*, but it is much larger, of thinner texture and has 8 or 9 weak spiral ridges.

Shell hemispherical, with short, pointed spire, and large, inflated body whorl. The protoconch is smooth, the next whorl is sculptured with two spiral ridges which are generally dissolved into tubercles or which are at least granulated. On the body whorl there is a third granulated spiral ridge on the periphery and 5-6 weak spiral ridges on the base. — Aperture large, semicircular; peristome thick but less so than *J. munensis* and *J. acuta*. — Operculum typical for the genus.

Size A 7.8-9.2 mm; D 8.1-9.5 mm; d 4.4-4.9 mm.

Rhachis with 6 cusps on either side of the cutting edge and with 3 basal cusps on each side. Laterals with the cusp formula 2(3)-1-6; the inner marginals have 11 cusps, the outer 6-7.

Type locality: Mekong River at Bandan.

Distribution Known from three places in the Mekong: Bandan, 9 km N of Bandan and Cham Passak in Laos.

Jullienia harmandi POIRIER, 1881.

pl. 6 fig. 3.

1881 *Jullienia harmandi* POIRIER, J. de Conch., 29: 10, pl. 1 fig. 4, pl. 3 fig. 3 (radula) (Cambodge).

1889 *Jullienia harmandi*, — MORLET, J. de Conch., 37: 148 (Rapids de Sambor-Mékong, Cambodge).

1904 *Jullienia harmandi*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 421 (Rapides de Sambor, Mé-Khong, Cambodge; Khone, dans les rapides de Me-Khong).

1971 *Jullienia harmandi*, — BRANDT & TEMCHAROEN, Arch. Moll., 101: 131 (Mekong between Bandan and Sambor).

This species belongs to the group of species of *Jullienia* which has a short spire and flattened ventral face of the body whorl. It differs from *J. munensis* n. and *J. rolfbrandti* TEMCHAROEN by its reduced spiral sculpture. The sculpture consists of 2-4 spiral ridges which are generally dissolved into spiral rows of tubercles. These spiral ridges may be obsolete. There are populations which show only an obtuse angle below the suture. — Aperture, peristome and operculum typical for the genus.

Size A 5.0-6.8 mm; D 4.3-5.6 mm; d 3.0-4.4 mm.

Animal typical for the genus. The triangular cutting edge of the rhachis has generally 7-8 (rarely 11) small cusps on either side. There are 4 basal cusps on either side. The laterals have the cusp formula 3(4)-1-5(3-6), the inner marginals have 12-17 cusps, the outer 5-7 — Male reproductive organs typical for the genus.

Type locality: "Cambodge" POIRIER did not give an exact locality. The original specimens were collected by HARMAND either in N Cambodia (between Kratie and Sambor) or at the Papaeng or Sompamit Falls near Khone. *J. harmandi* has not yet been found at Khong Island. As the specimens were collected together with *J. nodulosa* POIRIER, a species which lives in abundance at the Sompamit Falls, but has not been found by the present author between Kratie and Sambor, it is to be assumed that the original material was collected at the Sompamit Falls near Khone, a small village which formerly belonged to Cambodia. This locality is therefore designated as type locality.

Distribution Mekong from Ban Khum N of Bandan to Samboc, N of Kratie. Lower reaches of the Mun River (Tana Falls).

Biology: This species lives on rocks in the rapids and feeds on algae.

Parasitology: This species has been unsuccessfully exposed to miracidia obtained from a Laotian patient with *Schistosoma japonicum*.

***Jullienia prasongi* n. sp.**

pl. 6 fig. 4.

Diagnosis: A species of *Jullienia* CROSSE & FISCHER which differs from its closest relative, *J. harmandi* POIRIER, by its smaller size and by its numerous rows of obtuse tubercles.

Description: Shell small for the genus, rather solid, dull, transparent, with depressed but pointed spire and large, rounded body whorl. The ventral face of the body whorl is flattened but not bordered by a carina. The white shell is covered by an olive-green periderm. The $3\frac{1}{2}$ whorl increase rapidly in size. They are well rounded and separated by a deep suture. The protoconch is smooth, the last two whorls are sculptured with 4 or 5 spiral rows of weak tubercles and the body whorl shows below the periphery 2 or 3 very feeble spiral ridges. — The aperture is large and measures about $\frac{5}{8}$ of the height of the shell. The peristome is continuous, appressed, extremely thick, whitish and shows the growth lines distinctly. — The operculum is semilunar in shape, very thin, transparent, flexible but brittle, paucispiral with basal nucleus.

Size A 5.2-5.7; D 5.1-5.6 mm; d 3.7-4.1 mm.

Soft parts unknown. The radula differs from that of *J. harmandi* by showing 9 small cusps on either side of the rather narrow and broad cutting edge of the rhachis. There are 4 basal cusps on either side, the finger-shaped wing included. The innermost cusps are pointed, the other cusps finger-shaped. The lateral teeth have the formulae (5)4-1-4; M₁ and M₂ have 7 or 8 cusps respectively.

Type locality: Mun River at Tana Falls, 5 km W of Bandan, Pibun Mangsahan District, Ubon Province, Thailand.

Distribution: Known from the type locality only.

Biology The animals sit on rocks and feed on algae.

Holotype SMRL 5142/A; paratypes 5142/10.

Although very similar in shape to *J. harmandi*, it is a different species as it lives together with that species without any intermediate forms and as it shows a quite different dentition of the rhachis.

***Paraprososthenia* ANNANDALE, 1919.**

Shell elongate-conoidal or turreted, with spiral ridges which may be granulous or dissolved into tubercles. — Aperture ovate or rounded, generally rather small. Peristome thin or moderately lipped, often expanded and with protruding outer margin; sometimes with double lip and flattened. — Operculum oval or rounded, thin, corneous, paucispiral, nucleus near the lower half of the columellar margin. The length of the shell rarely exceeds 10 mm.

Animal typical for the subfamily, with black and whitish or sand-coloured pigmentation. — The radula differs from that of the similarly shaped genus

Radula of *Paraprososthenia*:

Species	Rhachis	Laterals	M ₁	M ₂
<i>acicula</i>	$\frac{4-1-4}{2 \quad 2}$	2-1-(7-8)	14	8
<i>adami</i>	$\frac{5-1-5}{4 \quad 4}$	3-1-8	11	9
<i>bollingi</i>	$\frac{5-1-5}{4 \quad 4}$	3-1-8	27	18
<i>brandti</i>	$\frac{5-1-5}{5 \quad 5}$	3-1-8	16	11
<i>davisi</i>	$\frac{3-1-3}{(2-3) \quad (2-3)}$	(3-4)-1-(6-7)	(14-20)	(10-13)
<i>fischerpiettei</i>	$\frac{4-1-4}{(4-5) \quad (4-5)}$	(2-3)-1-(7-9)	(15-16)	(11-12)
<i>hanseni</i>	$\frac{3-1-3}{(3-4) \quad (3-4)}$	3-1-(7-8)	(16-18)	(8-10)
<i>iijimai</i>	$\frac{4-1-4}{4 \quad 4}$	4-1-(11-13)	20	12
<i>hydrorissoidea</i>	$\frac{5-1-5}{3 \quad 3}$	3-1-10	(18-20)	15
<i>levayi</i>	$\frac{3-1-3}{(3-4) \quad (3-4)}$	(2-3)-1-(8-11)	(18-25)	(12-16)
<i>taylori</i>	$\frac{4-1-4}{(4-5) \quad (4-5)}$	(2-3)-1-(7-8)	(20-25)	(12-15)
<i>vivonai</i>	$\frac{(3-4)-1-(3-4)}{2 \quad 2}$	2-1-(9-12)	(15-18)	(12-14)

Remark: *P. adami* BRANDT is known from the Mekong at Sambor in Cambodia only. *P. acicula* BRANDT is found in the Mekong between Khong Island and Sambor. *P. brandti* TEMCHAROEN is known from the Mekong at Sambor and from the Sedone River in Laos. *P. bollingi* BRANDT, *fischerpiettei* BRANDT and *hydrorissoidea* BRANDT are known from Laos and Cambodia only.

Delavaya by having several small cusps on either side of the cutting edge. As *Parapyrgula* ANNANDALE & PRASHAD has a rhachis with a simple cutting edge like that of *Delavaya*, *Parapyrgula* has to be considered a separate genus unless we place it into the synonymy of *Delavaya* HEUDE. There is only one other genus of this subfamily which is elongate and shows spiral ridges: *Hydrorissoia* BAVAY. This genus, however, shows a rhachis with a simple cutting edge as *Delavaya*. There is still some doubt whether the following species are really

conspecific with *Paraprososthenia minuta* ANNANDALE and *P. gredleri* (HEUDE). The first named species is only known from fossil layers in Burma and the anatomy and radula of *gredleri* are still unknown. The shell characters, however, are so similar, that it does not seem to be justified to establish a new taxon for the Thai, Laotian and Cambodian species. The shells are also very similar to species of the genera *Pyrgula*, *Bugesia*, *Micromelania*, *Chilopyrgula* and *Pyrgulopsis*. As far as the animals of these genera are known to the present author, they all seem to differ from Lithoglyphinae by lacking the yellowish pigmentation typical for this subfamily.

Type species *Paraprososthenia minuta* ANNANDALE (fossil).

Distribution: Upper Burma; Yunnan; Mekong from Thailand to Cambodia and several of its tributaries.

Literature ANNANDALE 1919, HEUDE 1889.

Key to the Thai species:

- | | |
|--|----------------------|
| 1. Shell conoidal, with 4-5 spiral rows of tubercles; peristome simple | ... <i>hanseni</i> . |
| — Shell turreted, with spiral ridges on the whole shell or with spiral rows of tubercles on the upper half of the whorls and spiral ridges on the lower half | 2 |
| 2. Shell sculptured with spiral ridges only | 3 |
| — Shell with spiral ridges on the lower half of the body whorl and with spiral rows of tubercles on the upper half | 5 |
| 3. Shell with 4 strong spiral ridges; size more than 8.5 mm; outer margin of peristome protruding | <i>vivonai</i> . |
| — Shell with 6-7 spiral ridges; size under 8 mm; peristome not protruding | 4 |
| 4. Size of shell about 6 : 2.2 mm; peristome simple | <i>davisi</i> . |
| — Size of shell about 8 : 2.9 mm; peristome reflected and flattened | <i>taylori</i> . |
| 5. Size of shell 4.8 : 2.1 mm and larger; base without periomphalic ridge | <i>levayi</i> . |
| — Size of shell 4.5 : 2.0 and smaller; base with periomphalic ridge | <i>ijimai</i> . |

Paraprososthenia levayi (BAVAY, 1895).

pl. 7 fig. 5-6.

1895 *Hydrorissoia levayi* BAVAY, J. de Conch., 43: 92, pl. 6 fig. 6 (Khone dans les rapides du Mékong).

Shell of medium size for the genus, elongately conic or turreted, with 7 regularly increasing whorls which are somewhat convex or almost flat, but separated by a deep suture. The first two whorls are smooth, the remaining whorls are sculptured with 1 or 2 spiral rows of tubercles. These rows of tubercles are sometimes transformed into obtuse spiral ridges or the tubercles consolidate, thus forming short axial riblets. On the base of the body whorl there are generally 2 (1-3) sharp spiral ridges which are very rarely dissolved into tubercles. — Aperture oval or rounded, somewhat exerted from the right side-line of the shell. Peristome continuous, appressed to the penultimate whorl, somewhat expanded at the outer margin, lipped; the lip is generally flattened. — Operculum typical for the genus.

Size A 4.8-5.5 mm; D 2.0-2.3 mm.

Animal grey with black and whitish pigment spots. — Rhachis with a large, triangular cutting edge with large, pointed mesocone and 4 or 5 small cusps on

either side. There are 3 prong-like basal cusps on either side. Laterals with the cusp formula (2-3)-1-(8-11), inner marginals with 18-25 cusps, outer with 12-16.

Type locality Mekong rapids near Khone, Laos.

Distribution Mekong from Ban Khum N of Bandan to Samboc N of Kratie in Cambodia.

Habitat: This species is found on sandy ground in quiet parts of the river as well as on rocks in the rapids.

Parasitology: Miracidia from *Schistosoma* eggs obtained from a Laotian patient, did not accept this species when it was exposed to them in the laboratory.

***Paraprososthenia taylori* BRANDT, 1968.**

pl. 7 fig. 7.

1968 *Paraprososthenia taylori* BRANDT, Arch. Moll., 98: 234, pl. 8 fig. 21, textfig. 14 (Mekong at Bandan).

Shell elongately turreted, vitreous, glossy, young specimens with thin, yellowish periderm. There are 7 almost flat whorls separated by a very shallow suture. The first postnuclear whorl has 2 solid spiral ridges, the next 3 and the following whorls have 4, of which 1 or 2 may sometimes become obsolete. The body whorl has 2 additional spiral ridges below the periphery. When one or two of these ridges become obsolete, the remaining are generally stronger than usual. The two upper spiral ridges are generally granulated. Beside the macrosculpture of spiral ridges there is a delicate spiral microsculpture which is crossed by the fine growth lines. — Aperture ovate; peristome continuous, appressed to the penultimate whorl, outer margin somewhat sinuously produced, adult specimens with flattened lip. — Operculum typical for the genus.

Size A 6.2-7.8 mm; D 2.4-2.9 mm.

Animal typical for the genus. The row of translucent, hemispherical, (?) sensory cells at the truncate front of the foot have not been observed in all other species of the genus and as these cells have also been found in species of other genera of the subfamily, they can not be regarded as typical for the genus. — The radula has a trapezoidal rhachis with triangular cutting edge. The cleft mesocone as found in the holotype is not typical for the species as later other animals with normal, pointed mesocone at the cutting edge were dissected. There are 4 small cusps on either side of the cutting edge and 4-5 basal cusps on either side. The laterals have the cusp formula (2-3)-1-(7-8), the inner marginals have 20-25 cusps, the outer 12-15. In the original description, the two marginals were erroneously exchanged.

Type locality Mekong at Bandan.

Distribution Known from the type locality only.

Habitat The species lives on rocks.

***Paraprososthenia davisii* BRANDT, 1968.**

pl. 7 fig. 8.

1968 *Paraprososthenia davisii* BRANDT, Arch. Moll., 98: 234, pl. 8 fig. 20 (Mekong and Mun River at Bandan).

This species differs from *P. taylori* BRANDT and *levayi* (BAVAY) by its much stronger spiral ridges which are extremely rarely granulated. The aperture is round, the peristome simple, neither protracted at the outer margin nor lipped. There are generally 2 spiral ridges above the periphery, 1 on the periphery and 2 below. Often 1 or 2 ridges are missing, rarely 3 or 4. If four ridges are missing either the ridge on the periphery or the one below it are present. The body whorl measures about half the length of the shell. — Aperture ovate or nearly circular; it is not expanded. Peristome not thickened; it is neither extended nor protracted at the outer margin. — Operculum typical for the genus.

Size A 5.4-6.0 mm; D 1.9-2.5 mm.

Shape, colour and pigmentation of the animal typical for the genus. — Cutting edge of the rhachis with 3 cusps on either side. There are 2 or 3 basal cusps on either side. Laterals with the cusp formula 3(4)-1-7(6), inner marginals with 14-20 cusps, outer with 10-13, generally 17 or 12 cusps respectively.

Type locality Mekong at Bandan.

Distribution: Mekong between Ban Khum N of Bandan and Samboc N of Kratie in Cambodia.

Habitat: This species is found on sandy ground in quiet parts of the river as well as on rocks in the rapids.

Variability: As almost all species of *Paraprososthenia* also *davisi* shows a broad spectrum of variability with regard to size, diameter and sculpture. The spiral ridges may be reduced to 3, 2 or even 1 only. Several specimens have been found in which some of the tubercles are produced into long, sharp spines. These specimens look like a different species, however, all intermediate forms between the typical form and the spiny form are found at the same locality.

***Paraprososthenia vivonai* BRANDT, 1968.**

pl. 7 fig. 9.

1968 *Paraprososthenia vivonai* BRANDT, Arch. Moll., 98: 233, pl. 8 fig. 18 (Mekong at Bandan).

This is the largest species of *Paraprososthenia* in Thailand. It differs from all other species by its size and by its tongue-shaped protrusion of the outer margin of the peristome. The sculpture consists generally of 4 strong, granulated spiral ridges, two of which are seen on the middle whorls. Sometimes there is a third ridge visible just above the suture. The third ridge is on the periphery of the body whorl and a fourth is placed below it. This fourth ridge is often obsolete. There is a very weak periomphalic keel. — The aperture measures about half the height of the body whorl. It is therefore comparatively large for the genus. The base is distinctly angled, the angle corresponding with the periomphalic keel. The peristome is thin-lipped, connected by a thin parietal callus. Its outer margin is protracted in a tongue-like way and shows 3 obtuse angles which correspond with the ends of the three upper carinas. — Operculum typical for the genus.

Size A 8.0-10.2 mm; D 2.9-3.5 mm.

Shape, colour and pigmentation of the animal typical for the genus. — Radula with trapezoidal rhachis. Its cutting edge has 7-9 cusps. There are 2 or 3

basal cusps on either side, rarely 4. Laterals with the cusp formula 2-1-(9-13), inner marginals with 15-18 cusps, outer with 12-14.

Type locality Mekong at Bandan.

Distribution Mekong between Ban Khum and Samboc. Since its description the species has been collected at Ban Khum, 12 km N of Bandan, at Bandan, at the rapids of Cham Passak (Laos), at Khong Island and at Samboc, Cambodia.

***Paraprososthenia iijimai* BRANDT, 1970.**

pl. 7 fig. 10.

1970 *Paraprososthenia iijimai* BRANDT, Arch. Moll., 100: 187, pl. 13 fig. 4, textfig. 4 (Mekong between Bandan and Sambor).

This species differs from its closest relative, *P. levayi* (BAVAY), by its smaller size and its more delicate and more numerous tubercles.

Shell small for the genus, slender, turreted, of dirty-white colour. The embryonic whorls are smooth, the remaining whorls are sculptured with spiral rows of tubercles and spiral ridges. The postnuclear and middle whorls have 2 rows of tubercles, the body whorl shows also a spiral ridge on the periphery and 2 on the base. One ridge of the basal ridges may sometimes be missing. The traces of a third spiral row of tubercles may be seen just above the suture. Rarely the 2 upper spiral rows of tubercles are consolidated into continuous spiral ridges. Each row on the penultimate whorl carries about 14-16 tubercles. — Aperture round, small, peristome somewhat expanded, continuous, appressed to the penultimate whorl, thickened without and flattened. — Operculum typical for the genus.

Size A 3.4-4.9 mm; D 1.3-2.0 mm.

Animal typical for the genus, grey with black and sand-coloured pigmentation. — Radula with trapezoidal rhachis; its cutting edge has 4 (3-5) cusps on either side. There are generally 4 basal cusps on each wing. The laterals have the cusp formula 4-1-12(11-13), the inner marginals have 20 cusps, the outer 12.

Type locality Mekong at Bandan.

Distribution: From Ban Khum, 12 km N of Bandan to Sambor in N Cambodia. One dead specimen was found in the Mun River at Pibun Mangsahan.

***Paraprososthenia hanseni* BRANDT, 1970.**

pl. 7 fig. 11.

1970 *Paraprososthenia hanseni* BRANDT, Arch. Moll., 100: 188, pl. 13 fig. 6, textfig. 6 (Mekong at Bandan, Khong Island and Sambor).

This species differs from all preceding species by its short, conic shape which is more similar to a *Hydrorissoia* than to the previously described species of *Paraprososthenia*. There are several species of this genus known from Laos and Cambodia which also have a comparatively short shell. From these it differs by its 5 regular rows of tubercles.

Shell regularly conic, with 6 almost flat whorls. The postnuclear and middle whorls carry 3 (sometimes only 2, rarely 1) spiral rows of tubercles. There is

a fourth row of tubercles on the periphery of the body whorl and a fifth below the periphery. On the postnuclear whorls these rows of tubercles may sometimes be consolidated to solid spiral ridges. The base of the body whorl is either well rounded or may be somewhat flattened when there is an obtuse keel at the periphery. — Aperture almost round, not expanded. Peristome connected, appressed to the penultimate whorl, thin-lipped, not protracted nor extended. — Operculum typical for the genus.

Size: A 5.5-7.0 mm; D 3.0-3.3 mm.

Animal with few black pigment patches only, but dusted with many small and densely placed orange pigment dots. — Radula with trapezoidal rhachis. Its cutting edge carries 3 or 4 very small cusps on either side. There are 3 or 4 basal cusps on each side. The laterals have the cusp formula 3(2)-1-8(7), inner marginals similar to the laterals with a cusp formula 12-1-4, outer marginals with 8-10 cusps.

Type locality: Mekong at Sambor in Cambodia.

Distribution: Known from the Mekong at Bandan and extralimitarily from Khong Island (Laos) and Sambor in Cambodia.

***Hubendickia* BRANDT, 1968.**

This genus was established for a group of species which differ from *Paraprososthenia* by having axial ribs instead of spiral sculpture and whose shape is generally more cylindrical or fusiform, rarely elongately conoidal. There is only one other genus of this subfamily known which has also an axial sculpture, *Pachydrobia*. The shape of the species of this genus, however, is ovate with conoidal spire and the lip of the peristome is extremely thick. Only one species of this genus was formerly known, *H. sulcata* (BAVAY), which its author had placed in the genus *Pachydrobia*.

Shell cylindrical or fusiform, rarely elongately conoidal with oval body whorl. Sculptured with axial ribs and often with more or less distinct spiral microsculpture. — Aperture rather large, piriform; peristome delicately lipped, often somewhat sinuous. Some species have an alloisthophic or even heterostrophic protoconch. — Operculum oval, corneous, paucispiral, with eccentric nucleus.

The size rarely exceeds 10 : 3.5 mm and is never under 3 : 1.2 mm.

Animal greyish or sand-coloured with black and whitish or yellowish pigmentation. The tentacles are very long and thin. The eyes are placed in moderate swellings at the bases of the tentacles, rarely without swellings. The foot is well rounded behind and truncate in front. Several species show a line of translucent, semispherical sensory cells at the front line. — Radula with trapezoidal rhachis whose cutting edge always carries several lateral cusps. The mesocone may be missing. There are 3-5 basal cusps on either side. Laterals with large mesocone, marginals with numerous cusps. — The verge of the male reproductive organ is somewhat compressed, coiled, simple, with pointed tip; there are no appendages.

Type species: *Hubendickia siamensis* BRANDT.

Distribution: Mekong between Ban Khum in Thailand and Samboc in Cambodia; lower reaches of the Mun River in Thailand.

Biology The species live on sandy ground in quiet parts of the rivers and also on rocks in the rapids. They feed on algae and decaying organic matter.

Parasitology Species of this genus are not accepted by miracidia of *Schistosoma japonicum* from the Mekong Valley.

Radulae of *Hubendickia* species:

Species	Rhachis	Laterals	M ₁	M ₂
<i>cingulata</i>	$\frac{4-1-4}{5 \quad 5}$	3-1-4	10	8
<i>coronata</i>	$\frac{2-0-2}{4 \quad 4}$	1-1-6	12	10
<i>crooki</i>	$\frac{3-0-3}{3 \quad 3}$	2-1-5	13	11
<i>cylindrica</i>	$\frac{3-1-3}{3 \quad 3}$	4-1-14	ca. 50	ca. 40
<i>gochenouri</i>	$\frac{2-1-2}{3 \quad 3}$	2-1-5(6)	(15-17)	(11-13)
<i>rolfbrandti</i>	$\frac{4-1-4}{5 \quad 5}$	3-1-6(5)	(12-17)	(8-10)
<i>schlickumi</i>	$\frac{4-1-4}{4 \quad 4}$	3- 1-5	13	8
<i>schuetti</i>	$\frac{2-1-2}{3 \quad 3}$	2-1-6	(17-19)	(12-13)
<i>siamensis</i>	$\frac{2-1-2}{5 \quad 5}$	2-1-5	13	11
<i>spiralis</i>	$\frac{(3-4)-1-(3-4)}{(4-5) \quad (4-5)}$	2-1-5	(12-13)	(11-12)
<i>sulcata</i>	$\frac{3-1-3}{(4-5) \quad (4-5)}$	2-1-5	(9-13)	(8-9)
<i>tuberculata</i>	$\frac{2-1-2}{4 \quad 4}$	3-1-5	(14-15)	11

Note: *H. rolfbrandti* TEMCHAROEN and *H. sulcata* (BAVAY) are only known from the Mekong in Laos.

Key to the Thai species:

- | | |
|--|---|
| 1. Length of the shell 5.2 mm and above | 2 |
| — Length of shell 5.0 mm and below | 8 |
| 2. Sculptured with axial ribs and/or tubercles | 3 |
| — Sculptured with axial ribs only | 5 |

Shell with ribs and tubercles	4
— Ribs dissolved into 2 spiral rows of tubercles	<i>schuetti</i> .
4. Shell with a subsutural groove which separates a row of tubercles from the ribs . . .	<i>tuberculata</i> .
.	
— Ribs with a subsutural ridge which carries small sharp tubercles	<i>coronata</i> .
5. With distinct microsculpture	6
— Spiral microsculpture obsolete	<i>crooki</i> .
6. Ribs rudimentary at the periphery, shell with 2 very weak keels on the upper half of the whorls	<i>gochenowri</i> .
— Ribs not rudimentary, without any traces of a keel	7
7 Apex homoeostrophic, spiral sculpture very strong; Mekong River	<i>spiralis</i> .
— Apex alloistrophic, spiral sculpture moderately strong; Mun River	<i>siamensis</i> .
8. Shell without spiral sculpture, axial ribs continuous, widely placed	<i>cylindrica</i> .
— Shell with spiral microsculpture, ribs dissolved into tubercles or very weak	9
9. Ribs dissolved into 2 rows of tubercles, diameter 1.6 mm and smaller . . .	<i>schlickumi</i> .
— Ribs reduced to striae; with 3 traces of spiral ridges; diameter of shell 1.9 mm and larger	<i>cingulata</i> .

Hubendickia siamensis BRANDT, 1968.

pl. 7 fig. 12.

1968 *Hubendickia siamensis* BRANDT, Arch. Moll., 98: 236, pl. 8 fig. 22, textfig. 15 (Mun River at Pibun Mangsahan).

Shell thin, translucent, yellowish, cylindrical with conic spire and heterostrophic apex. The embryonic whorls are smooth, the other whorls are sculptured with strong axial ribs which are crossed by spiral microlines. There are 14-16 ribs on the penultimate whorl. The body whorl measures about $\frac{4}{7}$ of the height of the shell. Sometimes there is an obtuse carina around the umbilical pit. Below this carina the ribs become obsolete. — The oval aperture is rather large and measures about $\frac{1}{3}$ of the length of the shell. Peristome with thin lip, not continuous, connected by a thin parietal callus. Outer margin well curved. — Operculum typical for the genus.

Size A 6.4-7.7 mm; D 2.8-3.4 mm.

Type locality: Mun River at Pibun Mangsahan.

Distribution Lower reaches of the Mun River.

Hubendickia spiralis BRANDT, 1968.

pl. 7 fig. 13.

1968 *Hubendickia spiralis* BRANDT, Arch. Moll., 98: 237, pl. 8 fig. 24 (non 23!), textfig. 16 (Mekong at Bandan).

Shell of the same shape and colour as *H. siamensis* but somewhat smaller. The spiral microsculpture is much stronger, but the axial ribs are much weaker than in *H. siamensis*. The spiral sculpture gives the surface a silky lustre. The ribs are thickened below the suture and flattened at the periphery. The body whorl measures about $\frac{1}{2}$ of the length of the shell. — Aperture, peristome and operculum like those of the type species.

Size: A 5.5-6.5 mm; D 2.6-3.0 mm.

Animal typical for the genus but with much stronger black pigmentation than in the type species. — Cutting edge of the rhachis with 3 or 4 lateral cusps; there are 5 basal cusps on either side. Laterals with the cusp formula 2-1-5, inner marginals with 12-13 cusps (2 or 3 of which are extremely small) and outer with 11-12.

Type locality: Mekong River at Bandan.

Distribution: Known from the Mekong between Kemmarath and Sambor in N Cambodia.

Hubendickia tuberculata BRANDT, 1968.

pl. 7 fig. 14.

1968 *Hubendickia tuberculata* BRANDT, Arch. Moll., 98: 237, pl. 8 fig. 23 (non 24) (Mekong at Ban Khum).

This species differs from all other species of the genus by its subsutural groove which separates the upper part of the ribs from the remaining part, thus forming a subsutural spiral row of tubercles. The shell is also somewhat smaller than those of the preceding species. — Aperture, peristome and operculum typical for the genus.

Size: A 5.2-5.8 mm; D 1.6-1.9 mm.

Rhachis of the radula with 5 cusps at the cutting edge and 4 basal cusps on either side. Laterals with the cusp formula 3-1-5, inner marginals with 15 cusps, outer with 11.

Type locality: Mekong at Ban Khum, N of Bandan.

Distribution: Known from the Mekong at Ban Khum and Bandan. Extralimitarily known from Laos.

Hubendickia crooki BRANDT, 1968.

pl. 7 fig. 15.

1968 *Hubendickia crooki* BRANDT, Arch. Moll., 98: 240, pl. 9 fig. 28, textfig. 18 (Mekong at Bandan).

This species differs from all other species by its rudimentary spiral sculpture and by its glossy surface. Shape and costulation are similar to those of *H. cylindrica* n. but this species is much larger and its radula shows conspicuous differences.

Shell of medium size for the genus, cylindrical or somewhat fusiform, thin, translucent, whitish. Apex homoeostrophic, embryonic whorls smooth, the remaining whorls are sculptured with obtuse, axial ribs; there are 10-12 ribs on the penultimate whorl. These ribs become obsolete at the base of the body whorl. The spiral microsculpture is either completely missing or delicate traces of it may be seen under very strong magnification. The cylindrical body whorl measures about $\frac{4}{7}$ of the length of the shell. — Aperture ovate, about half the length of the body whorl; peristome thin-lipped, outer margin curved, connected by a thin parietal callus. — Operculum typical.

Size: A 6.0-6.8 mm; D 2.1-2.8 mm.

Animal typical for the genus. — Radula with trapezoidal rhachis; its cutting edge is very broad and low and has 3 very small cusps on either side but no genuine mesocone. Laterals with the cusp formula 2-1-5. There are 3 basal cusps on either side. Inner marginals with 13 cusps, outer with 11.

Type locality Mekong at Bandan.

Distribution Known from the Mekong around Bandan only.

Hubendickia gochenouri BRANDT, 1968.

pl. 7 fig. 16.

1968 *Hubendickia gochenouri* BRANDT, Arch. Moll., 98: 238, pl. 8 fig. 25 (Mekong at Ban Khum).

This species differs from *H. crooki* by its more cylindrical shape, distinct spiral microsculpture and by its ribs being obsolete in the middle at the periphery. Above and below the periphery the remainder of the ribs form very obtuse keels.

Shell rather large for the genus, elongately cylindrical, rarely turreted, whitish or yellowish, thin, translucent. The embryonic whorls are smooth and somewhat convex, the other of the 7 whorls are almost flat and sculptured with axial ribs. These ribs are irregularly placed, obtuse and are weaker or rudimentary at the periphery. The penultimate and antepenultimate whorls are somewhat shouldered, the body whorl shows a very obtuse keel each below and above the periphery. There are traces of a very delicate spiral microsculpture. — Aperture, peristome and operculum typical for the genus.

Size: A 7.2-8.8 mm; D 2.6-3.0 mm.

The animal is typical for the genus. — The rhachis has 3 basal cusps on either side and 5 cusps at the cutting edge. Laterals with the cusp formula 2-1-5(6), inner marginals with 15-17 cusps, outer with 12-13.

Type locality: Mekong at Ban Khum, N of Bandan.

Distribution: Known from the Mekong at the type locality and at Bandan.

Hubendickia schuetti (BRANDT, 1968).

pl. 7 fig. 17.

1968 *Paraprososthenia schuetti* BRANDT, Arch. Moll., 98: 232, pl. 8 fig. 17 (Mekong at Bandan).

This species differs from *H. gochenouri* BRANDT by having the axial ribs reduced to 2 spiral rows of tubercles. Therefore it was originally placed in the genus *Paraprososthenia*, but as the tubercles do not originate from dissolved spiral ridges but from axial ribs its place is in this genus.

Shell large for the genus, cylindrical, with homoeostrophic apex and smooth embryonic whorls. The remaining of the 6½ almost flat whorls are sculptured with 2 spiral rows of tubercles which originate from dissolved ribs. There are about 10-12 tubercles in each row on the penultimate whorl. The body whorl may show a very obtuse keel. The fine growth lines are crossed by a delicate spiral microsculpture. This sculpture is less distinct than in *H. spiralis* and *H. siamensis*, but much coarser than in *H. crooki*. — Aperture retracted above

and below; peristome not continuous, connected by a thin parietal callus; it is distinctly protacted at the outer margin. — Operculum typical for the genus.

Size A 7.5-9.3 mm; D 2.8-3.3 mm.

Rhachis with 5 cusps at the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 2-1-6, inner marginals with 18 cusps, outer with 13. — The verge of the male reproductive organs is blade-like compressed; it is sharply bent and ends in a pointed tip. There is only a single duct and no appendage.

Type locality Mekong at Bandan.

Distribution: Mekong around Bandan.

Hubendickia coronata BRANDT, 1968.

pl. 7 fig. 18.

1968 *Hubendickia coronata* BRANDT, Arch. Moll., 98: 239, pl. 9 fig. 26 (Mekong at Ban Khum).

This species differs from *H. spiralis* BRANDT by having the subsutural thickenings of the ribs connected by a more or less strong subsutural spiral ridge. The spiral microsculpture is much weaker, the shell therefore glossy and not silky.

Shell of medium size for the genus, elongately turreted or fusiform, yellowish, translucent, somewhat glossy, more so when the periderm is removed. The apex is homoeostrophic or alloistrophic, the postnuclear whorls are distinctly convex, the last whorls are flattened. The embryonic whorls are smooth, the other whorls are sculptured with obtuse ribs, about 11-12 on the penultimate whorl. Below the suture this axial sculpture is produced into a spiral row of sharp tubercles. These tubercles may be connected by a more or less strong spiral ridge. Often a second spiral row of very weak tubercles may be seen above the periphery. — Aperture beside the upper insertion with an angle which corresponds with the ridge, otherwise aperture, peristome and operculum are typical for the genus.

Size: A 6.6-8.6 mm; D 2.8-3.2 mm.

Animal typical for the genus. — Radula with trapezoidal rhachis; its cutting edge has 2 cusps on either side but like in *H. crooki* no mesocone. Laterals with the cusp formula 1-1-6, inner marginals with 12 cusps, outer with 10.

Type locality Mekong River at Ban Khum, N of Bandan.

Distribution Known from the Mekong between Ban Khum and Cham Passak.

Hubendickia cylindrica n. sp.

pl. 7 fig. 19.

Diagnosis: A species of *Hubendickia* BRANDT which differs from *H. schlickiumi* by its stout, cylindrical shape and distantly placed axial ribs. From all other species it differs by its small size.

Description: Shell small for the genus, slender specimens cylindrical, broad specimens somewhat turreted. Thin, translucent, whitish, vitreous, glossy, fragile; with 5-5½ convex whorls. Apex homoeostrophic; the first 2½ (em-

bryonic) whorls are smooth, the other 3 whorls are sculptured with distantly placed, obtuse ribs. There are 9-11 ribs on the penultimate whorl. These ribs may partly become obsolete. Growth lines very delicate, spiral microsculpture even under strong magnification not observed. However, several specimens show spiral lines within the shell material which may simulate a spiral sculpture. The body whorl measures about half the size of the shell. — The aperture is small, ovate, angled above, only moderately protracted at the outer margin. It measures about half the height of the body whorl. The peristome is thin-lipped, connected by a thin parietal callus; outer margin somewhat protracted. — Operculum oval, thin, translucent, paucispiral, nucleus near the lower half of the columellar margin.

Size A 3.0-4.5 mm; D 1.4-2.0 mm.

No data on the soft parts can be given as only desiccated animals were available for description. The radula has a trapezoidal rhachis with 7 cusps at the cutting edge and 3 basal cusps on either side. The laterals have the cusp formula 4-1-14, the inner marginals have about 50 cusps, the outer about 40. This radula differs considerably from those of the other species of *Hubendickia*.

Type locality Mekong at Bandan.

Distribution Mekong at Bandan, at Ban Khum and opposite Bandan. Mouth of the Mun River at Bandan.

Material Holotype SMRL 5099/4; paratypes 5099/100. — SMRL 16071/20-Mekong opp. Bandan; 5117/20-Mekong at Ban Khum; 5141/5-Mouth of Mun River.

***Hubendickia cingulata* n. sp.**

pl. 7 fig. 20.

Diagnosis: A species of *Hubendickia* BRANDT which differs from its closest relative, *H. rolfbrandti* TEMCHAROEN, by its much smaller size and from all other species of this genus by its 3 weak spiral ridges.

Description: Shell small for the genus, fusiform or somewhat elongately conoidal, thin but solid, yellowish-vitreous, translucent, somewhat glossy, with 6 convex whorls. The first two whorls are smooth, the other whorls are sculptured with coarse, irregular and distantly placed riblets. These carry 3 spiral rows of very delicate tubercles which are generally confluent and thus form 3 weak spiral ridges, one below the upper suture, one above the lower suture and one below the periphery of the body whorl. The distance between the two upper ridges is almost double the distance between the 2nd and the 3rd ridge. The riblets may be obsolete and the axial sculpture therefore reduced to coarse growth lines only. There is no spiral microsculpture or only rudimentary traces of it. The body whorl measures $\frac{5}{8}$ of the length of the shell. — Aperture ovate, large, almost $\frac{3}{8}$ of the length of the shell, somewhat extended. Peristome moderately lipped, well curved and somewhat expanded at the base and the outer margin; this is slightly sinuous. — Operculum ovate, thin, brittle, translucent, paucispiral; nucleus placed near the lower half of the columellar margin.

Size A 3.7-5.0 mm; D 1.9-2.4 mm.

Animal slate-grey with numerous black pigment spots dusted over all parts of the body and with large black patches on the mantle lobe. No yellowish pigmentation was seen in the examined specimens as they were preserved in

alcohol. The broad rostrum is truncate in front. The thin, round tentacles measure about twice the length of the rostrum. The eyes are placed in moderate swellings at the bases of the tentacles. — The radula has a trapezoidal rhachis; its cutting edge has 7 cusps. There are 5 basal cusps on either side. Laterals with a cusp formula 3-1-6, inner marginals with 10 cusps, outer with 8. — Male reproductive organs with a comparatively large verge. This is bent, laterally compressed and ends in a pointed tip. It has a single duct and no appendages.

Type locality: Mekong at Bandan.

Distribution: Known from the Mekong around Bandan only.

Material Holotype SMRL 5100/A; paratypes 5100/70. — SMRL 5121/30-Mekong at Ban Khum, 12 km N of Bandan.

Remarks: This species looks like a very small race of *H. rolfbrandti* and as it also shows a very similar radula, it may well be united with that species. However, very close to the type locality of this species, a population of extremely large specimens of the Laotian *rolfbrandti* was found. As long as no intermediate forms are known, *cingulata* may be considered a good species.

Hubendickia schlickumi (BRANDT, 1968).

pl. 7 fig. 21.

1968 *Paraprososthenia schlickumi* BRANDT, Arch. Moll., 98: 233, pl. 8 fig. 19 (Mun River at Pibun Mangsahan).

This is the smallest known species of the genus. The axial ribs are dissolved into 2 spiral rows of tubercles. Because of these tubercles, the author had placed this species in the genus *Paraprososthenia*.

Size A 3.2-3.8 mm; D 1.2-1.6 mm.

When the species was described the radula was still unknown. The cutting edge of the rhachis has 9 cusps and there are 4 basal cusps on either side. Laterals with the formula 3-1-5, inner marginals with 13, outer with 8 cusps.

Type locality: Mun River at Pibun Mangsahan.

Distribution: Mun River and Mekong around Bandan.

Manningiella BRANDT, 1970.

The species of this genus differ from those of *Hubendickia* by either their lack of axial sculpture or their ovate shape. The peristome is generally thicker than that of *Hubendickia*, the aperture extended and the outer margin of the peristome is not protracted as in *Hubendickia*.

Shell ovate, ovate-conoidal or rarely somewhat cylindrical or pupaeform. Surface generally without axial or spiral macrosculpture, (only one species is sculptured with axial striae or riblets), but sometimes with spiral microsculpture. — Aperture large, often expanded, angled above and well rounded below. Peristome connected by a parietal callus, somewhat extended, with thin lip which often merges into brown with age; sometimes somewhat protracted below the columella. — Operculum typical for the subfamily. The length of the shell never exceeds 8 mm but in truncate species sometimes measures less than 3 mm.

The animal is typical for the subfamily. The pigmentation consists of black dots and patches and of yellow, orange-coloured or sand-coloured granules. —

The radula has a trapezoidal rhachis with serrated cutting edge. There are generally 7-9 cusps on the cutting edge and 3-5 basal cusps. — Male reproductive organs typical for the subfamily with simple verge without appendages and with a single duct.

Type species: *Manningiella polita* BRANDT, 1970.

Distribution: Known from the Mekong and several of its tributaries from Ban Khum to Samboc in Cambodia.

Remarks: This genus is not a homogenous systematic unit as it contains all those species which do not belong to any of the other genera. *M. pellucida* (BAVAY), described as a *Pachydrobia*, has the shape of a *Hubendickia* but a smooth surface and an aperture similar to that of the more ovate type species. *M. incerta* is ovate, has an axial sculpture but the aperture is neither thick-lipped as in *Pachydrobia* nor is its outer margin protracted as in *Hubendickia*. The aperture is similar to that of *M. microsculpta* or *M. rolfbrandti* TEMCHAROEN. Two species assigned to this genus differ from the other species by having the peristome protracted below the columella: *expansa* BRANDT and *cambodiensis* BRANDT. They differ also from the other species by being often truncate. They also show a thick periderm as does *M. incerta*. We can recognize several groups ("Formenkreise") of species. These are:

- 1) The type species *M. polita* with *M. pellucida* (BAVAY),
- 2) *M. expansa* with *M. cambodiensis* BRANDT,
- 3) *M. microsculpta*, *M. subulata* and a still undescribed species from Cham Passak,
- 4) *M. rolfbrandti* and *M. incerta* TEMCHAROEN,
- 5) *M. conica* TEMCHAROEN.

Radulae of *Manningiella*:

Species	Rhachis	Laterals	M ₁	M ₂
<i>cambodiensis</i>	(2)3-1-3(2)	4-1-3	17	15
	(3)4 4(3)			
<i>expansa</i>	3-1-3	2-1-5	(11-14)	(8-10)
	3(4) (4)3			
<i>incerta</i>	4-1-4	—	—	—
	3 3			
<i>microsculpta</i>	3-1-3	3-1-4	14	10
	5 5			
<i>pellucida</i>	(4)3-1-3(4)	1-1-5	15	10
	4 4			
<i>polita</i>	4-1-4	4-1-6	(13-15)	11
	4 4			
<i>rolfbrandti</i>	3-1-3	3-1-4	9	6
	4 4			

Key to the Thai species:

- | | |
|---|----------------------|
| 1. Shell without axial ribs or striae | 2 |
| — Shell with axial riblets | <i>incerta.</i> |
| 2. Peristome not protracted below the columella | 3 |
| — Peristome protracted below the columella | <i>expansa.</i> |
| 3. Shell without spiral microsculpture | . . . 4 |
| — Shell with spiral microsculpture | <i>microsculpta.</i> |
| 4. Shell cylindrical or ovate, corneous | 5 |
| — Shell regularly conic, diaphanous | <i>conica.</i> |
| 5. Shell ovate or ovoidal-conic | <i>polita.</i> |
| — Shell cylindrical or turreted | 6 |
| 6. Size 3.5 : 1.5 mm | <i>subulata.</i> |
| — Size 5.5 : 2.5 mm | <i>pellucida.</i> |

Manningiella polita BRANDT, 1970.

pl. 7 fig. 22.

1970 *Manningiella polita* BRANDT, Arch. Moll., 100: 195, pl. 13 fig. 13, textfig. 13 (Mekong at Bandan and Ban Khum, mouth of Mun River at Bandan).

Shell oval or ovate-conoidal, rarely somewhat cylindrical. In shape similar to a *Mastus* or *Ena*. Thin but solid, corneous, transparent, hardly glossy. The sculpture is restricted to the delicate growth lines. Sometimes the shell is variegated with corneous and straw-coloured stripes. — The peristome is a little expanded; it is rather thin, but less so than in *M. pellucida* (BAVAY).

Size: A 3.5-5.1 mm; D 2.2-2.7 mm.

The animal is typical for the genus. It shows black and sand-coloured pigment spots. — Rhachis with 4 cusps on either side of the cutting edge. Laterals with the cusp formula 3-1-6, inner marginals with 13-15 cusps, outer marginals with 10-12. The large mesocone of the laterals is serrated on the inner side.

Type locality: Mekong at Bandan in Thailand.

Distribution Known from the Mekong between Ban Khum and Bandan, from the mouth of the Mun river at Bandan and from the rapids 2 km S of Bandan. No living specimens have been collected in Laos and Cambodia, but 4 dead shells were obtained from the Mekong branch near the Sompamit Falls SW of Khone in S Laos.

Habitat The species lives together with *Pachydrobia wykoffi*, *P. crooki* BRANDT and with species of the genera *Hubendickia* BRANDT, *Paraprososthenia* ANNANDALE and *Stenothyra* BENSON on sandy ground of the river, rarely on rocks in quieter parts near the rapids, never in strong current.

Manningiella microsculpta (BRANDT, 1968).

pl. 7 fig. 23.

1968 *Hubendickia microsculpta* BRANDT, Arch. Moll., 98: 239, pl. 9 fig. 27, textfig. 17 (Mekong at Bandan).

This species was originally described as a *Hubendickia*. Lack of axial sculpture, shape and characteristics of the aperture, however, let appear an assignation to this genus more appropriate.

This species differs from all other species of the genus by its delicate but distinct spiral microsculpture. It is much smaller than the preceding species and its aperture is not expanded.

Shell rather small for the genus, slender, elongately ovate, conoidal or fusiform, corneous, translucent, solid but not thick; sculptured with spiral microlines which are crossed by the growth lines, thus giving the shell a silky lustre. The body whorl measures $\frac{6}{8}$ of the length of the shell. — The aperture is ovate, not expanded; it measures about $\frac{2}{3}$ of the height of the body whorl. Peristome not reflected or lipped, but rather thick; it is connected by a thick parietal callus.

Size A 3.6-4.8 mm; D 1.6-1.8 mm.

The back of the animal is dusted all over with black and sand-coloured pigment spots. — The cutting edge of the rhachis has 7 cusps. There are 5 basal cusps on either side. Laterals with the cusp formula 3-1-4, inner marginals with 14 cusps, outer with 10. — Male reproductive organs typical for the genus.

Type locality Mekong at Bandan.

Distribution Mekong around Bandan and mouth of Mun River at Bandan. Three specimens from the Sompamit Falls in S Laos may have been washed downstream as this species has never been found alive near Khong and Khone.

***Manningiella expansa* BRANDT, 1970.**

pl. 7 fig. 24.

1970 *Manningiella expansa* BRANDT, Arch. Moll., 100: 196, pl. 13 fig. 14, textfig. 14 (Mekong at Bandan, Khong Island and Sambor).

This species differs from the type species by its thick olive-coloured periderm and the more expanded peristome which is distinctly protracted below the columella. Young and uncorroded specimens are of ovate-conoidal shape, those with eroded and obtuse spire are oval or pupaeform. The 6 whorls are almost flat; the body whorl measures about $\frac{1}{2}$ of the length of the shell — Aperture obliquely ovate with straight parietal margin, somewhat funnel-like extended. Peristome thick but not lipped, glossy, brownish; at the base of the columella the peristome is distinctly protruding.

Size A 4.0-8.2 mm; D 2.0-4.0 mm.

The animal is slate-coloured. There are conspicuous orange or lemon-coloured pigment patches on the tip of the rostrum and the tentacles. The body is dusted with fine black pigment dots which are mixed with dots of yellowish pigmentation. This mixed pigmentation gives the animal a brownish tint which covers the grey ground colour. — The radula shows a rhachis with triangular cutting edge and 3 (rarely 4) cusps on either side of the mesocone. There are 3 basal cusps in either side. Laterals with the cusp formula 3-1-4, inner marginals with 10-12 cusps, outer marginals with 8.

Type locality: Mekong at Muang Khong in Laos.

Distribution: Known from the Mekong between Bandan in Thailand and Sandan in N Cambodia.

Habitat: Lives on sandy ground as well as on rocks in stronger current.

Parasitology: This species has been one of the few species from the Mekong which were successfully infected with miracidia from *Schistosoma* obtained from human patients in the Mekong valley, though no cercariae developed.

Manningiella pellucida (BAVAY, 1895).

pl. 7 fig. 25.

1895 *Pachydrobia pellucida* BAVAY, J. de Conch., 43: 88, pl. 5 fig. 3 (Khone et Lakhone, sur le Mékong, dans les rapides).

1971 *Manningiella pellucida*, — BRANDT & TEMCHAROEN, Arch. Moll., 101: 125, textfig. 10 (Laos: Mekong at Cham Passak, Khong Island, Khone, Sompamit Falls).

This species differs from the type species of this genus by its long, cylindrical shell and the less expanded aperture with sharp peristome. The shell is rather thin and very translucent. It is smooth except for the delicate growth lines.

Size: A 5.5-6.5 mm; D 2.4-2.6 mm.

Animal typical for the genus. — Rhachis with 7-9 cusps on the cutting edge and 4 basal cusps on either side. Laterals with the cusp formula 1-1-5, inner marginals with 15 cusps, outer with 10. — Male reproductive organs typical for the genus.

Type locality: Mekong, rapids between Khone and Sompamit Falls, 2 km SW of Khone, Laos.

Distribution: Mekong in S Laos. Some dead specimens from Bandan are assigned to this species with hesitation.

Manningiella conica TEMCHAROEN, 1971.

pl. 7 fig. 25a.

1971 *Manningiella conica* TEMCHAROEN, Arch. Moll., 101: 98, pl. 6 fig. 7 (Mekong at Ban Na on Khong Island).

This species differs from the preceding species by its regular conic spire and greyish periderm. Aperture rather large, ovate, angled above and well rounded below. The margin is sharp and somewhat reflected at the base. — Animal whitish-grey with few larger black pigment patches. Rhachis with 7-9 cusps on the cutting edge and 3-4 basal cusps on either side.

Type locality: Mekong at Ban Na at Khong Island, Laos.

Distribution: Known from the Mekong between Kemmarath and Khone.

Manningiella incerta (TEMCHAROEN, 1971).

pl. 7 fig. 26.

1971 *Hubendickia incerta* TEMCHAROEN, Arch. Moll., 101: 95, pl. 6 fig. 5, textfig. 5 (Mekong between Khong and Khone).

This species differs from all preceding species by its axial sculpture which either consists of very coarse striae or obtuse riblets. The shell is ovate or ovate-conoidal, either with pointed, conic spire or short, convex spire. — Aperture piriform, angled above and well rounded below. Peristome thin-lipped, the lip becomes brownish with age; the connecting parietal callus is straight or somewhat concave.

Size: A 3.8-5.0 mm; D 2.4-2.9 mm.

Animal typical for the genus. The yellowish pigmentation is sand-coloured or whitish. — The rhachis carries 9 cusps at the cutting edge. There are 3 basal cusps on either side.

Type locality Mekong at Ban Na on Khong Island.

Distribution Mekong at Bandan; extralimarily known from Khong Island and Khone in Laos.

Remarks: This species has the shape of a *Pachydrobia*, the sculpture of a *Hubendickia* and the aperture of a *Manningiella*.

Manningiella subulata BRANDT, 1971.

pl. 7 fig. 27.

1971 *Manningiella subulata* BRANDT in BRANDT & TEMCHAROEN, Arch. Moll., 101: 112, fig. 1 (Mekong about 20 km N of Bandan).

This is the smallest of a group of species assigned to the genus *Manningiella*. It is similar to *M. microsclupta* but much smaller and without the distinct microsculpture typical for that species.

Shell very small, subulate, rather thin but solid, whitish, somewhat glossy, with delicate growth lines and partial rudiments of a very delicate spiral sculpture. The 6 whorls increase slowly in size; they are moderately convex and separated by a simple suture. The body whorl measures about half the length of the shell. — Aperture ovate, pointed above and well rounded below. It measures about $\frac{4}{7}$ of the height of the body whorl. Peristome sharp, connected by a very thin parietal callus; columella short, curved. — Operculum very thin, paucispiral, translucent, with eccentric nucleus. — Soft parts and radula unknown.

Size (holotype): A 3.5 mm; D 1.3 mm.

Type locality: Mekong about 20 km N of Bandan.

Distribution Known from the type locality only.

Hydrorissoia BAVAY, 1895.

This genus was established by BAVAY (1895: 90) for two species, *H. elegans* BAVAY and *H. levayi* BAVAY which he described in the same paper. Examination of the latter species has proved that *levayi* belongs to that group of species from the Mekong drainage which is now tentatively placed in the genus *Paraprososthenia* ANNANDALE. Another species beside the type species of this genus was known from the Mekong before the present author and TEMCHAROEN (1968, 1970, 1971) described several new species from Laos, Thailand and Cambodia. It was *H. elongata* (BAVAY). However, it was described as a *Pachydrobia*. In 1968 the present author described a *Hydrorissoia*, *H. hospitalis*, which seems to be nothing but a smaller, stouter and more strongly sculptured form of *H. elongata* from Khong.

Hydrorissoia comprises several small species from the Mekong drainage which show a more or less strong spiral sculpture and a thick-lipped peristome like that of *Pachydrobia* and *Pachydrobiella*. From *Pachydrobia* it is distinguished by its smaller size, spiral sculpture and by its rhachis having a simple cutting edge without lateral cusps. From the closely related monotypical genus *Pachydrobiella* THIELE, *Hydrorissoia* differs mainly by its sculpture.

Shell elongately ovate-conoidal, small for the subfamily, generally with more or less strongly developed spiral ridges which may be granulated or dis-

solved into spiral rows of tubercles. — Aperture ovate, with thickly lipped peristome. — Operculum typical for the subfamily. Rhachis with a simple, triangular cutting edge. The size rarely exceeds 4.5 mm. The male reproductive organs show a curved verge which is somewhat flattened.

Paraprososthenia ANNANDALE, another genus with spiral sculpture, includes several species which are very similar in shape to *Hydrorissoia*. They differ, however, by their thin peristome and by having a serrated cutting edge at the rhachis.

Type species: *Hydrorissoia elegans* BAVAY.

Distribution: Mekong between Khemmarat Rapids in Thailand and rapids of Samboc in Cambodia. Mun River (Thailand) and Srepok River (Cambodia), two tributaries to the Mekong, but probably in many more still unexplored tributaries.

Key to the Thai species:

1. Size 4 : 2.3 mm and larger, generally with 5-6 strong spiral ridges *elegans*.
— Size smaller than 3.6 : 2.3 mm, generally with 2-4 weak spiral ridges 2
2. Spire regularly conic, aperture $\frac{1}{2}$ the size of the shell or more, D generally larger than 1.8 mm 3
— Spire almost cylindrical, aperture less than $\frac{1}{2}$ the length of the shell, exerted, D generally smaller than 1.8 mm *gracilis*.
3. Shell ration 7 : 4, height of the aperture about $\frac{1}{2}$ of that of the shell, aperture hardly exerted *munensis*.
— Shell ratio 3 : 2, height of aperture more than $\frac{1}{2}$ of that of the shell, aperture distinctly exerted *trispiralis*.

Radulae of the species:

Species	Rhachis*)	Laterals	M ₁	M ₂
<i>elegans</i>	4-5 4-5	1-1-6	12	7
<i>elongata</i>	3 3	(2-3)-1-4	9	6
<i>gracilis</i>	4 4	2-1-4	11	7
<i>hospitalis</i>	2-3 2-3	2-1-4	9	6
<i>munensis</i>	3 3	(1-2)-1-4	9	6
<i>paviei</i>	3 3	2-1-2	7	5
<i>trispiralis</i>	4 4	3-1-5	7	6
<i>waltoni</i>	2 2	2-1-2	6	(4-5)

*) basal cusps only as the cutting edge is simple.

Hydrorissoia elegans BAVAY, 1895.

pl. 8 fig. 28.

1895 *Hydrorissoia elegans* BAVAY, J. de Conch., 43: 91, pl. 6 fig. 5 (Khone et Lakhone, sur le Mekong).

The specific characteristics of the type species are: The elongately conic shell is large (4.5 mm) compared with other known species. Of the 6 whorls, the first two are smooth, the next two bear 2 spiral ridges, the fifth shows 3 and the body whorl generally 5 spiral ridges. On the last two whorls the two upper ridges are ornate with distinct tubercles. The body whorl measures about $\frac{3}{4}$ of the height of the shell. — Aperture comparatively large, $\frac{3}{5}$ of the body whorl

with the typical thick peristome which under strong magnification shows the distinct growth lines.

Size A 4.0-4.5 mm; D 2.3-2.6 mm.

Animal typical for the genus. — Rhachis almost triangular, with a long and narrow cutting edge which is narrowed in the middle and carries 1 pointed cusp; there are 4-5 basal cusps on either side.

Type locality Mekong at the rapids near Khone, Laos.

Distribution Mekong between Bandan and Kratie. — The populations in Thailand show a less sharp costulation than those from Laos and are on the average smaller. This, however, does not justify a taxonomic separation.

Hydrorissoia trispiralis BRANDT, 1968.

pl. 8 fig. 29.

1968 *Hydrorissoia trispiralis* BRANDT, Arch. Moll., 98: 243, pl. 9 fig. 31, textfig. 22 (Mekong at Bandan).

This species differs from the type species by its smaller size, stouter shape, blunter apex and by showing 3 spiral ridges only.

Size: A 2.6-3.3 mm; D 1.8-2.2 mm.

Animal typical. — Radula with trapezoidal (not triangular) rhachis whose cutting edge is curved and carries 1 large, pointed cusp; there are 4 small basal cusps on either side. Laterals with the cusp formula 3-1-5, marginals with 6-7 cusps only.

Type locality Mekong River at Bandan.

Distribution Known from the Mekong between Kemmarath and Paksé.

Note: There are populations with rudimentary sculpture.

Hydrorissoia munensis BRANDT, 1968.

pl. 8 fig. 30.

1968 *Hydrorissoia munensis* BRANDT, Arch. Moll., 98: 243, pl. 2 fig. 30, textfig. 21 (Mun River, Pibun).

This species differs from the two preceding species by its slender shape and thick greenish periderm. It is smaller than the type species and has on the average 3 spiral ridges (sometimes 2 or 4) only. These are much weaker than those of *H. elegans*. It is much more slender than *trispiralis* and has a smaller aperture. It is the only species of this genus found in the Mun River in Thailand.

Size: A 3.2-3.8 mm; D 2.0-2.3 mm.

Radula: The cutting edge proper of the rhachis is very low with a point on either side. It carries a large, triangular cusp. There are 3 basal cusps on either side beside the finger-shaped wings. The inner cusps are the largest. The marginals have 7 or 9 cusps respectively.

Type locality: Mun River at Pibun Mangsahan, Ubon.

Distribution: Known from the lower reaches of the Mun River only. See remarks below the next species.

Hydrorissoia gracilis BRANDT, 1968.

pl. 8 fig. 31.

1968 *Hydrorissoia gracilis* BRANDT, Arch. Moll., 98: 242, pl. 2 fig. 27, textfig. 19 (Mekong at Bandan).

This species differs from all preceding species by its slender shape and small size and the almost obsolete spiral sculpture. It looks like an extremely small *H. elongata* (BAVAY).

Size A 2.1-3.2 mm; D 1.1-1.7 mm.

Animal typical for the genus. — Radula with broad, trapezoidal rhachis with low, rounded cutting edge. Base with central rounded projection. At either side is a large basal cusp; between the large cusp and the finger-shaped wings are 3 smaller basal cusps. Laterals with the cusp formula 2-1-4, inner marginals with 11 cusps, outer with 7.

Type locality Mekong River at Bandan, Ubon Province.

Distribution Mekong from Ban Khum in Thailand to Sambor in Cambodia.

Remarks In 1968 the present author also reported *H. hospitalis* BRANDT from Bandan. This report refers to *H. munensis* BRANDT, a species which is so closely related to *hospitalis* that it may be considered a local race of that species only. It seems that *elongata* BAVAY is the race from Khone, *hospitalis* that from Khong and *munensis* the race from the Mun River. *H. gracilis* BRANDT is closely related to this Rassenkreis but differs constantly by having a rhachis with 4 basal cusps. It is found together with above mentioned species.

H. elegans is also very variable. Very slender specimens with sharp granulated ridges are found together with ovate specimens whose sculpture is reduced to weak spiral lines only. These different forms are connected by intermediate forms. The typical form is predominant in Laos, the ovate form in Thailand.

Closely related to *Hydrorissoia* is the monotypical genus *Pachydrobiella*. It has the thick-lipped peristome and triangular, simple cutting edge of *Hydrorissoia*, but is completely smooth.

Pachydrobiella THIELE, 1928.

This genus differs from *Hydrorissoia* by its short, conic spire, obtuse apex, flat whorls and smooth surface. — The peristome is as thick as that of *Pachydrobia*. The only species known of this genus, was therefore described by its author as a *Pachydrobia*. The genus may well be assigned to *Hydrorissoia* as a subgenus.

Pachydrobiella brevis (BAVAY, 1895).

pl. 8 fig. 32.

1895 *Pachydrobia brevis* BAVAY, J. de Conch., 43: 87, pl. 5 fig. 2 (Khone et Lakhone).

Shell like that of the genus. — The animal is slate-grey, the sole is sand-coloured. It is tapering to the rounded end and truncate in front. The foot-groove is distinct. Rostrum tapering to the front, with truncate, cleft front end. Front part of the foot and its sides are pigmented with straw- or golden coloured pigment spots which are also densely placed on the rounded tentacles. Parts of the back and head are also dusted with fine pigmentation which may

form a mashwork pattern. The eyes are placed in distinct swellings at the bases of the tentacles. — The verge of the male reproductive organs is finger-shaped, bent, with rounded tip; it carries no appendages and has a single duct only. — The rhachis is trapezoidal, the cutting edge simple, triangular with large, pointed cone, not serrated. The laterals have the cusp formula 3-1-3, the inner marginals have 9 cusps, the outer marginals 6.

Type locality: Mekong branch at Sompamit Falls near Khone in S Laos.

Distribution: Mekong from Ban Saphai in Laos to Sambor in Cambodia. This species has not yet been found in Thailand but was collected by the SMRL team in the rapids of the Mekong very near to Bandan.

Lacunopsis DESHAYES, 1876.

This genus was established by DESHAYES (1876: 149) for *L. monodonta*, *jullieni* and *tricostata* DESHAYES, three species, collected by JULLIEN in Cambodia. POIRIER (1881: 5) placed the latter into *Julliennia*, which was then subgenus of *Lithoglyphus*, established by CROSSE & FISCHER (1876: 323) for *Melania flava* DESHAYES. *L. monodonta* was therefore never monotype as cited by WENZ (1939: 580) as POIRIER described in the same paper three more species of this genus, *L. globosa*, *ventricosa* and *harmandi*. Only the latter has been found in Thailand. The validity of these species and the species later described by BAVAY will be discussed in a later paper on Laotian molluscs.

The shell of this genus differs from those of all preceding genera by its globose or semiglobose shape and by having a septum like Neritidae formed by a part of the columella and parietal callus of the aperture. The spire is very depressed conoidal or completely globose and consists of 2½-3½ whorls only. The body whorl is very large, often ear-shaped with a large aperture similar to *Clypeolum* or *Neritona*. The surface is either smooth or sculptured with spiral rows of tubercles. The callus of the septum can cover the whole front of the body whorl. — Operculum semicircular or oval, corneous, diaphanous, paucispiral, with almost basal nucleus.

Radula: Rhachis with a simple, generally triangular cutting edge and basal cusps on either side. Laterals and marginals with few cusps only. — The male reproductive organs show a simple verge without appendages. It is curved or coiled, somewhat flattened and has only a single duct.

Type species: *Lacunopsis monodonta* DESHAYES.

Distribution: Known from the Mekong and some of its tributaries only.

Biology: The species of this genus are found on rocks in the rapids.

Parasitology: This genus seems to be of no parasitological importance.

The genus can be divided into two groups, one group of species with a large, flattened plain on the front side of the body whorl which is generally separated from the rest of the body whorl by a sharp keel, and another group of species with a more or less rounded ventral side of the body whorl and with a narrow columellar septum.

Key to the Thai species of *Lacunopsis*:

- | | |
|--|---|
| 1. Septum and ventro-basal part of the body whorl form a large plain which is bordered by a sharp carina (like <i>Dostia</i>) | 2 |
| — Septum narrow, ventral part of the body whorl rounded | 4 |

2. Vento-basal plain more than 10 mm in diameter (like *Neripteron*) *fischerpiettei*.
 — Vento-basal plain less than 10 mm in diameter 3
 3. Shell without tubercles or spines *harmandi*.
 — Shell with scaly tubercles *massiei*.
 4. Shell without tubercles or spines *munensis*.
 — Shell with tubercles or spines 5
 5. Shell with few scaly spines *coronata*.
 — Shell with several obtuse tubercles *levayi*.

Radulae of *Lacunopsis*:

Species	Rhachis*)	Laterals	M ₁	M ₂
<i>concava</i> ***)	4 4	1(-4)**)	10	7
<i>conica</i> ***)	3 3	0-1-4	—	—
<i>coronata</i>	2 2	1**)	9	(5-7)
<i>deiecta</i> ***)	3 3	0-1-4	11	8
<i>fischerpiettei</i>	2 2	0-1-0	5	4
<i>harmandi</i>	2 2	0-1-(4)0	(8-10)	(8-9)
<i>levayi</i>	4 4	(0)1-1-(6-12)	(7-8)	(6-7)
<i>massiei</i>	1 1	0-1-6	(9-11)	(6-8)
<i>munensis</i>	3 3	1-1-3	5	4
<i>sphaerica</i> ***)	3 3	1**)	8	7
<i>ventricosa</i> ***)	2 2	1**)	9	7

*) basal cusps

***) there is a single, triangular cutting edge whose inner side is serrated

***) *L. conica* BRANDT, *concava* and *deiecta* TEMCHAROEN, *globosa*, *sphaerica* and *ventricosa* POIRIER have not yet been found in the Mekong in Thailand.

***Lacunopsis fischerpiettei* BRANDT, 1968.**

pl. 8 fig. 33.

1968 *Lacunopsis fischerpiettei* BRANDT, Arch. Moll., 98: 247, pl. 9 fig. 34, textfig. 25 (Mekong between Bandan and Cambodia).

This species is easily distinguished from all other species of the genus by its broad, cap-like shape, similar to that of certain Neritidae of the genera *Clypeolum*, *Neritona* or *Neripteron*.

Shell depressed cap-shaped, with very short, depressed spire and large body whorl. The ventral part of the body whorl is flattened and forms together with the aperture a somewhat concave plain which is bordered by a sharp keel. Septum and ventral plain are covered by a layer of milky-blue enamel. The shell is covered by a yellowish-green periderm; it is sculptured by strong growth lines which are crossed by still stronger spiral lines. The growth markings are sometimes thickened to ribs similar to that of certain species of *Cardium*. Below the suture there are generally 1 or 2 spiral rows of irregular tubercles. — The aperture is semicircular and small, compared with the ventral plain. — Operculum yellow, semicircular, otherwise like the genus.

Size: A (axial) 11 mm; D 14 mm; d 9.4 mm (holotype), aperture (within) 9 : 7 mm. A 9-12 mm; D 14-17 mm.

The animal differs from all the other species of the subfamily by its orange colour which is almost homogeneously distributed. Sole lemon-coloured. Head, back, rostrum and tentacles are dusted with grey pigment spots. The eyes are placed on distinct sockets of $\frac{1}{3}$ of the length of the long, pointed tentacles. — Radula: Rhachis with simple, triangular cutting edge which is placed on a squarish socket. There are 4 basal cusps on either side. Laterals with a simple triangular cutting edge (different from the laterals of most other species).

Type locality: Mekong at Bandan, Ubon Province.

Distribution: Mekong between Bandan and Khong Island.

L. conica BRANDT from Khong and this species are the extreme forms of this genus, the one similar to *Clypeolum*, the other shaped like a *Clithon*.

***Lacunopsis munensis* BRANDT, 1968.**

pl. 8 fig. 34.

1968 *Lacunopsis munensis* BRANDT, Arch. Moll., 98: 248, pl. 9 fig. 35, textfig. 26 (Mun River at Ubon).

This small species belongs to the groupe which has a rounded ventral side of the body whorl and a narrow septum which bears a small denticle.

Shell small, subglobose, with low spire and narrow milky-blue septum which shows a small denticle on the edge. *L. conica* and *sphaerica* differ by rosy apical whorls, *conica* furthermore by its elevated spire. — Operculum typical.

Size: A 5.0-5.5 mm; D 6.0-6.5 mm; d 3.2-4.0 mm.

Radula. Rhachis with a low, broad cutting edge which carries 1 large triangular cone. Laterals with the formula 1-1-3, marginals with 5 or 4 cusps respectively.

Type locality: Mun River at Ubon Ratchathani.

Distribution: Known from the Mun River at Ubon only.

This is the only known Thai representative of the group of small globose species (*conica-sphaerica-munensis*) which has a smooth surface. The group of the large species of globose shape (*monodonta-globosa-ventricosa*) with smooth surface has not yet been found in Thailand. The globose group with sculptured surface is represented by one species only.

***Lacunopsis levayi* BAVAY, 1895.**

pl. 8 fig. 35.

1895 *Lacunopsis levayi* BAVAY, J. de Conch., 43: 84, pl. 6 fig. 3 (Mekong at Kang-koum).

Shell larger than that of *L. munensis*, spire more depressed, last whorl with a spiral row of tubercles below the suture. Septum narrow, edge with a minute denticle, front of body whorl somewhat flattened.

Size A 7-9 mm; D 9-10 mm; d 4.7-5.3 mm.

Animal sand-coloured, with greyish pigment dots dusted over back and head. Rostrum less than half the length of the tentacles. — Rhachis with a simple cutting edge and 4 basal cusps on either side. Laterals with the cusp formula (0)1-16, inner marginals with 7 cusps, outer with 6.

Type locality Mekong rapids at Ban Khum, N of Bandan.

Distribution Dead shells were found in the sand of the Mekong at Khemmarath and Bandan. Live specimens were only obtained from the rapids at Ban Khum. Extralimitarily known from the Sompamit Falls in Laos.

Lacunopsis coronata BAVAY, 1895.

pl. 8 fig. 36.

1895 *Lacunopsis coronata* BAVAY, J. de Conch., 43: 83, pl. 6 fig. 2 (Khone et Lakhone, sur le Haut-Mekong, dans les rapides).

This species is similar to *L. sphaerica* BAVAY with regard to shape and size, but differs by showing a subsutural spiral row of scaly spines. BAVAY stated that some of his specimens have a reddish apex. All our specimens collected at the type locality and in Thailand had a pale, flesh-coloured or greyish apex. The number of scaly spines varies considerably; the set collected at the Mekong rapids near Ban Khum shows between 2 and 11 spines. These spines are restricted to the body whorl only. The penultimate whorl shows only a very obtuse spiral ridge below the suture. — Aperture semicircular, large; peristome connected by a thick callus. This forms a narrow septum which is not bordered by a carina as in *L. massiei* BAVAY. *L. levayi* BAVAY is also similar in shape but the tubercles are obtuse, never spiny and scaly as in this species.

Size A 7.0 mm; A 7.0 mm.

Animal typical for the genus. — Radula with trapezoidal rhachis. This has a simple, triangular cutting edge and 2 basal cusps on either side. The laterals have neither endo- nor ectocones but the inner slope of the large, triangular cusp is serrated. The inner marginals have 9 cusps, the outer 5, rarely 6 or 7.

Type locality Mekong rapids above Sompamit Falls near Khone in S Laos.

Distribution: Known from the Mekong between the Khemmarat Rapids in Thailand and the type locality.

Biology: The species lives on rocks in the rapids and feeds on algae.

Lacunopsis massiei BAVAY, 1895.

pl. 8 fig. 37.

1895 *Lacunopsis massiei* BAVAY, J. de Conch., 43: 86, pl. 6 fig. 4 (Kang-Koum, dans les rapides du Haut-Mekong).

Shell smaller than that of *L. harmandi*, very much depressed, with a large ventral face of the body whorl which is surrounded by a sharp carina. The shell is either smooth or carries a weak subsutural ridge; this may be ornamented with 1-5, generally 2-3 scaly spines.

Size A (axial) 3.7-6.2 mm; D 6.3-8.0 mm; d 4.0-5.2 mm. The maximal sizes are exceptions.

Animal grey with black and sand-coloured pigmentation. Radula with trapezoidal rhachis; this differs from those of all other species of the genus by having only 1 large basal cusp on either side. The other small basal cusps are rudimentary. Cutting edge simple, triangular. Laterals with the cusp formula 0-1-6, marginals with 9 or 6 cusps respectively.

Type locality: Mekong at Ban Khum in E Thailand.

Distribution Known from the Mekong at the type locality and in dead shells from Vientiane, Bang Kan and Bandan.

Note: The reduction of the basal teeth may not be considered a specific characteristic as only one specimen has been dissected and other species of this genus have also shown rudimentary basal cusps.

Biology: This species lives like all flattened species of this genus, in rapids on rocks and feeds on algae.

If the single specimen found at Vientiane and Bang Kan are not imported with sand from the south the populations from which they originate must be looked for near the rapids in the karst-area S of Luang Prabang. The rapids of Chieng Khan W of Luang Prabang are of sand-stone and void of molluscs.

***Lacunopsis harmandi* POIRIER, 1881.**

pl. 8 fig. 38.

1881 *Lacunopsis harmandi* POIRIER, J. de Conch., 29: 9, pl. 1 fig. 3 (Cambodge, Mekong).

1904 *Lacunopsis harmandi*, — FISCHER & DAUTZENBERG, Mission Pavie, 3: 421 (Me-Khong, Cambodge; Khone, dans les rapides du Me-Khong; rochers de Ban-Koum; Me-Khong à Sambor).

This species belongs to the group of *L. jullieni* DESHAYES or may even be united with this species as the differences between the two forms do not seem to be of specific character. The spire is round and depressed, rarely somewhat conic. The body whorl is large and inflated and its end-part is exerted to the right. The front of the body whorl is flattened and moderately concave. The septum of the columella is broad and merges with the semilunar part of the face of the body whorl. A delicate line separates these two parts of the face. This face is bordered by a sharp keel which begins at the parietal part of the aperture below the upper insertion of the peristome and is continued by the peristome below the columella. The surface is smooth except for the curved growth lines; 1-3 spiral lines may sometimes be seen below the suture. — The aperture is semicircular and bluish-white within. The outer margin of the peristome is sharp. — Operculum typical for the genus. As there is no denticle on the edge of the septum, the operculum does not show a dent at the columellar side.

Size: A (axial) 7.8-8.8 mm; D 7.2-8.2 mm; d 4.3-5.8 mm.

Animal sand-coloured, but it appears almost black because of the dense black pigmentation. This forms large patches on the mantle edge and visceral sack as if they were stained with China ink. The yellow pigmentation is therefore only seen under strong magnification. — Radula with trapezoidal rhachis. Its cutting edge is simple and triangular. There are 2-3 basal cusps on either side. The laterals have a large, triangular cusp and 5 rudimentary ectocones at its side. Inner marginals with 9-10 cusps, outer with 8-9. — The male reproductive organs show a flattened, bent verge with a pointed tip. It is simple, without appendages and has a single duct.

Type locality: Mekong in Cambodia. An exact type locality will be designated in another paper on this subfamily. It is highly probable that the original set was collected at the rapids of Samboc (often also called rapids of Sambor, although there are

no rapids near the town of Sambor), as these were the only rapids visited by HARMAND in northern Cambodia.

Distribution Known from the Mekong between Kemmarath and Kratie and from the lower reaches of the Mun River in Thailand (Tana Falls).

***Lithoglyphopsis* THIELE, 1928.**

Shell subglobose with short, regularly conic spire. Smooth except for the delicate growth lines. Aperture large, pointed above; peristome sharp without. Animal typical for the subfamily. Radula with squarish rhachis, cutting edge triangular, simple.

Type species *Lithoglyphus modestus* GREDLER.

Distribution: China, Laos, Thailand.

***Lithoglyphopsis aperta* TEMCHAROEN, 1971.**

pl. 8 fig. 39.

1971 *Lithoglyphopsis aperta* TEMCHAROEN, Arch. Moll., 101: 103, pl. 7 fig. 14, textfig. 12 (Mekong between Bandan and Khone).

Shell rather small for the genus, diaphanous, covered with a greyish periderm. Body whorl subglobose, spire sharply pointed and conic when young and rounded with obtuse apex when adult. — Aperture very large, ovate, pointed above and well rounded below. Peristome thin, sharp without but somewhat thickened within. — Operculum typical for the subfamily.

Size: A 2.0-4.0 mm; D 1.3-3.0 mm.

Animal light grey, with few black pigment patches. Typical with 3-4 large patches on the mantle lobe which can be seen through the diaphanous shell. Furthermore dusted with whitish pigment dots. — Radula typical for the genus, with squarish rhachis which has a simple, triangular cutting edge. Cusp formula of the laterals 3-1-3, inner marginals with 6 cusps, outer with 5.

Type locality: Mekong at Ban Na on Khong Island, Laos.

Distribution: Mekong between Kemmarath and Bandan; extralimitarily known from the Mekong at Paksé, Cham Passak, Khong Island and Sompamit Falls near Khone in S Laos.

Parasitology This species has been proven by a team of parasitologists from the School of Tropical Medicine in Bangkok to serve as intermediate host for the *Schistosoma* species of human patients in the Mekong Valley.

***Wykoffia* BRANDT, 1968.**

Shell medium-sized to small, solid, hemisphaerical, depressed, with red, mammilated apex and flattened ventral face. Aperture semicircular, peristome very thick, columella curved compressed but not forming a septum as in *Lacunopsis*. Operculum semicircular, paucispiral, thin, transparent. Animal with black and yellow pigmentation. Rhachis with simple, triangular cutting edge. Male reproductive organs with simple verge, without appendages and with one duct only.

Type species *Lacunopsis tricostata* DESHAYES.

Distribution Mekong from near Bandan in Thailand to Sandan N of Kratie in Cambodia.

This genus comprises *W. tricostata* (DESHAYES) (pl. 8 fig. 40), *W. costata* (POIRIER) (fig. 41) and *W. minima* TEMCHAROEN (fig. 42). It differs from *Lacunopsis* by the shape of its shell which is not neritoid as the columella does not form a septum. From *Jullienia* it differs by the simple cutting edge of its rhachis. The rhachis and the spiral sculpture place this genus close to *Lacunopsis*, the shape of the shell close to *Jullienia*. *Fenouilia* HEUDE is said to have no verge, but the rhachis is of the same type as that of *Lacunopsis* and *Wykoffia*.

W. tricostata and *W. costata* are so closely related to each other that it seems more justified to consider them as two races of one species. But as long as no intermediate forms are found, we treat them separately.

Although no species have yet been found in the Thai part of the Mekong, we include this genus in our fauna as the next locality in Laos is only few miles away from the Thai border. *Wykoffia tricostata* is — at least in the typical form — only known from Cambodia.

Key to the Laotian species:

- | | |
|------------------------------|------------------|
| 1. D of adult shell 3-4 mm | <i>minima</i> . |
| 2. D of adult shell 5.5-6 mm | <i>costata</i> . |

Stenothyridae P. FISCHER, 1887.

Shell small or very small, ovoidal-conic or pupa-shaped, thin, corneous, translucent, body whorl large, often bossed at the left side line and/or compressed dorso-ventrally. Often with a sculpture of spiral rows of small pits or delicate grooves, rarely with cutaneous ciliae.

Operculum with a low, semicircular ridge on the inner surface parallel to the margin and two short, high, somewhat diverging, straight ridges.

Rhachis with 3-6 basal cusps on either side, cutting edge in general with 5, rarely with 7 cusps. The laterals are shoe-shaped with a large, pointed mesocone, 2 or 3 endocones and several ectocones. The marginals have many cusps, the inner marginals have always more than the outer.

The animal has long, thin tentacles and a trunk-shaped rostrum. The pigmentation consists of very fine black pigment dots dusted over the animal and often of yellowish or orange patches. The verge is simple, without appendages and with a single duct. It may terminate in a small, conchiolinous stylet.

Distribution: S, SE and E Asia, islands of the western Pacific and Australia.

Biology: The species live in fresh or brackish water on sandy ground, on stones and decaying wood or buried in the mud. They feed on decaying organic matter.

Parasitology No member of this family is known to have parasitological importance.

Literature: ANNANDALE & PRASHAD 1921.

Fossil species have had a much wider distribution. They are known from the Paleocene and Pliocene from Europe, Siberia and China. More fossil species than recent are known of the genus *Gangetia*. Several fossil species of this

family are attributed to *Stenothyra*, but most of the fossil species belong to *Stenothyrella*, a genus which is now extinct.

Key to the genera:

1. Aperture generally more-or-less constricted, with long filiform process on the end of the back .. *Stenothyra*.
2. Aperture never constricted, back without filiform process *Gangetia*.

Gangetia ANCEY, 1890.

Shell small, ovoidal-conic, glossy, thin, sometimes sculptured with spiral lines or pits. The whorls are rather convex and separated by a deep suture. Last whorl sometimes with an obtuse carina, never compressed or bossed. Aperture not constricted. Operculum typical for the family. Animal without dorsal process; radula and reproductive organs typical for the family.

Distribution: India, Burma and Thailand.

Type species: *Hydrobia (Belgrandia) miliacea* G. NEVILL.

Gangetia tigerti BRANDT, 1968.

pl. 8 fig. 43.

1968 *Gangetica* (sic!) *tigerti* BRANDT, Arch. Moll., 98: 261, pl. 10 fig. 48, textfig. 31 (Ban Don Makok, Glaeng Distr., Rayong Prov.).

Shell small, ovoidal-conic, thin, smooth, transparent, greyish-corneous; the $4\frac{1}{2}$ whorls are convex and increase regularly in size; body whorl somewhat inflated, large, with rimate base; the aperture is ovate and measures more than half the size of the body-whorl, angulate above and regularly rounded below. — Peristome thin, not expanded, continuous and appressed to the penultimate whorl, outer margin slightly sinuous, but without incision at the base. — Operculum typical for the genus.

Size A 2.2-2.7 mm; D 1.7-1.8 mm.

Animal slate-grey with few black pigment spots. Foot produced into pointed pseudopodia at either anterior corner, tapering to the posterior end. Tentacles long and thin; eyes placed in distinct swellings at the bases of the tentacles. Rostrum of about $\frac{2}{5}$ of the length of the tentacles. — Male reproductive organs with a simple, curved verge. It has no appendages and one duct only. There is no stylet at the tip. — Radula with narrow, trapezoidal rhachis. Its cutting edge has 5 cusps; there are 3 basal cusps on either side. Laterals with the cusp formula 1-1-5, inner marginals with 14-16 extremely small cusps, outer marginals with 9 cusps.

Type locality Trench along high-way 3 at Ban Don Makok, Glaeng District, about 51 km E of Rayong.

Distribution: Known from Glaeng District, Khlung District (Chantaburi Province) and between Narativat and Saiburi.

Habitat The species lives in brackish water but tolerates freshwater as well. At Khlung the water has a high degree of salinity, at the type locality it is almost fresh during the rainy season.

Relationship *G. burmana* PRASHAD differs from this species by its spiral sculpture; it is also smaller (A 1.5 mm). *G. miliacea* (NEVILL) has a distinct incision at the base of the aperture and *G. subangulata* PRASHAD has a thicker peristome and an obtusely angulated body whorl. Our Thai species looks very similar to very small, young specimens of *Wattebledia siamensis* which have not yet developed the curved outer margin of the peristome.

***Stenothyra* BENSON, 1856.**

Shell like that of the family but generally with a more or less constricted aperture. The aperture is normally placed within the regularly curved right or basal outline of the shell, it is only rarely exerted. The surface is smooth or sculptured with spiral grooves or spiral rows of small pits. Sometimes there is a delicate microsculpture. Spiral ridges are an exception. The spiral lines may be ciliated. Body whorl generally somewhat compressed dorso-ventrally, rarely with a basal keel. — Aperture small, constricted, round; peristome with a thin lip, appressed. — Operculum ovate, with 3 ridges on the internal surface, 2 short, straight, high, diverging ridges and a low, semicircular, parallel to the margin.

The size rarely exceeds 8 mm.

Animal like that of the family, but many species show, besides the black pigmentation, yellow granules or even orange-coloured patches. Most species show a long, filiform process on the posterior end of the back. — Radula with broad, low, trapezoidal rhachis; it has generally 3 or 4 basal cusps on either side, rarely more than 6. There are 5 or 7 cusps on the cutting edge. The laterals are shoe-shaped, with a large mesocone, few endocones and several ectocones. The marginals have many cusps, sometimes more than 25. The inner marginals have a set of large endocones and a set of small ectocones. — The verge of the male reproductive organ is simple with a single duct and without appendages. Its pointed tip often carries a curved stylet.

Type species *Nematura deltae* BENSON.

Distribution: S Asia from Pakistan to Burma, SE Asia, Indonesia, N Australia, China, Japan, Formosa, Philippines and New Guinea.

Habitat: This genus may be divided into two groups, one of which is found in brackish and tidal water and the other in rivers and streams with freshwater.

Most species are endemic, particularly the freshwater species, only a few are distributed over a wide area. Although most of the Thai species were found at their habitats in abundance, no *Stenothyra* have ever been reported from Thailand, though several of the Thai species were already known from neighbouring countries.

The first species of this genus was described in 1834 from Celebes as *Paludina ventricosa* QUOY & GAIMARD. It was later incorrectly reported from Indonesia (Java, Sumatra), Malaya and India. *S. ventricosa* is a freshwater species from the Tondano Lake found in an altitude of about 3000', *S. moussoni* MARTENS, with which it has often been confused, is a brackish water species of rather wide distribution. The first *Stenothyra* described from brackish water was *Nematura deltae* BENSON which became the type species for the genus *Stenothyra*. Many more species from brackish water were described by later authors (BENSON, GOULD, A. ADAMS, NEVILL, PRASHAD, PRESTON, VAN BENTHEM JUT-

TING, ABBOTT), but only few freshwater species became known and none of these from Thailand. With the surprisingly large number of new species from Thailand, particularly new freshwater species from the Mekong drainage, the number of species of this genus has almost been doubled. Of the 16 freshwater *Stenothyra* now known from SE Asia, only *hybocystoides* BAVAY and *messengeri* BAVAY & DAUTZENBERG were formerly reported. The latter is only found in Tonkin. *S. foveolata* BENSON, the only freshwater species from India, is restricted to the upper reaches of the Ganges. Several of the brackish water species found in Thailand had already been reported from neighbouring countries: *polita* A. ADAMS from Singapore and Penang (and as *quadrasi* MOELLENDORFF from the Philippines), *monilifera* and *deltae* BENSON from India and Burma, *glabrata* A. ADAMS and *moussoni* MARTENS from Malaya and Indonesia. One population of *Stenothyra* from Thailand is assigned to the Indian *nana* PRASHAD, though with hesitation, as that species is based on a single specimen only.

Key to the freshwater species of *Stenothyra* from Thailand:

1. Shell without spiral ridges 2
- Shell with spiral ridges *spiralis*.
2. Shell with microsculpture 3
- Shell without microsculpture 4
3. Microsculpture restricted to the last quarter of the body whorl; base of body whorl generally with pitted spiral lines *basisculpta*.
- Microsculpture on all whorls, pitted spiral lines on nuclear whorls only *microsculpta*.
4. Shell with macrosculpture 5
- Shell without macrosculpture 9
5. Sculpture restricted to the upper whorls 8
- Sculpture on all whorls 6
6. Shell subglobose, sculptured with grooves *roseni*.
- Shell ovoidal-conic, sculptured with spiral rows of pits 7
7. D less than 1.4 mm *schuetti*.
- D more than 1.5 mm *k. holosculpta*.
8. Shell ovate-conoidal *k. koratensis*.
- Shell ovoidal or subglobose 10
9. Neck with distinct brown patch 11
- Neck without distinct brown patch 12
10. Shell ovoidal *ovalis*.
- Shell subglobose *crooki*.
11. Shell ovoidal with conic spire *fasciata*.
- Shell pupaeform with dome-shaped spire *wykoffi*.
12. Shell ovate-conoidal *jiraponi*.
- Shell ovoidal or ovate 13
13. Apex flattened, aperture exerted *hybocystoides*.
- Apex dome-shaped, aperture not exerted 14
14. Shell higher than 3.0 mm, aperture oblique *mcmulleni*.
- Shell smaller than 2.5 mm, aperture straight *cambodiensis*.
15. From the Moei (Thaungyin) River *confinis*.
- 1-14 are from the catchment areas of the Chao Phraya, Maeklong and Mekong.

***Stenothyra microsculpta* n. sp.**

pl. 9 fig. 44.

Diagnosis: A species of *Stenothyra* BENSON which differs from *S. bassisculpta* n. by its oval shape, lack of spiral lines on the body whorl and by having the complete shell (except for the embryonic whorls) covered with a very delicate spiral microsculpture. This species is distinguished from all other *Stenothyra* species from Thailand by this microsculpture.

Description: Shell of medium size for the genus, ovoidal when seen in a dorsal view and somewhat ovate-conoidal when seen in a ventral view; rather solid, straw-coloured, somewhat glossy. The 4 whorls increase regularly in size; they are convex, the upper whorls more so than the last two whorls, and separated by a deep suture. The last whorl is large and inflated, somewhat bossed at the left side line and moderately compressed dorso-ventrally. The nuclear whorls are sculptured with pitted spiral lines, the other whorls are covered with a very delicate and irregular spiral microsculpture. The neck has a touch of a brown patch. The part near the aperture is whitish. — The aperture is small, oval, oblique; it measures about $\frac{2}{5}$ of the height of the body whorl. The peristome is continuous, appressed to the penultimate whorl; it is somewhat thickened within and carries a minute dentition on the parietal wall. — Operculum oval, with the 2 typical straight and converging ridges and the semi-circular ridge parallel to the margin.

Size: A 2.8-3.1 mm; D 1.9-2.1 mm.

Animal sand-coloured with large black pigment patches on back and mantle, and fine black pigmentation dusted over head and rostrum. The tentacles carry 4 black rings. Yellow pigmentation could not be seen as the animals were preserved in alcohol. The back carries at its end the filiform process typical for this genus. — The rhachis of the radula has 5 cusps on the cutting edge and 4 basal cusps on either side. — The verge of the male reproductive organs is finger-shaped. It is somewhat curved, has a single duct and no appendages. Its tip ends in a minute, curved stylet.

Type locality: Huai Tuay near Tha Uthen, Nakon Panom Province, in the NE of Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 5037/A; paratypes 5037/22.

Biology: This species lives on the sandy bottom of the above named small river together with *S. fasciata*, *koratensis* and *jiraponi*.

***Stenothyra hybocystoides* BAVAY, 1895.**

pl. 9 fig. 45.

1895 *Stenothyra hybocystoides* BAVAY, J. de Conch., 43: 93, pl. 7 fig. 7 (Khone, dans les rapides du Mékong).

This species differs from all other Thai species by its large aperture which is not constricted and exserts conspicuously from the outline of the shell. As it resembles a *Hybocystes*, the given name is well chosen. The shell is depressed, with flat or dome-shaped spire and obtuse apex. Body whorl large, inflated, broadly pupaeform. The shell is generally smooth, but specimens with pitted

spiral lines were found. — Aperture large, base not receding but generally somewhat protruding. Peristome continuous, appressed to the penultimate whorl. — Operculum typical for the genus.

Size A 2.0-4.0 mm; D 1.3-2.0 mm.

Animal slate-grey with black pigment spots dusted over head and back. There are only few black dots on the tentacles, but there are several large or many small lemon-, orange- or brick-coloured dots on rostrum and tentacles. — Radula with trapezoidal rhachis; its cutting edge carries 5 cusps; there are 4 basal cusps on either side. Laterals with the cusp formula 1-1-12, inner marginals with more than 20 cusps, the outer marginals with 10.

Type locality: Mekong branch at the Sompamit Falls, SW of Khone, S Laos.

Distribution: Known from the Mekong between Ban Khum in E Thailand and Kratie in N Cambodia.

This was the only freshwater *Stenothyra* which was already known from the Mekong drainage when this survey was started. *S. dorriana* and *truncata* WATTEBLÉ are species of the Mekong in its tidal area. *S. messengeri* BAVAY & DAUTZENBERG from Tonkin is a freshwater species from the drainage of the "Red River"

***Stenothyra basisculpta* BRANDT, 1970.**

pl. 9 fig. 46.

1970 *Stenothyra basisculpta* BRANDT, Arch. Moll., 100: 200, pl. 13 fig. 19, textfig. 19 (Mekong between Ban Khum and Kratie).

This species differs from *S. koratensis* BRANDT by its pitted spiral lines on the base of the body whorl and by its microsculpture on the end part of the last whorl. The embryonic whorls are generally also sculptured with punctate spiral lines, those of *koratensis* are smooth. The postnuclear whorls of this species are smooth while those of *koratensis* are sculptured. The species is very variable with regard to size and shape. Broadly ovate shells and slenderly cylindrical shells look as if they belong to different species.

Size: A 2.0-3.0 mm; D 1.3-1.8 mm.

Rhachis with 5 teeth on the cutting edge and 3 basal cusps on either side.

Type locality Mekong at Bandan.

Distribution Mekong between Ban Khum and Kratie.

***Stenothyra ovalis* BRANDT, 1970.**

pl. 9 fig. 47.

1970 *Stenothyra ovalis* BRANDT, Arch. Moll., 100: 201, pl. 13 fig. 20 (Thailand: Mun River; Songkram River; Mekong between Ta Uthen and Bandan).

This species differs from *S. basisculpta* by its oval shape and lack of spiral sculpture on the base of the body whorl. It differs from *S. koratensis* also by its oval shape and by having the embryonic whorls sculptured instead of the postnuclear. It is similar in shape to *S. fasciata* but lacks the rusty brown patch on the neck. It is also much thinner than *fasciata*. It is much smaller than *S. mcmulleni* and has the typical dorsal filament which is missing in *mcmulleni*.

Size: A 2.7-3.2 mm; D 1.7-2.0 mm.

Rhachis with 7 cusps on the cutting edge and 4 basal cusps on either side. Laterals with the cusp formula 3-1-7, inner marginals with 8 cusps, outer with 17.

Type locality: Mun River at Rasi Salai, Thailand.

Distribution: Known from the Mekong around Bandan and from several western tributaries, Songkram River, Huai Thai and Mun River.

Stenothyra conifinis n. sp.

pl. 9 fig. 48.

Diagnosis: A species of *Stenothyra* BENSON which differs from its apparently closest relative, *S. mcmulleni* BRANDT, by its deeper suture, therefore more convex whorls and by its delicate microsculpture on the end of the body whorl, similar to that of *S. basiculpta*.

Description: Shell of medium size for the genus, thin but solid, corneous-brown, somewhat glossy, translucent, without any trace of the typical pitted spiral sculpture, but with a very delicate spiral microsculpture on the body whorl which is crossed by very fine growth lines. At the end of the body whorl these form distinct wrinkles. The shape of the shell is slenderly ovate-conoidal, more so when seen from a back view. The $4\frac{1}{2}$ whorls are convex and separated by a deep suture. The body whorl is greatly swollen and measures about $\frac{5}{8}$ of the length of the shell. It is neither bossed nor flattened dorso-ventrally. — Aperture comparatively large, although constricted. It measures a little less than $\frac{1}{2}$ the height of the body whorl. It is oval and somewhat oblique. Peristome continuous, appressed, with the typical parietal notch within. — Operculum typical for the genus with its 2 straight ridges and 1 semicircular.

Size A 3.5-4.0 mm; D 1.9-2.2 mm.

Animal grey with many black pigment spots. Mantle and visceral sac almost completely black. As the examined animals were preserved in alcohol nothing can be said about any yellow pigmentation. Back of the animal with the typical filiform process (which is missing in *S. mcmulleni*). — Rhachis with 5 cusps on the cutting edge and 3 basal cusps on either side. Laterals with the formula (1-2)-1-6, inner marginals with 24-26, outer marginals with 12 cusps. — Male reproductive organs with curved prone-like verge without appendages and with a single duct. There is a delicate conchiolinous stylet at the tip of the verge.

Type locality: Moei (Thaungyin) River between Myawaddi (Burma) and Mae Sot (Thailand).

Distribution: Known from the Moei River only.

Material: Holotype SMRL 4966/A, paratypes 4966/8. — SMRL 5001/15-Maenam Moei, 8 km W of Mae Ramat and 16249/5-Thaungyin (Moei) River at Wang Ka, Burma.

Stenothyra mcmulleni BRANDT, 1970.

pl. 9 fig. 49.

1970 *Stenothyra mcmulleni* BRANDT, Arch. Moll., 100: 202, pl. 13 fig. 21, textfig. 20 (Mekong between Ban Khum and Kratie).

Shell ovate or elongately pupaeform, thin, corneous, translucent, somewhat glossy, without any traces of microsculpture except for the growth lines. The

4 whorls are somewhat convex, the apex is dome-shaped; the penultimate whorl is swollen at the left side as seen from the back. The body whorl is large and elongate and measures $\frac{2}{3}$ of the length of the shell. It is not "bossed" at the left side as in *koratensis* or *jiraponi*. The body whorl is slightly compressed dorso-ventrally. — Aperture oblique, oval, somewhat contracted but relatively large. Peristome somewhat thickened within but not expanded like in *hybocystoides* BAVAY. — Operculum typical for the genus.

Size: A 2.0-3.8 mm; D 1.2-2.3 mm.

Anatomy: The radula is typical for the genus and so is the pigmentation. The animal, however, differs considerably from those of the other examined species of *Stenothyra* (except for *cambodiensis*) by lacking the dorsal filiform process which seemed to be a typical characteristic of this genus.

Type locality Mekong at Bandan in E Thailand.

Distribution Mekong between Ban Khum in Thailand and Kratie in Cambodia.

***Stenothyra cambodiensis* BRANDT, 1971.**

pl. 9 fig. 50.

1971 *Stenothyra cambodiensis* BRANDT, Arch. Moll., 101: 113, textfig. 3 (Mekong between Bandan and Kratie).

This is the smallest species of the ovoidal group, without any spiral sculpture. It is slenderly ovoidal, almost cylindrical, with large body whorl and comparatively large aperture. As the final process is also missing at the back of the animal, this species could be considered as a small form or race of *S. mcmulleni*, were it not found together with this species without intermediate forms. The colour pattern is also similar, but the two orange patches on either side of the rostrum are missing.

Size: A 1.8-2.3 mm; D 1.0-1.2 mm.

Locus typicus: Mekong at Sambor, Cambodia.

Distribution: Mekong from Bandan in Thailand to Kratie in Cambodia.

***Stenothyra koratensis koratensis* BRANDT, 1968.**

pl. 9 fig. 51.

1968 *Stenothyra koratensis* BRANDT, Arch. Moll., 98: 255, pl. 9 fig. 42 (Mekong between Nakon Panom and Bandan and many tributaries; Maenam Kwae Noi at Nakon Thai; Maenam Kaek near Pitsanulok and Maenam Kwae Yai near Kanchanaburi).

Shell small, ovate-conoidal, with rather short, conic spire and large, inflated body whorl. Brownish or yellowish corneous, rarely olive-coloured or reddish-brown. Thin, glossy, translucent, without brownish patches. The first three of the 4-4 $\frac{1}{2}$ whorls increase regularly in size, the last is suddenly inflated. The embryonic shell is generally smooth, but not always, the first postnuclear whorl is sculptured with spiral rows of small pits. This sculpture sometimes extends over the third whorl. The body whorl is compressed dorso-ventrally and distinctly bossed at the left side-line. It measures about $\frac{2}{3}$ of the length of the shell. — Operculum typical for the genus.

Size A 2.3-2.9 mm; A 1.6-2.0 mm.

Animal with diffuse black pigmentation dusted over head and back; it is particularly dense on the proboscis and the tentacles. — Rhachis with 5 cusps on the cutting edge and 3-4 basal cusps on either side. The laterals are very variable. Sometimes they have the cusp formula 1-1-7, but there are also laterals which look similar to the inner marginals and have several large endo- and many small ectocones. The second endocone from the left is somewhat larger and is the mesocone. Inner marginals with more than 20 cusps, outer generally with 10-12. The radula described in 1968 is an exception for this species. — Tip of the simple verge with curved stylet.

Type locality: Huai Takrong at Nakon Ratchasima.

Distribution: Known from the Mekong between Tha Uthen (Nakon Panom Province) to Bandan and probably south to Khong Island. Found in almost all tributaries from Loei Province to Ubon Province. Found in the Chao Praya drainage in the Maenam Kwae Noi at Nakon Thai and Maenam Kaek near Pitsanulok. It was also found in the Maenam Kwae Yai ("River Kwai") near Kanchanaburi. The locality Moei River at Mae Sot has to be omitted. No known freshwater *Stenothyra* has such a wide distribution. All other species seem to be restricted to one drainage system only.

***Stenothyra koratensis holosculpta* n. subsp.**

pl. 9 fig. 52.

This local race differs from the type subspecies by having the whole shell sculptured with pitted spiral lines like *S. schuetti* BRANDT. From the latter it differs by its larger size and stouter shape.

Size: A 2.2-3.0 mm; D 1.5-2.0 mm.

Animal and radula like those of the type subspecies.

Type locality: Maenam Kham near Tat Panom.

Distribution: Maenam Kham and Huai Glang Yang, Pibun.

Material: Holotype SMRL 4054/A, paratypes 4054/10. — SMRL 5153/10-Huai Glang Yang near Pibun.

Remark: Although completely sculptured specimens have been found in several populations (mouth of Mun River about 1%), this is a well defined race. At the type locality it is found together with the following species, thus proving that *S. jiraponi* is not an extremely large race of *S. koratensis*.

***Stenothyra jiraponi* BRANDT, 1968.**

pl. 9 fig. 53.

1968 *Stenothyra jiraponi* BRANDT, Arch. Moll., 98: 254, pl. 9 fig. 41 (Songkram River; Kham River).

This species differs from *S. koratensis* by its larger size, deep-brown colour and lack of any spiral sculpture. The apical whorls are often eroded.

Size: A (of the complete holotype) 4.6 mm; D 2.9 mm. Average size of decollated specimens A 3.3-3.9 mm; D 2.3-2.9 mm.

Animal and radula of the *koratensis*-type.

Type locality: Maenam Songkram N of Wanonnivat.

Distribution: Songkram River, Huai Thuai and Kham River, E Thailand.

Stenothyra spiralis BRANDT, 1968.

pl. 9 fig. 54.

1968 *Stenothyra spiralis* BRANDT, Arch. Moll., 98: 256, pl. 6 fig. 43 (Mun River; Songkram River).

This small species differs from all other freshwater species of *Stenothyra* by its 2 strong spiral ridges on the middle and last whorls. The brackish water species *S. labiata* BRANDT sometimes shows a spiral ridge or carina. As the second ridge is placed below the periphery it is only seen on the body whorl. The shell is more slender than those of *S. koratensis* and *jiraponi* and even of *S. schuetti*. There is no trace of spiral sculpture.

Size A 2.5-2.7 mm; D 1.3-1.4 mm; d 1.1 mm.

Rhachis with 5 cusps at the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 1-1-(9-11), inner marginals with 20-22 cusps, outer with 10-11.

Type locality Maenam Mun at Rasi Salai.

Distribution Maenam Mun and Songkram River.

Stenothyra schuetti BRANDT, 1968.

pl. 9 fig. 55.

1968 *Stenothyra schuetti* BRANDT, Arch. Moll., 98: 256, pl. 9 fig. 44 (Maenam Songkram, E Thailand).

This species differs from *S. koratensis* by its smaller size, more slender shape and by having the pitted spiral sculpture cover the entire shell.

This is one of the smallest species of the Mekong drainage. *S. decollata* is still smaller and it lacks the spiral sculpture.

Size: A 1.8-2.3 mm; D 1.2-1.3 mm.

Rhachis of the radula with 3 basal cusps on either side.

Locus typicus: Maenam Songkram at Wanonivat.

Distribution Songkram River in E Thailand.

Besides *S. dorriana* which is much larger, only two *Stenothyra* species from the Mekong have a sculptured body whorl: *koratensis holosculpta* and *roseni* BRANDT. This species is short and stout, somewhat larger and the spiral lines are continuous grooves, not rows of small pits.

Stenothyra crooki BRANDT, 1968.

pl. 9 fig. 56.

1968 *Stenothyra crooki* BRANDT, Arch. Moll., 98: 252, pl. 9 fig. 39; text-fig. 29 (Maenam Songkram, Huai Mae Un).

This species is closely related to *S. koratensis* but differs considerably from that species by its shorter and stouter shape and large body whorl. The apical whorls are sculptured with fine spiral rows of pits, the body whorl is smooth. Shell of corneous colour. — Operculum typical.

Size A 2.1-2.9 mm; D 1.7-2.2 mm.

Rhachis with 5 basal cusps on either side, otherwise typical for the genus.

Type locality Songkram River at Sri Songkram.

Distribution Songkram River and Huai Mae Un, one of its tributaries, E Thailand. — This species lives together with *S. koratensis*, *S. jiraponi* and several other species.

Stenothyra roseni BRANDT, 1968.

pl. 9 fig. 57.

1968 *Stenothyra roseni* BRANDT, Arch. Moll., 98: 253, pl. 9 fig. 40 (Maenam Songkram; Maenam Kham).

A species of the same or similar shape as *S. crooki*. It differs from this species by its spiral sculpture which covers the entire shell. The sculpture consists of delicate, continuous spiral grooves, not of pitted spiral lines. A similar sculpture is only known from the brackish water species *S. cyrtochila*. As long as no other species with a similar sculpture turns up from the Mekong drainage, this characteristic is a safe help for identification. The shell is olive coloured, not corneous like *S. crooki*.

Size A 2.3-2.6 mm; D 1.8-2.0 mm.

Radula like that of *S. koratensis* with 4 basal cusps on either side.

Type locality Maenam Songkram near Wanonivat.

Distribution Maenam Songkram and Kham River in E Thailand.

Stenothyra fasciata BRANDT, 1968.

pl. 9 fig. 58.

1968 *Stenothyra fasciata* BRANDT, Arch. Moll., 98: 251, pl. 9 fig. 38 (E Thailand: Several tributaries of the Mekong).

This species differs from *S. roseni* by its ovoidal shape and smooth surface. From all other species it differs by its distinct but weak brown patch on the neck which may be prolonged to a brown band.

Seen from the ventral side the shape of the shell is similar to that of *S. koratensis* but seen from the back the shell shows a regular ovoidal form. Adult specimens are not glossy and transparent but of a dull, yellowish straw-colour similar to that of old specimens of *S. crooki*.

Size: A 2.3-3.2 mm; D 1.8-2.1 mm.

Radula of the *koratensis*-type.

Type locality Maenam Songkram at Wanonivat.

Distribution Known from the Maenam Sangkram; Maenam Mun; Huai Tuai; Maenam Kham; Huai Dom Yai, all in E Thailand and all tributaries of the Mekong.

Stenothyra wykoffi BRANDT, 1968.

pl. 9 fig. 59.

1968 *Stenothyra wykoffi* BRANDT, Arch. Moll., 98: 250, pl. 9 fig. 37, textfig. 28 (Maenam Mun).

This species differs from *S. fasciata* by its slender pupaeform shape which reminds of a *Macrogonaxis*. From *S. roseni* it differs further by the smooth

surface. The cylindrical, pupa-like shape is an easy help for identification. Only *fasciata* and *roseni* have a similar brown patch on the neck.

Size: A 2.8-3.2 mm; D 1.5-1.7 mm.

Rhachis with 4 basal cusps on either side.

Locus typicus Maenam Mun at Rasi Salai, Sri Saket Province.

Distribution: Known from the Maenam Mun only.

Key to the brackish or tidal water species of *Stenothyra* from Thailand.

- | | |
|--|-----------------------|
| 1. Peristome without varix, penultimate whorl without spiral ridges | 2 |
| — Peristome with varix | 15 |
| 2. Neck with 1 or more rusty brown patches | 3 |
| — Neck without brown patches | 5 |
| 3. Neck with 1 diffuse patch | 4 |
| — Neck with several patches | <i>maculata.</i> |
| 4. A of shell smaller than 2 mm | <i>schlickumi.</i> |
| — A of shell larger than 2 mm | <i>moussoni.</i> |
| 5. Shell without any spiral sculpture | 10 |
| — Shell with spiral sculpture | 6 |
| 6. Spiral lines pitted | 7 |
| — Spiral lines form continuous grooves | <i>cyrtochila.</i> |
| 7. A of shell smaller than 3.5 mm | 8 |
| — A of shell larger than 4.0 mm | .. 9 |
| 8. Shell conoidal, glossy, corneous | <i>mandahlbarthi.</i> |
| — Shell ovoidal, dull, reddish | <i>nana.</i> |
| 9. Base with keel | 13 |
| — Base without keel | 14 |
| 10. Shell conoidal, suture between the last two whorls deep, A smaller than 3.5 mm | 11 |
| — Shell ovoidal, suture between the last two whorls shallow, A larger than 3.5 mm | <i>glabrata.</i> |
| ..... | <i>annandalei.</i> |
| 11. Shell smaller than 2.1 mm, umbilicus open | 12 |
| — Shell larger than 2.1 mm, umbilicus closed | <i>krungtepensis.</i> |
| 12. Upper whorls convex, apex moderately pointed | <i>acuta.</i> |
| — Upper whorls flat, apex very acutely pointed | <i>polita.</i> |
| 13. Keel ends at the base of the aperture | <i>prasongi.</i> |
| — Keel ends at the side of the aperture | <i>monilifera.</i> |
| 14. Body whorl with 19-21 pitted spiral lines | <i>hardouini.</i> |
| — Body whorl with 25 spiral lines | <i>labiata.</i> |
| 15. Middle whorls generally with spiral ridge, 3.4 1.9 and larger | <i>spinosa.</i> |
| — Middle whorls generally with spines, 3.4 1.9 and smaller | |

Stenothyra monilifera (BENSON, 1856).

pl. 9 fig. 60.

- 1856 *Nematura monilifera* BENSON, Ann. Mag. nat. Hist., 17: 342 (Burma, Mergui).
 1856 *Stenothyra monilifera*, — BENSON, Ann. Mag. nat. Hist., 17: 497 (Burma, Mergui).
 1864 *Stenothyra monilifera*, — CROSSE & FISCHER, J. de Conch., 12: 331 (Cochinchine, dans le marécage situé sur la rive gauche du Vaica, à son embouchure).
 1867 *Stenothyra monilifera*, — BLANFORD, J. asiat. Soc. Bengal, 36: 58, pl. 13 fig. 15 (Burma: Mergui).

Shell rather large, of the same size as *S. glabrata* ADAMS, but with deep suture between the last two whorls and with distinct spiral sculpture which

consists of rows of rather large pits. There are 17-21 spiral rows which are deeper around the open umbilicus and become continuous grooves. In *S. deltae* BENSON there are about 25 spiral lines of pits and the pits are smaller. *S. deltae* has a shallow suture like *glabrata*. Body whorl neither flattened (as in *glabrata* and *deltae*) nor bossed. There is no trace of basal keel as in *polita* and *prasongi* n. — Aperture and operculum typical.

Size A 3.6-4.8 mm; D 2.2-2.9 mm.

Animal greyish with diffuse black pigmentation dusted over back and head. The long tentacles without rings but with fine black dots. The left tentacle shows delicate ciliae which are missing on the right. The truncate rostrum shows an angled black ring in the middle and a black tip. There are two yellow patches at the end of the rostrum. There is a black line running between the tentacles on the forehead. There are two large yellow dots on either side of the animal below the tentacles. Whitish pigmentation is seen on the foot, the tentacles and at the side lines of the body. The dorsal filiform process is moderately long, the posterior end of the foot is rounded. — Radula with trapezoidal rhachis; its cutting edge has 5 cusps; there are 4 basal cusps on either side. Laterals with the cusp formula 3(5)-1-8, inner marginals with 6 large cusps and 7 small, outer marginals with 6 cusps. — Penial complex with a comparatively long verge which ends in a pointed stylet. It has a single duct only and no appendages.

Type locality: Burma: Mergui.

Distribution Coastal area of Thailand at the Gulf of Thailand and the Indian Ocean. Extralimitarily known from Burma, Malaya, S Vietnam, Java and Sumatra.

Habitat: The species lives in the drainage trenches of mud-flats and mangrove forests in brackish water.

Biology: The species lives half buried in the mud feeding on decaying organic matter. The females lay single, round eggs with brown, calcareous shells which they attach to stones or other shells.

Note This species seems to be closely related to *S. punctulata* GOULD and may even be identical with that species. *S. punctulata* is based on a single specimen which shows sufficient differences that the use of the older name by GOULD does not seem to be justified before more material of *punctulata* has been collected.

***Stenothyra moussoni* MARTENS, 1897.**

pl. 9 fig. 61.

- 1848 *Paludina ventricosa*, — MOUSSON, Mitth. naturf. Ges. Zürich, 1: 261 [non QUOY & GAIMARD] (Java).
1849 *Paludina ventricosa*, — MOUSSON, Land & Süßw. Moll. Java: 63, pl. 8 fig. 6 [non QUOY & GAIMARD] (Java).
1897 *Stenothyra moussoni* MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostindien, 4: 210, pl. 9 fig. 7 (Java, Celebes).
1956 *Stenothyra ventricosa*, — VAN BENTHEM JUTTING, Treubia, 23 (2): 340, pl. 44, 45, 47 [non QUOY & GAIMARD] (Java, many localities).
1959 *Stenothyra ventricosa*, — VAN BENTHEM JUTTING, Beaufortia, 7 (83): 88 [non QUOY & GAIMARD] (Sumatra: Tandjong Tiram and Labuan Ruku).

Shell ovoidal-conic, more so when seen from the back than from the front, spire conic, penultimate whorl somewhat inflated and slightly compressed dorso-ventrally. Greyish or yellowish-corneous, diaphanous, smooth, glossy, very

rarely with rudiments of pitted spiral lines. Neck with a rust-brown patch shaped like an hour-glass. Body whorl regularly rounded, not "bossed" at the left side, about $\frac{3}{5}$ of the length of the shell. Umbilicus rimate. Suture either deep between all whorls or shallow between the last two whorls. — Aperture small, constricted, oval or almost round, a little higher than $\frac{1}{3}$ of the body whorl. — Operculum typical.

Size: A 2.3-3.6 mm; D 1.6-2.2 mm.

Animal typical for the genus. Tentacles and rostrum with two black pigment rings each. — Rhachis with 5 cusps at the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 2-1-8, inner marginals with 10-12 large and 15-18 very small cusps, outer marginals with 10-15 cusps, generally with 12. — Reproductive organs typical for the genus.

Type locality Surabaya, estuary of the Kediri River.

Distribution: Java, Sumatra, Celebes, Malaya and Thailand. It is also reported from several small Indonesian islands. This species is common in Thailand; it is found in the coastal area of the Gulf of Thailand, but seems to be replaced by *S. schlickumi* on the Indian Ocean.

Habitat: Drainage trenches of the mud-flats and mangrove and nipa palm forests.

Note: MARTENS was the first to doubt the identity of this brackish water species with the freshwater species *S. ventricosa* (QUOY & GAIMARD) from the Lake Tondano in Celebes. A comparison of this species collected at the type locality by the present author with *S. moussoni* proved MARTENS' doubt to be justified.

***Stenothyra mandahlbarthi* BRANDT, 1968.**

pl. 9 fig. 62.

1968 *Stenothyra mandahlbarthi* BRANDT, Arch. Moll., 98: 259, pl. 9 fig. 47 (Thonburi, Nakon Pathom and Suratthani).

This species is similar in shape to *S. krungtepensis*, but still more slender, with more acutely pointed apex and deeper suture. The colour is whitish-diaphanous or bright yellowish-vitreous. It has a distinct spiral sculpture of pitted rows of which there are 9-16 rows on the body whorl.

Size: A 2.8-3.3 mm; D 1.4-1.8 mm.

Radula of the "*krungtepensis*-type" Rhachis with 5-7 cusps on the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 3-1-6, inner marginals with 21-24 (12-14 large and 9-10 small) cusps, outer with 12.

Type locality: Bang Khon Kao near Nakon Chai Sri, Nakon Pathom Province.

Distribution: Thonburi, Bangkok, Nakon Pathom and Suratthani Provinces.

Variability: Specimens with rudimentary sculpture are not rare. These differ from *S. krungtepensis* by their deeper suture, more acute apex and larger size.

***Stenothyra labiata* BRANDT, 1968.**

pl. 9 fig. 63.

1968 *Stenothyra labiata* BRANDT, Arch. Moll., 98: 259 (Creek 40 km N of Ranong).

1970 *Stenothyra labiata*, — BRANDT, Arch. Moll., 100: pl. 13 fig. 23.

This species differs from all other brackish water species of the genus (except *S. spinosa*) from Thailand by its external varix parallel to the peristome and —

if present — by a sharp spiral ridge which may carry cutaneous spines. The shell is sculptured with spiral rows of pits which may be connected and form continuous grooves on the postnuclear whorls. The colour of the shell is chestnut-brown. It is dull and barely translucent. — Aperture rather large, about $\frac{2}{3}$ of the height of the shell. Adult specimens with a distinct external varix.

Size: A 3.4-4.2 mm; D 1.9-2.2 mm.

Animal, anatomy and radula do not show any particular characteristics. Rostrum with two black rings. — Rhachis with 5 cusps on the cutting edge and 4 basal cusps on either side. Laterals with the cusp formula 2-1-8, inner marginals with 10 large and 14 small cusps, outer marginals with 10 cusps of equal size. — Male reproductive organs typical for the genus.

Type locality Creek 40 km N of Ranong.

Distribution Known from the Provinces of Ranong and Trang on the Indian Ocean.

Stenothyra polita (A. ADAMS, 1851).

pl. 10 fig. 64.

1851 *Nematura polita* A. ADAMS, Proc. zool. Soc. London, 1851: 226 (no locality).

1856 *Stenothyra polita*, — BENSON, Ann. Mag. nat. Hist., (2) 17: 500 (Singapore).

1897 *Stenothyra polita*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl. Ostind., 4: 211 (Singapore, Penang, Basilan Island).

1895 *Stenothyra quadrasi* MOELLENDORFF, Nachr. Bl. dtsh. malak. Ges., 27: 138 (Mindoro, Busuanga).

The compressed basal keel and the extremely constricted aperture make the identification of this interesting species easy. It has no brownish patches as the similar *S. prasongi* n.

Shell rather large for the genus, with pointed apex and large, compressed body whorl. Base of the shell with a compressed keel which is continued to the suture on the left side by an obtuse carina. The whole shell is sculptured with pitted spiral lines. The end part of the last whorl is very much constricted and forms a flat plane in the middle of which the aperture is placed. At the end of the basal keel the peristome forms an angle on which spiral lines may be seen. The rimate umbilicus is placed in the lower third of the face of the body whorl. — Operculum typical.

Size: A 5.9-7.2 mm; D 3.8-4.2 mm; d 2.9-3.1 mm.

Animal grey with black pigment patches. Tentacles long, with clusters of grey and black dots, rostrum blackish with greyish tip. — The radula differs from those of all other species of the genus by having a rhachis with 6-7 basal cusps on either side similar to that of *S. basiangulata* MORI. The cutting edge, however, has only 5 cusps. Laterals with the cusp formula 1-1-5, inner marginals with 5 large and 6 small cusps, outer marginals with 5 cusps only. — Male reproductive organs typical for the genus.

Type locality: Singapore (BENSON 1856: 500).

Distribution: Philippines, Java (?), Sumatra, Malaya and Thailand. In Thailand not rare in mud-flats and mangrove forests on the Indian Ocean and Gulf of Thailand.

Stenothyra cyrtochila VAN BENTHEM JUTTING, 1959.

pl. 10 fig. 65.

1959 *Stenothyra cyrtochila* VAN BENTHEM JUTTING, *Beaufortia*, 7 (83): 88, pl. 1 fig. 6 (Sumatra: Tandjong Tiram).

1963 *Stenothyra cyrtocheila*, — VAN BENTHEM JUTTING, *Nova Guinea*, *Zool.* 20: 449 (in the text).

This species differs from all other species of *Stenothyra* from brackish water by being sculptured with fine, incised grooves as in *S. roseni* BRANDT instead of punctuated spiral lines. The shell is of the shape of *S. glabrata* A. ADAMS, but much smaller.

Size A 1.8-2.3 mm; D 1.3-1.6 mm.

Radula with trapezoidal rhachis; its cutting edge has 7 cusps; there are 3 basal cusps on either side within the wings.

Type locality Tandjong Tiram, E Sumatra.

Distribution Known from the type locality and from Thailand only. In Thailand this species has been found in the Provinces of Trang and Ranong.

Habitat Brackish water creeks in mud-flats and mangrove forests.

Stenothyra acuta n. sp.

pl. 10 fig. 66.

Diagnosis: A species of *Stenothyra* BENSON which differs from all other species of this genus from Thailand by its elongately conic spire with almost completely flat whorls and very pointed apex.

Description: Shell rather small for the genus, ovate-conoidal, corneous, translucent, glossy, smooth except for the delicate growth lines and traces of a spiral microsculpture which may only be seen under very strong magnification. On the back of the body whorl the growth lines may form very delicate, oblique grooves. The apex is acutely pointed unless eroded, the spire is regularly conic with almost completely flat side lines. The body whorl is large, but only slightly inflated; its left side line is more curved than the right; it is somewhat flattened at the ventral face below the periphery. There is a distinct rusty brown patch on the neck similar to that of *S. moussoni* MARTENS. The end part of the last whorl is very much descended and constricted; thus the aperture is smaller than the diameter of the last whorl. — The aperture is almost circular, very small, about $\frac{2}{5}$ of the height of the body whorl, somewhat oblique. Peristome sharp, continuous, appressed to the penultimate whorl. — Operculum subcircular, corneous, brittle, glossy, translucent, paucispiral with subcentral nucleus. There are two short, straight, diverging ridges in the middle of the internal surface and a low, semicircular ridge parallel to the margin.

Size: A 2.5-3.2 mm; D 1.5-1.9 mm.

Animal bright grey with blackish and sand-coloured pigment spots dusted over head and back. On the long filiform tentacles these black spots form several rings; on the truncate rostrum there are two black rings. On the posterior end of the back there is the typical filiform process. — Radula with trapezoidal rhachis; its cutting edge with 5 cusps; there are 3 basal cusps on either side. Laterals with the cusp formula 1-1-8, inner marginals with 25-30 cusps, outer

with about 15. — Male reproductive organs with a simple, bent, compressed verge which carries a curved stylet at its pointed tip.

Type locality Trench near Pakon Dakon, Chachoengsao.

Distribution Known from the drainage system of the Bang Prakon River only.

Habitat: Brackish water trenches with muddy ground.

Material Holotype SMRL 5157/A; paratypes 5157/30. — SMRL 5164-Swamp at Bang Prakon bridge, high-way 3.

Stenothyra glabrata (A. ADAMS, 1851).

pl. 10 fig. 67.

1851 *Nematura glabrata* A. ADAMS, Proc. zool. Soc. London, 1851: 226 (Penang).

1856 *Stenothyra glabrata*, — BENSON, Ann. Mag. nat. Hist., (2) 17: 499 (Penang).

This species differs from all other smooth brackish water species by its large size and extremely shallow suture between the last two whorls. It is similar to *S. deltae* (BENSON) but differs from that species by its smooth surface. However, there are populations with sculptured specimens, but these are great exceptions.

Shell rather large for the genus, ovate-conic, olive-coloured or yellowish-corneous, smooth, glossy, translucent. The upper whorls are somewhat convex, the last two whorls are almost flat and separated by a very shallow suture. The body whorl is large and inflated; its side lines are well rounded and never "bossed", it is distinctly compressed dorso-ventrally. — Aperture small, constricted, oblique; peristome and operculum typical for the genus.

Size: A 3.3-5.5 mm; D 2.1-3.4 mm.

Animal grey with large black pigment patches on mantle and visceral sac and fine pigment spots dusted over head and back. One large, elongate black patch is almost typical for the species. It is seen through the shell parallel to the peristome when the animal is retracted. Rostrum almost completely black. Tentacles without black pigment but with few, deeply embedded yellowish granules. Such granules are also found in the sides of the body. The typical dorsal process is comparatively short. — Rhachis with 5 cusps on the cutting edge and 3 basal cusps on either side. The laterals have a cusp formula 1-1-8, the inner marginals have 25-30 (10-12 large and 15-18 small) cusps, the outer have 14-15 cusps of equal size. — The verge of the male animals is bent and shows a small, curved stylet at its pointed tip.

Type locality: Penang, Malaya.

Distribution: Known from Thailand, Malaya, Java and Sumatra, but probably also in Burma and Vietnam.

Habitat Brackish water creeks in the tidal zone.

Stenothyra schlickumi BRANDT, 1968.

pl. 10 fig. 68.

1968 *Stenothyra schlickumi* BRANDT, Arch. Moll., 98: 258 (Thailand: 2 km S of Palian, Trang Prov.).

1970 *Stenothyra schlickumi*, — BRANDT, Arch. Moll., 100: pl. 23 fig. 22.

This species looks like a small sculptured *S. moussoni*, but the apex is more obtuse and the suture between the last two whorls is very shallow. There is a

population of sculptured *moussoni* known from Samut Prakan. These are much larger, have a pointed apex and the suture between the last two whorls is deeper. The sculpture of that population consists of many fine, closely set pits. The pits of this species are larger and less densely placed.

Size: A 1.8 mm; D 1.1 mm.

Animal, anatomy and radula still unknown.

Distribution: Known from Palian (Province of Trang) only.

Habitat: Brackish water drainage along the road from Palian to the Custom House in a mangrove swamp.

Relationship: The closely related *S. nana* is somewhat broader than this species and differs by its angled body whorl.

***Stenothyra maculata* n. sp.**

pl. 10 fig. 69.

Diagnosis: A species of *Stenothyra* BENSON which differs from all other known species of the genus by having several rusty brown dots on the neck.

Description: Shell below medium size for the genus, with conic spire and large, but moderately inflated body whorl, smooth, glossy, thin, transparent. The apex is always eroded, the remaining 4 whorls are convex, increase regularly in size and are separated by a rather deep suture which is not as deep between the last two whorls. The body whorl is distinctly "bossed" at the left side but only moderately compressed dorso-ventrally. The umbilicus is narrow but distinctly open. The most conspicuous characteristic is the pattern of patches on the neck which is different in all collected specimens. There are generally 3 or 4 irregularly placed rusty brown patches on the neck. When fully developed there is: 1) a patch on the left side of the penultimate whorl, 2) a subsutural band of about half the length of the body whorl, 3) a peripheral band running from the "boss" on the left side of the body whorl to the aperture; this band is formed by the connection of 2 or 3 patches, 4) a patch above the umbilicus which extends towards the aperture, and 5) a patch on the base of the body whorl below the open umbilicus. The bands may be dissolved into patches, one or several of these patches may be missing. One of the specimens had 5 dots arranged in the pattern of the dots on a dice. Another specimen was found with the brown colour pattern dissolved into 9 tiny dots placed on the neck and base. — Aperture of moderate size, almost circular, base not retracted, constricted, not exerted. Peristome continuous, not thickened, appressed to the penultimate whorl, without a notch at the parietal wall. — Operculum typical for the genus.

Size: A 2.1-2.5 mm; D 1.4-1.7 mm.

Animal (preserved in alcohol) slate-grey with few black pigment patches. — Rhachis of the radula with 5 cusps on the cutting edge and 4 basal cusps on either side. Laterals with the cusp formula 1-1-6, inner marginals with 12, outer with 4-5 cusps. — Male reproductive organs with a simple, prong-shaped verge without appendages. It ends in a tiny, curved stylet.

Type locality: Tarua ("harbour") Khlung, Chantaburi.

Distribution: Known from the type locality and a brackish water khlong near Narativat in S Thailand.

Material: Holotype SMRL 4965/A; paratypes 4965/15. — SMRL 5167/30-Khlong Tan Yong, near Ban Kuyong Baru Mayo, about 74 km N of Narathivat.

Relationship There are several species known with brown patches or bands: *S. moussoni* MARTENS has an hour-glass-shaped brown patch on the neck; *S. prasingi*, which is much larger and has distinct basal keel, has several brown spots on the neck; the patches of *S. minima* SOWERBY are always connected with obsolete bands.

Stenothyra krungtepens BRANDT, 1968.

pl. 10 fig. 70.

1968 *Stenothyra krungtepens* BRANDT, Arch. Moll., 98: 257, pl. 9 fig. 45, textfig. 30 (Bangkok; Thonburi; Nakon Pathom).

Shell of about the same size as *S. moussoni*, but whorls more convex, suture between the last two whorls deeper and spire longer and more conical. The rusty brown patch on the neck typical for *moussoni* is completely missing. Generally there is no pitted spiral sculpture, but exceptions with traces of spiral lines are known.

Size: A 2.3-3.2 mm; D 1.2-1.8 mm.

Animal typical for the genus, with irregular, fine pigment spots, but without yellowish pigmentation. — Radula of the “*moussoni*-type”; rhachis with 5 cusps on the cutting edge and 3 basal cusps on either side. Laterals with the cusp formula 3-1-6, inner marginals with 11 endocones and 8 smaller ectocones, outer marginals with 12 cusps. *S. moussoni* has never more than 15 cusps at the outer marginals, *S. mandahlbarthi* has only 12 cusps.

Type locality: Klong Premprachakon in Bangkok.

Distribution: In Klongs with tidal water in Bangkok, Thonburi Province, Nakon Pathom Province and Ayutthia Province.

Stenothyra annandalei BRANDT, 1968.

pl. 10 fig. 71.

1968 *Stenothyra annandalei* BRANDT, Arch. Moll., 98: 260, pl. 9 fig. 46 (Rayong Province: Ban Don Makok near Glaeng).

This small species differs from the preceding species by its size, slender shape and open umbilicus. Aperture and operculum typical.

Size: A 1.8-2.0 mm; D 1.0-1.2 mm.

Animal and radula unknown as only very few specimens of this obviously rare species have been found.

Type locality and distribution Trench along the highway 3 at Ban Don Makok, 51-52 km E of Rayong, in the District of Glaeng.

Habitat This trench opens into the Klong Don Makok, a tributary of the Prasae River. In the dry season the water of this trench is slightly brackish, in the rainy season, however, it is almost fresh.

Stenothyra spinosa n. sp.

pl. 10 fig. 72.

Diagnosis: A species of *Stenothyra* BENSON which differs from *S. echinata* and *S. ornata* ANNANDALE & PRASHAD by its smaller size, more slender shape and the deep suture between the last two whorls.

Description: Shell of medium size for the genus, slender, ovate-conoidal with rather long, conic spire. Thin, brownish or corneous, almost dull, slightly translucent. The 5 convex whorls increase regularly in size and are separated by a deep suture which is also deep between the last two whorls. The embryonic shell is smooth, the other whorls are sculptured with fine pitted spiral lines. There are about 17-19 lines on the penultimate whorl above the aperture. The 3. and 4. (antepenultimate) whorls carry a spiral row of short spines. There are 13-17 spines on each whorl. The spines can be reduced to one whorl only or may be completely missing. Sometimes there is a trace of a delicate keel present. The body whorl is well rounded on both sides and without a "boss"; it is only very slightly compressed ventro-dorsally. The umbilicus is a narrow chink beside the columellar side of the aperture. — Aperture oval, only slightly constricted, oblique; peristome continuous, appressed to the penultimate whorl. There is a more or less distinct outer varix parallel to the peristome, similar to that of *S. labiata* BRANDT. — Operculum oval, corneous, thin, translucent; inner surface with two short, high, diverging lamellae and a long, low, semi-circular ridge parallel to the margin.

Size: A 2.6-3.4 mm; D 1.5-1.9 mm.

Animal light sand-coloured, with very few small black pigment spots on the head and back and some large patches on the mantle lobe which can be seen through the translucent shell. Head, back, mantle lobe, tentacles and rostrum dusted with yellowish pigment dots. These merge into orange at the anterior end of the rostrum. Here are also two black rings of very densely placed black pigment spots. The foot is straight in front and rounded behind. There is the typical filiform dorsal process at the end of the back. Front part slightly notched in the middle, with a narrow line of densely placed black pigment spots. Tentacles round, filiform, with numerous yellow pigment dots but rarely with black pigmentation. — Cutting edge of the rhachis with 5 cusps. There are 4 basal cusps on each side. Laterals with the cusp formula 3-1-4(5), M₁ with 22-25 cusps, o M₂ with 10-12.

Type locality: Klong Wan, about 5 km S of Kraburi, Ranong Province.

Distribution: Known from some tributaries of the upper reaches of Pakchan River.

Habitat: The localities in which this species was found are still under tidal influence. The water is slightly brackish during the dry season, but completely fresh during the rainy season.

Material Holotype SMRL 5145/A; paratypes 5145/15. — SMRL 5193-Klong "Sapan Poon", 0.5 km E of Kraburi.

***Stenothyra prasongi* n. sp.**

pl. 10 fig. 73.

Diagnosis: A species of *Stenothyra* BENSON which differs from its closest relative, *S. polita* ADAMS, by its rusty-brown palatal patches, the less constricted aperture and the beak-like ending of the basal keel at the outer margin of the peristome.

Description: Shell rather large for the genus, of almost triangular shape, rather solid but translucent, of creamy-corneous or yellowish-olive ground

colour, with rusty brown colour pattern. This consists of a subsutural spiral band which borders the suture, a brown antepieristomal zone, a peripheral band on the body whorl, two patches on the neck and another patch on the omphalic area. This pattern seems to be rather constant and varies only in the size of the patches. The 5 whorls are convex and separated by a deep suture which is shallower between the last two whorls. The first whorl is smooth, the other whorls are sculptured with regular spiral lines of distinct pits. There are about 10 lines on the penultimate whorl above the aperture and 12 lines on the body whorl between suture and periphery and about 8 spiral lines on the base, those near the omphalic pit being almost solid grooves. The spire is conic, the body whorl large, measuring about $\frac{3}{5}$ of the length of the shell; its right side line is only moderately curved, the left side is almost semicircular; the body whorl is distinctly compressed dorso-ventrally and carries a "boss" at the left side near the periphery; the basal keel is short, much shorter than in *S. polita*; it ends in a distinct beak at the lower outer margin. In *S. polita* it ends exactly underneath the aperture in an angle, not in a protruding beak. The umbilicus is a chink beside the aperture. — Aperture oval, moderately oblique, constricted; peristome formed by the constricted end part of the last whorl. — Operculum ovate, glossy, corneous, translucent, paucispiral with subcentral nucleus; on the inner surface there are the two typical straight, high, converging lamellae and the semicircular ridge parallel to the margin.

Size A 4.0-5.0 mm; D 2.6-2.9 mm; d 1.9-2.1 mm.

Animal grey with blackish and yellowish pigment spots. These form rings on the tentacles and rostrum. End of the back with typical filiform process. — Radula with trapezoidal rhachis; its cutting edge has 5 cusps; there are 5-6 basal cusps on either side. — The simple verge has a single duct and ends in a concholinous stilet.

Type locality Trench in a mangrove swamp about 2 km S of Palian, Trang Province.

Distribution: Known from the type locality only.

Material: Holotype SMRL 5155/A; paratypes 5155/5.

***Stenothyra hardouini* MORGAN, 1885.**

pl. 10 fig. 74.

1885 *Stenothyra hardouini* MORGAN, Bull. Soc. zool. France, 10: 68, pl. 4 fig. 15 (Poulu Tikous).

Shell ovate-conoidal with small, conic spire and large body whorl. The ventral surface of the body whorl is flattened, and the shell is ornamented with spiral punctured lines. There are about 25 spiral lines on the body whorl, those around the rimate umbilicus are almost continuous grooves. — Aperture extremely small and constricted. — Operculum typical.

Size: A 4.5-5.5 mm; D 2.8-3.4 mm.

The animal differs from that of *S. monilifera* by the lack of the two orange patches on the anterior end of the rostrum. Yellow and black pigmentation is dusted over body, head and rostrum. The pigment dots form irregular rings on the tentacles. Tip of the rostrum almost entirely black; there are two diffuse black patches on either side of the rostrum. Near these patches the yellow

pigment dots are more densely placed than at other parts of the animal. There are blackish zones behind the tentacles and at the sides of the foot.

Cutting edge of the trapezoidal rhachis with 7 (rarely 5) cusps; there are 4 latero-basal cusps on either side. Laterals with the cusp formula 3-1-6, inner marginals with 13 cusps, outer marginals with 5.

Type locality: Poulu Tikous (Penang Island).

Distribution: Hitherto known from the type locality only. In Thailand in some tributaries to the upper or middle reaches of the Pakchan River near Kraburi, Ranong Province.

The Thai specimens are tentatively assigned to this species as the holotype of MORGAN is unknown to the present author.

Stenothyra nana PRASHAD, 1921.

pl. 10 fig. 75.

1921 *Stenothyra nana* PRASHAD in ANNANDALE & PRASHAD, Rec. Ind. Mus., 22: 130, pl. 16 fig. 5-6 (Chandipal, Calcutta).

With some hesitation a population of small *Stenothyrae* from Ranong Province is assigned to this Indian species. The species was based on a single specimen and this unique holotype is not even in good condition of preservation. Size, shape and sculpture of our specimens, however, agree so completely with those of the holotype of *S. nana* that the creation of a new taxon for this population does not seem to be justified. As the description given by PRASHAD is incomplete, it is repeated below. Unfortunately only 10 dead shells were collected, therefore no data on the animal, soft parts and radula can be given.

Description: Shell small, ovoidal-conic, with a small, conic spire placed on the ovate last two whorls. It is brownish-corneous, barely glossy, with a deep suture between the upper whorls and a shallow suture between penultimate and body whort. The sculpture consists of 12 rows of small pits on the upper whorls and 20 rows on the body whorl. The pits are rather large for the size of the shell. They are densely placed and sometimes connected by very delicate grooves. — Aperture ovate, oblique, constricted, not exerted; peristome continuous, angled above, well rounded below, somewhat thickened. — Operculum ovate, corneous, brittle, paucispiral, with subcentral nucleus. The internal surface carries the typical ridges of *Stenothyra*.

Size A 1.7-2.2 mm; D 1.1-1.4 mm.

Type locality: Chandipal near Calcutta.

Distribution: Ranong harbour in Thailand and Chandipal near Calcutta.

Iravadiidae THIELE, 1928

The subfamily of Iravadiinae was established by THIELE as a taxon of Hydrobiidae for *Iravadia* BLANFORD and Fairbankiinae as a subfamily of Micromelaniidae for *Fairbankia*. Shell characteristics, operculum, animal and radula are so similar that there is no doubt about the close relationship between *Fairbankia* and *Iravadia*. They are also found in the same habitat. There are, however, differences in the male reproductive organs.

Shell elongate-conoidal or turreted, rather solid, covered with a thick, brown periderm, with more or less strong spiral lines or ridges. — Aperture oval, milky-blue within, peristome with an outside varix. — Operculum corneous, concentric, with inner ridges. The concentric operculum distinguishes this family from Hydrobiidae. "*Pachybilus*" *parvus* LEA, later placed wrongly into *Pachydrobia*, now in an own genus (*Rehderiella*) and subfamily in Hydrobiidae, has the same habitat, the same brown periderm and bluish-white aperture as *Iravadia* and *Fairbankia*, but the operculum is paucispiral and the rhachis has several basal cusps.

Animal sand-coloured or greyish with black pigmentation. The long, round filiform tentacles carry black pigment rings. The rostrum is long, very mobile, ringed, truncate in front. — Radula with 7 teeth. Rhachis with or without basal cusps, cutting edge with several cusps. — Male reproductive organs with a blade-like verge which carries a more or less distinct appendage. It has only one duct and no stylet at the tip.

Distribution: S and SE Asia, Indonesia, N Australia, Japan. Not yet reported from Taiwan and the Philippines.

Key to the genera:

1. Shell with few strong spiral ridges and sometimes with axial ribs. Inner surface of the operculum with one ridge parallel to the columellar margin and two ridges radiating from the nucleus in an angle of 45° *Iravadia*.
2. Shell with many delicate spiral lines, never with axial ribs but sometimes with cutaneous spines; operculum with one curved ridge only *Fairbankia*.

Iravadia BLANFORD, 1867

Shell with strong spiral ridges and sometimes with axial ribs. The shape is conic, the apex is sometimes decollated. Aperture like that of the family. Operculum with a ridge parallel to the columellar margin and two ridges which radiate in an angle of 45° from the nucleus. — Rhachis broad, low, with several (generally 13) cusps on the cutting edge and one basal cusp on either side. The lower margin is winged at the sides and carries a pointed, triangular process in the middle. Laterals with few, marginals with many cusps.

Type species: *Iravadia ornata* BLANFORD.

Distribution: India, Burma, Thailand, Malaya, China, Japan. Not yet reported from Indonesia, Taiwan and the Philippines.

Key to the species from Thailand:

1. Shell with spiral ridges only *ornata*.
- Shell also with axial ribs . . . 2
2. Shell with colour bands *tuberculata*.
- Shell without colour bands *reticulata*.

Iravadia ornata BLANFORD, 1867

pl. 10 fig. 76.

1867 *Iravadia ornata* BLANFORD, J. asiat. Soc. Bengal, 36: 56, pl. 13 fig. 13-14 (Burma: Pegu).

1885 *Rissoina (Iravadia) ornata*, — WEINKAUFF, Conch. Cab., 1, 22: 71, pl. 15b fig. 1 (Burma: Iravadi).

Shell turreted or elongately conoidal, with whitish ground colour, but covered with an olive-coloured periderm which appears brownish by a layer of mineral deposit. The 6 whorls are hardly convex but separated by a well indented suture. The first two whorls are smooth, the third and fourth whorls show 2 or 3, the fifth whorl 4 and the body whorl 6-7 strong spiral ridges. These are crossed by axial striae which may sometimes be strengthened into distinct riblets. The subsutural ridge is the weakest and may sometimes be missing. — Aperture rather large, thickened within, with a milky-blue nacre within. Peristome connected by a thick callus, sharp, with an outer varix parallel to the margin, angled at the base, with slightly curved columellar margin; the outer margin shows 4 or 5 short processes caused by the spiral ridges. — Operculum elongately ovate, corneous, concentric with marginal nucleus; parallel to the margin there is a semicircular ridge and two ridges radiate from the nucleus in a right angle.

Size: A 3.8-6.9 mm; D 2.2-3.8 mm.

Animal greyish with large black pigment dots on head and back and small black pigment dots dusted over the whole body with exception of the sole; this shows several deeply embedded whitish pigment dots; the long filiform tentacles carry several black pigment rings; between these rings minute whitish pigment dots may be seen. The foot is rounded behind with a short, rounded process; it is truncate in front and produced at either side into triangular pseudopods. The truncate rostrum protrudes only a little beyond the frontline of the foot. The front line shows a distinct mucous slit, which is a little indented in the middle. — Radula with a broad and low, trapezoidal rhachis which carries 5 small cusps on either side of the larger middle cusp on the cutting edge. The basal corners are produced to broad wings which are less pointed at their tips than those of *I. reticulata*. There is a small rounded basal cusp in the bay formed by the wings and the sides of the central process. Laterals with 2(-3)-1-3, marginals with 14 or 12 cusps respectively. — The male reproductive organs show a flattened verge with a single duct. It carries a long, finger-shaped appendage. Female reproductive organs with multibranched gonads, moderately long oviduct which joins with the receptacular duct and the ladderlike bursa copulatrix.

Type locality Myattaya branch of the Bassain River in Burma.

Distribution Known from Burma and Thailand. The species is also to be expected in Malaya and Sumatra. In Thailand it was found in the Provinces of Ranong, Grabi, Trang, Samut Prakan, Chachoensao, Chantaburi, Rayong, Trat and Sri Tammarat.

Habitat: The species lives in brackish water in the drainages of mud-flats, nipa palm and mangrove swamps and in the estuarine area of rivers. It was found partly buried in mud feeding on decaying organic substance.

Iravadia reticulata BRANDT, 1968.

pl. 10 fig. 77.

1968 *Iravadia reticulata* BRANDT, Arch. Moll., 98: 268, pl. 10 fig. 55, textfig. 37a, b (Tarua Khlung).

Shell rather small for the genus, with eroded apex and 4 remaining whorls. These are somewhat convex and separated by a shallow suture. The sculpture

consists of 2 or 3 spiral ridges on the postnuclear whorls and 7-8 ridges on the body whorl. The subsutural ridge is weak, the two below it are much stronger and the fourth, the peripheral ridge, is again somewhat weaker. The four upper whorls are crossed by strong axial ribs which are much weaker on the lower half of the body whorl. There are often sharp tubercles at the crossings of the ribs and ridges. Sometimes the ridges and ribs may become obsolete but the tubercles remain well developed. Thus the shells may appear to be sculptured with several spiral rows of beads. — Aperture, peristome, varix and operculum typical for the genus.

Size A 2.9-4.6 mm; D 1.7-2.4 mm.

Animal typical for the genus. — Radula like that of the type species. — The appendage of the verge is reduced to a distinct swelling.

Type locality Tarua Khlung harbour, Chantaburi Prov.

Distribution: Thailand in the provinces of Ranong, Grabi, Trang, Rayong, Samut Prakan, Chonburi, Chantaburi and Trat. Extralimitarily not yet known but probably also in Burma and Malaya.

Habitat The animals live in the drainage trenches of mud-flats, nipa and mangrove swamps in brackish water. They live partly buried in the mud and feed on decaying organic matter.

Iravadia tuberculata n. sp.

pl. 10 fig. 78.

Diagnosis: A species of *Iravadia* BLANFORD which differs from *I. reticulata* by its violet spiral bands and by having 3 spiral rows of tubercles on the postnuclear whorls and 6 on the body whorl.

Description: Shell comparatively small for the genus, elongately conic with eroded apex. Vitreous but covered with a brownish periderm and generally with a blackish layer of mineral deposit. With exception of the protoconch, the shell is sculptured with spiral rows of tubercles, of which 3 are seen on the middle whorls and 6 on the body whorl, 5 of these spiral rows are coloured by violet bands. When the periderm is removed the 5 spiral colour bands still remain visible and they can be seen inside the aperture reaching to the peristome. The peripheral row of tubercles seems always to lack the colouring. The tubercles are connected by weak axial ribs and spiral ridges. These ridges are stronger around the umbilical area. — Aperture small, oval, peristome extremely thick, with an outside varix. The bluish-white nacreous layer within the aperture is very thin and easily eroded. — Operculum oval, concentric, with almost marginal nucleus. The two ridges which radiate from the nucleus are very delicate; they are often missing or not connected.

Size: A (decollate) 2.8-3.2 mm; D 1.5-1.8 mm.

Animal sand-coloured. The short rostrum and long, filiform tentacles are ornate with black rings of pigmentation. Tiny dots of black are dusted over head and back. The mantle lobe and visceral sac are coloured with large black patches. — Radula with broad, narrow rhachis with winged and somewhat pointed ends and a triangular process in the middle of the base. The cutting edge bears 9 cusps; there is one basal cusp on either side only. Laterals with

the cusp formula 2-1-3, marginals with many cusps. — Reproductive organs not yet studied.

Type locality Brackish water trench along the road about 1-2 km S of Grabi.

Distribution Known from the type locality only.

Material Holotype SMRL 3451/A; paratypes 3451/25.

Note Shell similar to that of certain species of *Alvania* RISSO and *Rissoina* ORDIGNY.

Fairbankia BLANFORD, 1868.

Shell elongately conic, with pointed apex when complete but generally truncate. Ground colour white but covered with a brown periderm. Sculptured with fine spiral lines which may carry ciliae. — Aperture bluish-white within, periderm with sharp margin and a thick varix outside parallel to it. — Operculum corneous, concentric, with lateral nucleus and with a curved ridge on the inner surface.

Animal with black pigmentation which forms rings on rostrum and tentacles. — Rhachis without basal cusps. — Verge with a finger-shaped appendage which in small species may be reduced to a minute swelling which easily escapes notice. Females seem to be generally larger than males.

Type species *Fairbankia bombayana* BLANFORD (Monotype).

Distribution Coasts of S and SE Asia, Sumatra, S China and Japan. Not yet recorded from Taiwan, Java and the Philippines.

Biology All species of this genus live in brackish water with muddy ground and feed on decaying organic substance.

The shells of another brackish water genus, *Mainwaringia* NEVILL, look exactly like those of a *Fairbankia*. The radula, however, at least as figured by ANNANDALE & PRASHAD (1919) is different. *Fairbankia* has a radula with an elongately oval rhachis with many cusps on the cutting edge, *Mainwaringia paludomoides* NEVILL (= *leithi* E. A. SMITH) has a semicircular rhachis with straight base and only 5 cusps at the cutting edge. The outer marginals of *Fairbankia* are typically shaped for the superfamily, those of *Mainwaringia* are S-shaped and carry only 3 cusps. The systematic position of *Mainwaringia* is still uncertain.

Key to the species from Thailand:

- | | |
|---------------------------------|--------------------------|
| 1. Shell not or little truncate | ... 2 |
| — Shell greatly truncate | <i>rohdei</i> . |
| 2. Shell smaller than 7 mm | <i>bombayana</i> . |
| — Shell larger than 8 mm | <i>cochinchinensis</i> . |

Fairbankia cochinchinensis BAVAY & DAUTZENBERG, 1910.

pl. 10 fig. 79.

1910 *Fairbankia cochinchinensis* BAVAY & DAUTZENBERG, J. de Conch., 58: 17, pl. 1 fig. 3-4 (Saigon).

Shell elongately conic, with strong, brown periderm; sculptured with fine spiral lines which may carry ciliae when young. The 8-10 whorls are only

moderately convex; the embryonic shell is generally missing, rarely also the first of the postnuclear whorls.

Size: A 8.2-12.0 mm; D 3.4-4.1 mm.

Animal greyish or sand-coloured, with the typical black pigmentation. The foot is straight in front and rounded behind. The rostrum is rounded in front and projects over the foot. — Radula with an elongately oval rhachis. This carries 17 cusps on the cutting edge. There are no basal cusps. Laterals with the formula 1-1-(5-6), marginals with 13-15 cusps. — The male reproductive organs show a short, compressed verge with a finger-shaped appendage and a single duct.

Type locality: Saigon in S Vietnam.

Distribution S Vietnam, Thailand, Malaya. In Thailand only known from the Provinces of Samut Prakan and Suratthani (Paknam Bandon).

Relations This species differs from the type species by its larger size and coarser spiral lines. Were it not found together with the following species, we would without any hesitation consider it to be a large race of the following species only.

Fairbankia bombayana BLANFORD, 1868.

pl. 10 fig. 80.

1868 *Fairbankia bombayana* BLANFORD, Ann. Mag. nat. Hist., (4) 2: 400 (Bombay, India).

1875 *Rissoina (Fairbankia) bombayana*, — WEINKAUFF, Conch. Cab., 1, 22: 81, pl. 15c fig. 8 (Bombay).

1959 *Fairbankia bombayana*, — VAN BENTHEM JUTTING, Beaufortia, 7 (83): 90 (Sumatra).

This species differs from *F. cochinchinensis* by its smaller size and more delicate spiral lines, otherwise there are no noteworthy differences between these two species.

Size: A 5.6-7.8 mm; D 2.6-3.2 mm.

Animal, radula and male reproductive organs typical for the genus.

Type locality: "Bombay"

Distribution Coasts of India, Burma, Thailand, Malaya and Sumatra. In Thailand the species is common in the drainage system of mud-flats, nipa palm and mangrove swamps.

Fairbankia rohdei BRANDT, 1968.

pl. 10 fig. 81.

1968 *Fairbankia rohdei* BRANDT, Arch. Moll., 98: 266, pl. 10 fig. 54, textfig. 36a, b (7 km from Chantaburi to Tachalaeb, Thailand).

This small species differs from the two preceding species by its small size and greatly decollated apex. The 4-5 remaining whorls are somewhat cylindrical. The spiral lines are very feeble. The body whorl measures more than half of the truncate shell. — Aperture, peristome and operculum typical for the genus.

Size A (truncate) 5.3-5.8 mm; D 2.8-3.1 mm.

Animal and radula typical for the genus. The verge of the dissected animals showed only a bulb-like swelling instead of an appendage.

This species is similar in size and shape to *F. feddeniana* NEVILL. This Indian species, however, differs by the obsolete spiral striation on the body whorl which is replaced by minute dents which give the body whorl a malleated appearance.

Type locality 7 km from Chantaburi to Tachalaeb, Thailand.

Distribution Not rare at the coasts of the Gulf of Thailand and of the Indian Ocean on the peninsula. Extralimitarily known from Malaya's west coast.

Biology: The animal lives in trenches of the drainages of mud swamps, nipa palm and mangrove forests.

Assimineidae H. & A. ADAMS, 1858.

Of the two subfamilies of this taxon which are recognized, only one, Assimineinae, is represented in fresh- and brackish water. The other subfamily, Omphalotropinae, comprises only genera of land-snails whose distribution is restricted to certain Pacific islands.

Assimineinae H. & A. ADAMS, 1858.

The shell is small to very small (L between 1.8 and 10.0 mm), subglobose, ovate or conoidal, rarely broader than long. There are often spiral colour bands and/or spiral threads or grooves. — The operculum is thin, corneous, paucispiral with eccentric nucleus. Sometimes there is a calcareous plate embedded in the corneous substance.

The animals differ from those of the other Rissoacea by their rudimentary tentacles which are reduced to stumpy eye-stalks (peduncles); the eyes are either placed at the tips of these peduncles or in the middle. The pigmentation generally consists of fine black dots dusted over back, head and rostrum and of whitish or yellowish pigment granules deeply embedded below the skin. The foot also differs from that of the other families by being divided into a lower and an upper portion, the latter being named "suprapodium" by ABBOTT. The foot is truncate anteriorly and bluntly pointed or rounded posteriorly, with a row of mucose glands anteriorly which open into a thin slit. The suprapodium rests on the top of the lower foot and its edge does not surpass that of the foot. There are two suprapedial grooves on either side of the anterior part. The sole of the foot is grey. In the anterior third of it is a large, yellowish-white organ connected with the surface; its function is unknown. The rostrum is broadly trunk-shaped or flap-like, distinctly cleft anteriorly. — Radula taenioglossate. Jaws are absent. The number of rows of the radula varies between 50 to about 100. The cutting edge of the rhachis has at least 2 cusps on either side of the mesocone. Basal cusps may be present or absent. Laterals often with a accessory plate and outer marginals sometimes with a "flange", a wing-like lateral process. A post-buccal pouch behind the buccal mass is typical for the subfamily. — The verge is large and simple; it has only one duct and carries no appendages.

Distribution Cosmopolitan but predominantly in the tropical and subtropical region.

Habitat: The species are mostly amphibious, spending most time outside the water on wet mud-flats under stones, on decaying wood or in the stumps of nipa palms.

Some species, however, live fully aquatic. They are found in drainage creeks, in the estuaries of rivers and also in trenches and ponds in freshwater within the tidal zone. Some species can easily be kept in tanks with fresh-water, other are limited to brackish habitats only.

Biology The animals are oviparous with free-swimming larvae. They feed on decaying organic substance, fresh vegetation (*Cyclotropis*) or on mud digesting the organic matter the mud contains.

Parasitology *A. lutea* A. ADAMS was reported (H. T. CHEN, 1935) to harbour microcercous cercariae of *Paragonimus westermani*. This seems to refer to a *Paragonimus*-species of animals. Several thousand specimens of *A. brevicula* and *A. obtusa* were checked for cercariae but no infected snail was found. The presumption of ABBOTT that cercariae of trematodes which normally develop in species of fresh-water do not tolerate the salinity of the habitats of *Assimineae* was fully confirmed by tests in our laboratories.

Key to the genera:

- | | | | |
|--|-------|-------|----------------------|
| 1. Shell generally with spiral threads and/or spiral grooves or with reticulate sculpture; generally with basal cusps at the rhachis; shape of the rhachis varies considerably | ..... | ..... | <i>Assimineae</i> . |
| — Shell generally smooth or rarely with axial sculpture; rhachis generally of rounded-triangular shape, always without basal cusps | .. | | 2 |
| 2. Shell unicoloured brownish-corneous; periomphalum without carina | | | <i>Paludinella</i> . |
| — Shell opaque with brownish bands, periomphalum with carina | | | <i>Cylostoma</i> . |

Assimineae FLEMING, 1828.

The shell is of simple structure, subglobose, ovate or conoidal. — Operculum like that of the subfamily. — For radula and soft parts see above under the subfamily.

Distribution: World-wide but predominantly tropical and subtropical.

Type species: *Assimineae grayana* FLEMING.

Habitat: Predominantly brackish, only few species are found in fresh water.

Key to the subgenera from Thailand:

- | | | |
|---|-------|---------------------------|
| 1. Shell without reticulate sculpture | .... | 2 |
| — Shell with reticulate sculpture | .... | <i>Sculptassimineae</i> . |
| 2. Operculum corneous; shell without or with few spiral lines | .... | 3 |
| — Operculum with a calcareous plate; shell with many spiral lines | | <i>Metassimineae</i> . |
| 3. Shell globose or globosely conoidal | | 4 |
| — Shell conic | | 5 |
| 4. Shell smaller than 4 mm, without spiral lines | ..... | 7 |
| — Shell larger than 5 mm, with one or more spiral lines | | <i>Sphaerassimineae</i> . |
| 5. Shell larger than 5 mm | | <i>Macrassimineae</i> . |
| — Shell smaller than 5 mm | | 6 |
| 6. Rhachis with basals | .. | <i>Assimineae</i> . |
| — Rhachis without basals | | <i>Eussoia</i> . |
| 7. Shell globose-conoidal, spire elevated | | <i>Sphaerassimineae</i> . |
| — Shell depressed, spire dome-shaped | | <i>Austropilula</i> . |

Assimineae (Sculptassimineae) THIELE, 1927.

The species of this subgenus differ from all other *Assimineae* species by their reticulate sculpture.

Shell small, conic, with well rounded whorls and open umbilicus. — Rhachis squarish with 3 or 4 basal cusps on either side. Outer marginals without flange and with few cusps only.

Type species: *Assiminea (Sculptassiminea) microsculpta* NEVILL.

Distribution S and SE Asia, Indonesia, Philippines.

Key to the species from Thailand:

1. Umbilical pit with spiral threads . *abbotti*.
2. Umbilical pit without spiral threads *microsculpta*.

***Assiminea (Sculptassiminea) microsculpta* NEVILL, 1880.**

pl. 11 fig. 82.

1880 *Assiminea microsculpta* G. NEVILL, J. asiat. Soc. Bengal, 49: 165 (Fort Canning).

1881 *Assiminea microsculpta*, — G. NEVILL, J. asiat. Soc. Bengal, 50: 158, pl. 7 fig. 5.

1927 *Assiminea (Sculptassiminea) microsculpta*, — THIELE, Zool. Jb. (Syst.), 53: 126, textfig. 4.

Shell small, conoidal, with 6 regularly increasing whorls which are moderately convex. Umbilicus open but narrow. Lower whorls with 2 faint brown spiral bands. With exception of the embryonic whorls, the whole shell is sculptured with spiral ridges which are crossed by axial ribs thus forming a reticulate pattern. The sculpture is much weaker on the base of the body whorl. — Operculum typical.

Size: A 1.8-3.4 mm; D 1.3-2.0 mm.

Radula with a squarish rhachis which shows a handle-shaped process at the middle of the base. There are generally 4 basal cusps on either side. The cutting edge has 7 cusps; that of the laterals has the formula 3-1-3; both marginals have 6 cusps.

Type locality Fort Canning near Calcutta.

Distribution: Known from Bengal, Thailand, Malaya, Sumatra and Java, therefore probably also in Burma. In Thailand known from Satun, Trang, Ranong, Rayong and Trat Provinces.

***Assiminea (Sculptassiminea) abbotti* BRANDT, 1968.**

pl. 11 fig. 83.

1968 *Assiminea abbotti* BRANDT, Arch. Moll., 98: 262, pl. 10 fig. 49, textfig. 32 (Palian, Trang Province).

Very similar to above species but generally darker in colour, more slender, with less convex whorls and with distinct spiral threads around the umbilical pit.

Size: A 1.9-2.4 mm; D 1.2-1.4 mm.

Radula similar to that of the type species, but rhachis with 5 cusps at the cutting edge and the marginals with 5 cusps.

Type locality Mud-flat near Yong Star Custom House, Palian, Trang Province.

Distribution: Known from the type locality only.

***Assiminea (Sculptassiminea) spiralis* n. sp.**

pl. 11 fig. 84.

Diagnosis: A species of *A. (Sculptassiminea)* THIELE, which differs from the type species of the subgenus by its very delicate spiral sculpture which is interrupted by the delicate growth lines. The rhachis has only one pair of basal cusps on either side.

Description: Shell of medium size for the genus, thin, corneous, transparent, conic, of silky lustre, with 6 convex whorls which are separated by a deep suture. The whorls increase regularly in size. The apex is pointed and smooth, the other whorls are sculptured with delicate spiral lines which are crossed by the growth lines. The umbilicus is open. There are neither spiral ridges nor spiral grooves. — Aperture rounded, not extended, peristome not continuous, curved and somewhat thickened at the columella, sharp without. — Operculum oval, paucispiral, thin, transparent, with subcentral nucleus.

Size: A 2.3-2.7 mm; D 1.7-1.9 mm.

Animal lead-grey with black pigmentation dusted over back, head and rostrum. Some dots of whitish pigmentation may be present near the eye-stalks. These are very short and broad at the base. The eyes are placed in the bases, not on top. The tips of the eye-stalks carry a black pigment dot. The rostrum is short and broad and cleft in the middle. — Verge of the male reproductive organs long and bent; it is slowly tapering to the pointed tip. — Radula with trapezoidal rhachis which carries 2 or 3 basal cusps on either side and 11 small cusps on the cutting edge. The mesocone is large and was found cleft in the two examined specimens.

Type locality Swamp with freshwater under tidal influence about 500 yards W of Ban Pa In.

Distribution Known from Thailand only from the following provinces: Thonburi, Ayuthia, Samut Prakan, Trang and Satun.

Material Holotype SMRL 4905/A; paratypes 4905/15. — SMRL 4912/5-Klong Dao Id, Thonburi; 4913/10-Klong Bang Phla, Thonburi; 4914/17-Klong Mun, Thonburi; 4915/2- 2 km N of Satun; 4942/5-Klong Bang O, Thonburi.

***Assiminea (Metassiminea) thielei* THIELE, 1927**

Shell with 1-8 subsutural spiral lines; without peripheral thread but with a weak thread around the narrow umbilicus. Without spiral microsculpture. The most conspicuous characteristic is the calcareous layer on the outer side of the operculum. — Rhachis without basal cusps, outer marginals without flange and with many small cusps. The radula is very similar to that of *A. thielei* ABBOTT and *A. crassitesta* BOETTGER.

Type species *Assiminea philippinica* O. BOETTGER.

Distribution: Philippines, Australia, ? Tasmania, SE Asia, Indonesia.

***Assiminea (Metassiminea) philippinica* O. BOETTGER, 1887**

pl. 11 fig. 85.

1887 *Assiminea philippinica* O. BOETTGER, Jb. dtsch. malak. Ges., 14: 195 (Manila, Luzon).

- 1889 ? *Assimineea australis* PETTERD, Proc. Soc. Tasmania, 1888: 77, pl. 3 fig. 10 (Kelso, Tasmania).
 1893 *Assimineea philippinica* var. *lirocincta* O. BOETTGER, Nachr. Bl. dtsh. malak. Ges., 25: 114 (Escalante auf Negros).
 1927 *Assimineea (Metassimineea) philippinica*, — THIELE, Zool. Jb. (Syst.), 53: 131, pl. 1 fig. 6 (Sydney).
 1958 *Assimineea philippinica*, — ABBOTT, Proc. Acad. nat. Sci. Philad., 110: 234, pl. 15 fig. 11, pl. 24 (Luzon, Mindanao).

Shell of medium to large size for the genus, moderately thick, ovate-conoidal, reddish or yellowish-brown, unicoloured or with 2 or 3 darker brown spiral bands. The 5 whorls are moderately convex and separated by an incised suture. The nuclear whorls are smooth and vitreous, the postnuclear whorls are sculptured with a thin subsutural thread and several fine incised spiral lines which may be reduced to one only. The narrow or closed umbilicus is surrounded by a very weak spiral thread. The body whorl measures $\frac{3}{5}$ of the height of the shell. — Aperture oval, angled above and well rounded below. Peristome sharp without, connected by a brown callus. Columella curved, broad, generally covering the umbilicus. — Operculum oval, paucispiral, corneous but with a strong calcareous layer on the outer side. Muscle scar raised to a curved, corneous ridge.

Size A 4.0-6.0 mm; D 2.8-3.8 mm.

Animal yellowish with black pigment dots and stripes on back, head and peduncles. Foot mottled with blackish pigment spots. Peduncles rather long, yellowish within and with black stripes without. Anterior part of suprapodium protruding, with several large glands. — Male reproductive organs with comparatively large verge which is somewhat flattened and tapers to the round distal end. The tip is bulb-shaped. — Radula with a squarish rhachis. Cutting edge with 5 cusps, basal cusps are missing. The laterals have 6 cusps, the inner marginals 6-7 and the outer marginals 20-22 cusps.

Distribution: Philippines, Java, Thailand. If *A. australis* PETTERD is synonymous with this species, Tasmania has to be added to the distribution. In 1927 THIELE described an *Assimineea ignota* which may be conspecific with our species. It is reported from the Andaman Islands. Known from Pak Panang and Paknam Bandon, S Thailand.

Biology: The species lives on mud-flats and brackish water creeks with muddy ground and feeds on decaying organic substance.

The populations in Thailand show great variability but even the most extreme forms do not deserve separate taxa as they are connected by intermediate forms. The colour is either unicolour brownish or yellowish or there are 1-3 darker brown spiral bands. The shape of the shell may be depressed conoidal or more elongately conic. The convexity of the whorls and with it the depth of the suture may be white or brownish. It is sometimes thickened to a drop-like callosity. The incised spiral lines are more often missing than present.

***Assimineea (Sphaerassimineea)* HABE, 1942.**

Shell rather large for the genus, subglobosely conoidal, generally with 1 or 2 subsutural spiral grooves but without spiral threads. Spiral microsculpture present. — Operculum corneous. — Rhachis with 1 or 2 (? 3) lateral basal

cusps, laterals and marginals with few cusps on the cutting edge and outer marginals with flange.

Type species *Hydrocena brevicula* PFEIFFER.

Distribution: Coasts of the Indian and eastern Pacific Ocean.

A. marginata LEITH from India belongs also to this subgenus.

Assiminea (Sphaerassiminea) brevicula (PFEIFFER, 1854).

pl. 11 fig. 86.

- 1854 *Hydrocena brevicula* PFEIFFER, Proc. zool. Soc. London, 22: 306 (Singapore).
1865 *Hydrocena marginata* MORELET, J. de Conch., 13: 226 [non LEITH] (Siam).
1866 *Assiminea pinguis* MARTENS, Ann. Mag. nat. Hist., (3) 17: 203 (Macao) [fide BOETTGER 1887].
1866 *Assiminea miniata* MARTENS, Ann. Mag. nat. Hist., (3) 17: 204 (Singapore).
1867 *Assiminea rubella* BLANFORD, Ann. Mag. nat. Hist., (3) 19: 384, fig. 6 (Iravadi delta).
1942 *Assiminea (Sphaerassiminea) brevicula*, — HABE, Venus, 12: 42, pl. 1bis fig. 7, pl. 2 fig. 4, pl. 3 fig. 1.
1958 *Assiminea brevicula*, — ABBOTT, Proc. Acad. nat. Sci. Philad., 110: 238, pl. 15 fig. 7, pl. 22 fig. 1 (India, Burma, Siam, Philippines, Borneo, Taiwan, Singapore, China).

Shell rather large, subglobose conoidal, solid, not transparent, dull, brick-red, brownish, yellowish or rarely olive-coloured. The 6 whorls are moderately convex and separated by a well incised suture. The sculpture consists generally of 1 spiral cord below the suture and 1-4 incised spiral lines, the uppermost of which is the deepest. Under high magnification a delicate wavy spiral sculpture is seen. The umbilicus is closed or a narrow slit. — Aperture large, oval, angled above and well rounded below. The peristome is sharp without and connected by a thin callus only. Columella curved, thick, white. — Operculum thin, corneous, with two delicate ridges at the muscle scar.

Size A 4.8-9.0 mm; D 3.9-5.8 mm.

The colour of the animals of Thai populations is generally a bright brick-red, but brownish or grey animals are not rare. Back, head and rostrum are dusted with fine black pigment spots which may form a reticulate pattern on the rostrum. The mantle shows several large pigment patches. The eye-stalks are very short and hardly thickened at their bases. The eyes are placed on top of the stalks. — Rhachis of the radula much higher than broad, with 1 or 2 very delicate lateral basal cusps which may sometimes be completely missing. ANNANDALE & PRASHAD (1919: 249, textfig. 4a) showed a rhachis of this species with 3 lateral basal cusps which were well developed; whether an abnormality or a misidentification is beyond the judgment of the present author. The cutting edge of the rhachis carries 5 cusps, the laterals and inner marginals 6 and the outer marginals 7 and a large flange. There are 2 small accessory plates at the side of the laterals. — The male reproductive organs show a moderately long verge which tapers somewhat to its tip. It is simple, with one duct only and without appendages or vermiform anterior process.

Type locality Singapore.

Distribution India, Burma, Thailand, Malaya, Java, Sumatra, Philippines, Borneo, Taiwan, China and Ceylon. Not yet reported from New Guinea or any Pacific island east of it. In Thailand widely distributed in mangrove and nipa-palm swamps.

***Assiminea (Ovassiminea)* THIELE, 1927.**

This subgenus differs from *Sphaerassiminea* by its lack of a subsutural thread or spiral lines, the well developed basal cusps on the rhachis and the lack of a "flange" at the outer marginals. — The shape is ovate to subglobose, the shell is barely translucent and the surface is dull. The spiral microsculpture is missing or rudimentary. The operculum is corneous without calcareous layer. The umbilicus is generally somewhat open.

The rhachis is squarish with a long handle-like process at the base. There are 1 or 2 basal cusps on either side. The outer marginals have no "flange" An accessory plate at the laterals has not been observed.

Type species: *Assiminea dohrneana* G. NEVILL.

Distribution The coastal areas of India, SE Asia, Indonesia and China.

The two species found in Thailand differ mainly in the size, *obtusa* being a little larger than 3 : 3 mm, *microscopica* being smaller than 2 : 2 mm. Different habitats and slight differences in the rhachis encouraged the author to describe *A. microscopica* as a new species.

***Assiminea (Ovassiminea) obtusa* WATTEBLÉ, 1886.**

pl. 11 fig. 87.

1886 *Assiminea* (?) *obtusa* WATTEBLÉ, J. de Conch., 34: 65, pl. 5 fig. 1 (La lagune de Thuan-an).

Shell subglobose-conoidal, with short spire, obtuse apex and large, inflated body whorl. Umbilicus very narrow but deep. The colour is yellowish to brownish, the surface dull and smooth except for the rough growth lines. The 3½ to 4 whorls are convex and separated by an impressed suture. There are neither spiral threads nor spiral lines. Body whorl well rounded, measuring about ¾ of the height of the shell. — Aperture crescent-shaped, columella moderately thickened, brownish. Operculum thin, corneous, paucispiral with eccentric nucleus.

Size: A 2.8-3.2 mm; D 2.6-3.1 mm.

Animal with lead-coloured sole and darker grey back which is dotted with black pigment spots. Peduncles very short, knob-like. Rostrum broad, compressed, flap-like.

Type locality Lagoon of Thuan-An, Vietnam.

Distribution Lagoons and estuarial areas of the Gulf of Thailand. Extralimarily known from Vietnam.

***Assiminea (Ovassiminea) microscopica* BRANDT, 1968.**

pl. 11 fig. 88.

1968 *Assiminea microscopica* BRANDT, Arch. Moll., 98: 263, pl. 10 fig. 50, textfig. 33 (Klong Yai Pin, Trad).

Very closely related to the preceding species and perhaps only a small race. It resembles a small *borneensis* but is much smaller.

Size A 1.2-1.9 mm; D 1.0-1.7 mm.

Because of the different radula it was described as a separate species. The rhachis has the typical shape for *Ovassiminea*, squarish with a handle-like basal process, but there is only one basal cusp on either side, which is small and does not protrude beyond the basal line.

Type locality Klong Yai Pin in Laem Ngob District, Trad Province, SE Thailand.

Distribution Known from the type locality and from Rayong Province.

Habitat: The species is found in the space between the trunk and old broken stems of palm fronds.

***Assiminea (Assiminea)* s. str.**

Shell conoidal with regularly increasing whorls and large body whorl which may be angulate. Umbilicus generally closed, rarely narrowly open. Brown or corneous, often with one or few whitish or darker bands and spiral threads. Operculum corneous, thin, paucispiral with eccentric nucleus. — Animal like that of the genus. Rhachis squarish, always with basal teeth.

Distribution and Habitat like those of the genus.

Key to the Thai species:

1. Shell index almost 2 1, spiral thread between suture and periphery *woodmasoniana*.
- Shell index about 3 : 2 2
2. Shell with subsutural thread, nuclear whorls smooth *nitida*.
- Shell without spiral thread, nuclear whorls with spiral lines *hidalgoi*.

***Assiminea (Assiminea) woodmasoniana* NEVILL, 1880.**

pl. 11 fig. 89.

1880 *Assiminea woodmasoniana* NEVILL, J. asiat. Soc. Bengal, 49: 163 (Port Canning).

1956 *Syncera woodmasoniana*, — VAN BENTHEM JUTTING, Treubia, 23 (2): 352, fig. 66 (Calcutta, Port Canning, Chandipal, Andaman Islands, Amsterdam Island).

Shell elongately conic, the most elongate species of the genus. Brownish or straw-coloured, glossy, with very delicate spiral microsculpture. About halfway between the suture and the periphery there is a distinct spiral thread; another spiral thread encircles the closed umbilicus. The 7 whorls are almost flat and increase regularly in diameter. Body whorl angulate in young shells but well rounded in adult ones. — Aperture pyriform, with pointed top and well rounded base. Peristome continuous, columellar straight, thick and flattened. — Operculum typical.

Size: A 2.5-3.8 mm; D 1.5-2.0 mm.

Radula with squarish rhachis which has at the base a long, handle-like process. The cutting edge has 5 cusps. There are 2 diagonally placed basal cusps on either side. The laterals have the formula 3-1-2, the inner marginals have 7 cusps, the outer about 20. The examined specimen had 53 rows of teeth but only 34 rows showed well developed teeth.

Distribution: The Bengal coast of the Indian Ocean, Thailand, Andaman Islands, Amsterdam Island near Java. Not yet reported from Burma, but known from Sumatra and Malaya. Common in Thailand in mud-flats with nipa palms or mangrove trees. Around the coast of the Gulf as well as at the coasts of the Indian Ocean.

Assiminea (Assiminea) hidalgoi (GASSIES, 1869).

pl. 11 fig. 90.

- 1869 *Hydrocena hidalgoi* GASSIES, J. de Conch., 17: 78 (Ins. Arta, Nova Caled.).
1882 *Assiminea granum* MORELET, J. de Conch., 30: 105, pl. 10 fig. 15 (Mauritius).
1883 *Assiminea granum* [= *hidalgoi*], — MORELET, J. de Conch., 31: 208 (Mauritius).
1927 *Paludinella (Paludinella) hidalgoi*, — THIELE, Zool. Jb. (Syst.): 53: 118.
1956 *Syncera hidalgoi*, — VAN BENTHEM JUTTING, Treubia, 23 (2): 354, fig. 67 (brackish shores of the Indian and Pacific Oceans between Mauritius and New Caledonia).

Shell conoidal, straw-coloured to reddish-brown, sometimes with a lighter zone below the suture. The mammilate embryonic whorls are smooth, the 3 following postnuclear whorls are sculptured with 3-5 fine spiral lines. The last two whorls are smooth save for the delicate spiral microsculpture and the growth lines. The postnuclear spiral lines make identification of this species easy. Umbilicus closed or narrowly open, surrounded by a weak thread. The 6 whorls are somewhat convex, the body whorl is well rounded. — Aperture piriform, angled above and well rounded below. Peristome connected by a thin parietal callus, columella thickened, flat and somewhat expanded. — Operculum typical for the subgenus.

Size A 2.7-3.2 mm; D 2.0-2.5 mm.

Animal and radula unknown. THIELE (1927: 118) assigned this species to *Paludinella* s. str. It is here placed tentatively in the subgenus *Assiminea* s. str.

Distribution Reported from the shores of the Indian and Pacific Oceans between Mauritius and New Caledonia. In Thailand this species seems to be rare as only few specimens were found in nipa palm swamps in the provinces of Trad and Grabi.

Assiminea (Assiminea) nitida (PEASE, 1865).

pl. 11 fig. 91.

- 1865 *Hydrocena nitida* PEASE in CHARPENTIER, Proc. zool. Soc. London, 1864: 674 (no locality).
1869 *Hydrocena nitida* PEASE, J. de Conch., 17: 165, pl. 4 fig. 11 (Huahine).
1949 *Syncera nitida*, — ABBOTT, Occ. Pap. B. P. Bishop Mus., 19: 272, fig. 7a-c.

Shell small, conoidal, with elevated spire and rounded body whorl; brownish or greenish-brown, sometimes with a reddish zone below the suture; glossy; sculptured with very delicate spiral microsculpture and a subsutural spiral thread. There is another thread around the narrow or closed umbilicus which may often be obsolete. — Aperture small, pear-shaped; peristome connected by a thin parietal callus. The sinuous columella is somewhat thickened and expanded. — Operculum typical for the subgenus.

Size: A 1.8-2.4 mm; D 1.3-1.6 mm.

Radula without accessory plate. Rhachis with 3 basal cusps on either side and 5 cusps on the cutting edge. L with the formula 2-1-3, M₁ with 6-7 large cusps, M₂ with 18 small cusps.

Distribution Coasts of the Indian and Pacific Oceans from Mauritius to the Society Islands. Northwards to Hongkong and the Philippines. In Thailand common in mangrove and nipa palm swamps in the coastal areas of the Gulf and the Indian Ocean.

Biology The species is found attached to stones and wood and feeds on decaying organic matter.

Note: The variability of this species has caused the description of several subspecies many of which may not be more than local forms. No attempt is made here to assign the many different forms to described subspecies let alone create for them new taxa.

***Assiminea (Assiminea) schlickumi* n. sp.**

pl. 11 fig. 92.

Diagnosis: A species of *Assiminea (Assiminea)* FLEMING which differs from its closest relatives, *A. thielei* ABBOTT and *A. nitida* PEASE by the absence of any trace of spiral lines or threads.

Description: Shell small, ovate-conoidal, with blunt apex and well-rounded body whorl, corneous, glossy, without any spiral macrosculpture and without any traces of spiral microsculpture. The 6 whorls are moderately convex and separated by a well-incised suture. Body whorl somewhat concave in the umbilical region but umbilicus completely closed. — Aperture pyriform, angled above and well rounded below. Peristome sharp, discontinued, connected by a feeble parietal callus, columella curved, covering the umbilicus. — Operculum ovate, thin, corneous, paucispiral with eccentric nucleus.

Size A 2.4-2.8 mm; D 1.6-1.8 mm.

Animal grey with few black pigment dots. The eyes are placed on top of the very short peduncles.

Type locality Pak Panang in the province of Sritammarath.

Distribution Known from the type locality and from Glaeng District in the province of Rayong.

Material: Holotype SMRL 3498/A; paratypes 3498/40 (10 specimens each in the collections of the author, USNM, ZMH and SMF). — 4104/20- Ban Don Makok, Glaeng District, 52 km E of Rayong.

***Assiminea (Assiminea) schuetti* n. sp.**

pl. 11 fig. 93.

Diagnosis: A species of *Assiminea (Assiminea)* FLEMING which differs from its closest relatives, *A. thielei*, *habei* ABBOTT and *nitida* PEASE by its minute size and by carrying a distinct peripheral thread like in *A. javana* THIELE and *boettgeri* ABBOTT.

Description: Shell very small, conical, solid but not thick, with conical spire and ovate-conoidal body whorl; opaque and generally variegated with brownish flames and ornate with 1-3 brown spiral bands which may often be missing. The growth lines are crossed by a very feeble spiral microsculpture. The 6 almost flat whorls increase regularly in size; the last whorl measures about $\frac{1}{2}$ of the length of the shell. There is no subsutural spiral thread as in *A. nitida* but a distinct thread around the periphery like in *javana* and *boettgeri*. This thread appears on the upper whorls above the suture and almost reaches the peristome. There is no thread around the completely closed umbilicus. — Aperture small, ovate, pointed above and well rounded below. Peristome

sharp, connected by a very feeble parietal callus. Columella short, curved, thick. — Operculum ovate, thin, corneous, without calcareous layer and with eccentric nucleus. There are about 3 whorls.

Size A 1.9-2.3 mm; D 1.2-1.4 mm.

Radula with trapezoidal rhachis which shows a long, triangular basal process. Shape similar to the rhachis of *A. beddomeana*. Laterals and marginals, however, are different. There are 2 pointed basal cusps on either side of the rhachis within the pointed lateral corners which appear as another pair of cusps. The cutting edge has 3 cusps, that of *beddomeana* 5. Laterals with 3 cusps, inner marginals with 5, outer with 9 cusps. Neither accessory plate at the lateral nor flange at the outer marginal was observed.

Type locality At the banks of the Klong Yai Pin in Trad Province.

Distribution: Known from the type locality only.

Biology The animals live underneath the stems of the fronds of nipa palms which grow at the banks of the above named brackish water creek.

Material Holotype SMRL 4096/A; paratypes 4096/10.

Etiology: Dedicated to Dr. HARTWIG SCHÜTT, Düsseldorf.

***Assimineae (Assimineae) zilchi* n. sp.**

pl. 11 fig. 94.

Diagnosis: A species of *Assimineae (Assimineae)* FLEMING which differs from its closest relative, *A. hidalgoi* GASSIES, by its much more elongate shape and lack of periomphalic thread or carina.

Description: Shell small for the genus, solid but not thick, brownish-corneous, with a brighter zone below the suture; translucent, somewhat shining; the irregular growth lines are crossed by a very feeble spiral microsculpture. The first 2 of the $6\frac{1}{2}$ whorls are smooth, the next $1\frac{1}{2}$ sculptured with 4-6 spiral lines which disappear on the 4th whorl. The body whorl measures about $\frac{3}{5}$ of the size of the shell; it is somewhat flattened around the periphery. The umbilicus is a narrow chink partly covered by the columella. — Aperture small, ovate, angled above and rounded below. Peristome connected by a feeble parietal callus, with curved, thickened columella. — Operculum ovate, corneous, paucispiral with eccentric nucleus. — Animal and radula unknown.

Size A 2.8-3.2 mm; D 1.7-2.0 mm.

Type locality: Klong Sun near Ban Klong Sun, Gradaeng District, Trad Province.

Distribution Only known from the type locality.

Material Holotype SMRL 4902/A; paratypes 4902/6.

***Assimineae (Eussoia)* PRESTON, 1912.**

Shell conoidal, brownish, glossy, generally with feeble spiral microsculpture and with or without spiral threads. — Operculum without calcareous layer. — Rhachis always without basal cusps, similar to that of *Paludinella*.

Type species: *Assimineae (Eussoia) inopina* PRESTON.

Assimineea (Eussoia) javana (THIELE, 1927).

pl. 11 fig. 95.

1927 *Paludinella javana* THIELE, Zool. Jb. (Syst.), 53: 133, pl. 1 fig. 11 (Sukabumi auf Java).

1956 *Syncera javana*, — VAN BENTHEM JUTTING, Treubia, 23 (2): 353, fig. 53, 64 (Java, Nusa Kambangan, Pulo Panaitan, Island of Nias, Sumatra).

Shell of medium size for the genus, with regular conical spire and ovate-conoidal body whorl, not glossy, almost dull, dark brown or reddish brown; the growth lines are crossed by a very feeble spiral microsculpture. The 7 whorls of the spire are almost flat and separated by a shallow suture; they increase regularly in size. There are two spiral threads, one below the suture and one on the periphery; this is often visible above the suture of the middle whorls. A very feeble thread around the closed umbilicus may be present or missing. — Aperture pyriform with pointed top and well rounded base. Peristome sharp, connected by a distinct parietal callus; columella curved, thickened. — Operculum corneous, paucispiral with eccentric nucleus.

Size A 5.0-6.8 mm; D 2.9-3.6 mm.

Radula of *Paludinella*-type. Rhachis ovate with 7 cusps on the cutting edge. Basal cusps are missing. Laterals and M₁ with 9 cusps, M₂ with 25.

Type locality Java, district of Sukabumi.

Distribution Java, Sumatra, several small islands off the shore of Java and in Thailand. Not yet reported from Malaysia.

Assimineea (Austropilula) THIELE, 1927

All those *Assimineea* species which have a subglobose or depressed shell and whose radulae have a rhachis with basal cusps will be tentatively placed into this subgenus to avoid the creation of new and unnecessary taxa. However, it has to be assumed that this subgenus is heteromorphic. The shell differs from that of the other subgenera by its subglobose, globose-conoidal or depressed shape and from *Metassimineea* by having a corneous operculum and basal cusps at the rhachis.

Type species *Assimineea beddomeana* NEVILL.

Distribution Coastal areas of the Indian and Western Pacific Ocean.

Assimineea (Austropilula) beddomeana NEVILL, 1880.

pl. 11 fig. 96.

1880 *Assimineea beddomeana* NEVILL, J. asiat. Soc. Bengal, 59: 163 (Port Canning).

1881 *Assimineea beddomeana*, — NEVILL, J. asiat. Soc. Bengal, 60: 158, pl. 7 fig. 3 (Port Canning).

Shell depressed, dome-shaped, chestnut to olive-brown, with a whitish umbilical zone, glossy, smooth except for the delicate growth lines. The spire is not elevated but forms a semiglobose small cupola with regular outlines. The 5 whorls are flat and increase regularly in diameter. The suture is very shallow but well marked. The base of the shell is moderately flattened, the

umbilicus is narrowly open. — Aperture semilunar, comparatively large; peristome sharp, connected by a thin parietal callus. Columella thick, broad, glossy, with a distinct incision at the umbilical side which leaves the umbilicus open which would be otherwise covered by the broad columella. Underneath the umbilicus the columella shows a short, tongue-like process. — Operculum semilunar, thin, brittle, paucispiral with eccentric nucleus.

Size: A 1.8-2.9 mm; D 2.1-3.5 mm.

Animal greyish with large black pigment dots on head, rostrum and peduncles. The eyes are placed in the swollen bases of the peduncles. — Rhachis with a long, triangular basal process. Cutting edge with 5 cusps. There are 2 pointed basal cusps on either side not counted the similarly shaped outer wings. The laterals have the cusp formula 4-1-3, the inner marginals have 8 cusps, the outer 15.

Distribution Mangrove forest about 2 km S of Palian, in the province of Trang. Extralimitarily known from the type locality only.

Biology The species was found in the mud on the ground of the mangrove swamp and also sitting on decaying wood. It feeds on decaying organic matter.

Paludinella L. PFEIFFER, 1841.

Shell conoidal, thin, unicoloured, smooth or with axial sculpture. — Aperture not extended, peristome not continuous or connected by a thin parietal callus. — Operculum corneous, paucispiral with eccentric nucleus. — Animal: The head forms a flaplike fold which covers the base of the rostrum. Tentacles very short; the eyes are placed in its bases. The pigmentation of the body consists of fine black spots dusted over back, head, rostrum and tentacles. — The radula shows a squarish or oval rhachis without basal cusps. The outer marginals have generally many small cusps. The radula is similar to that of *Cyclotropis*.

Type species: *Helix litorina* DELLE CHIAJE.

Distribution: Mediterranean, coasts of the Indian Ocean and of the tropical and subtropical Pacific as well as many Pacific islands.

Key to the Thai subgenera:

- | | |
|--|-----------------------|
| 1. Shell ovoidal-conic; umbilicus closed | <i>Schuetziella</i> . |
| 2. Shell conoidal; operculum open | <i>Paludinella</i> . |

Paludinella (Paludinella) s. str.

Shell conoidal, thin, corneous, smooth or with axial and sometimes also with spiral sculpture. Otherwise like the genus.

Distribution like that of the genus.

Habitat: The species live in brackish, slightly brackish or even freshwater in the tidal zone. Contrary to most species of *Assimineae* the species of this subgenus prefer creeks and irrigation ditches with rich vegetation and avoid still water. They are often found together with species of *Cyclotropis*. They feed, however contrary to *Cyclotropis*, generally on decaying organic matter.

Key to the Thai species:

1. Shell with sculpture
2. Shell smooth

thonburi.
kuiperi.

***Paludinella (Paludinella) kuiperi* n. sp.**

pl. 11 fig. 97.

Diagnosis: A species of *Paludinella (Paludinella)* s. str. which differs from its close relative, *P. halophila* RENSCH, by its smaller size, more convex whorls and by its columella ending in a tiny knot on the columellar part of the peristome.

Description: Shell small for the genus, broadly conoidal, thin, translucent, very light corneous, smooth except for the delicate growth lines. The 5½ convex whorls increase regularly and slowly in diameter and are separated by a deep suture. The body whorl is well rounded. — Aperture oval, pointed above and well rounded below. Peristome sharp, not connected. The columella ends on the columellar part of the peristome in a tiny knot. — Operculum very thin, corneous, paucispiral, with eccentric nucleus.

Size: A 1.6-1.8 mm; D 0.9-1.1 mm.

Animal light grey with few tiny black pigment spots dusted over back, head, rostrum and peduncles. — Radula with oval rhachis. Its cutting edge carries 5-7 small cusps. Laterals with 7-8 cusps, inner marginals with 9 cusps, outer with 24-28.

Type locality Swamp at Bang Prakon Highway 3 bridge.

Distribution Known from the type locality only.

Material Holotype SMRL 4919/A; paratypes 4919/20.

Etiology: It gives me great pleasure to dedicate this species to my friend Mijnheer J. G. J. KUIPER as a small token of gratitude for rendered help.

***Paludinella (Paludinella) thonburi* BRANDT, 1968.**

pl. 11 fig. 98.

1968 *Paludinella thonburi* BRANDT, Arch. Moll., 98: 265, pl. 10 fig. 52 (several localities in Thonburi and Satun Province).

Shell rather small, conic, short, light chestnut-brown, translucent, without any spiral threads or grooves but with very delicate oblique, axial riblets. These are crossed by a very feeble spiral microsculpture. The 5 whorls are rather convex and separated by a deep suture.

Size: A 2.0-2.4 mm; D 1.7-1.9 mm.

Animal grey with fine black pigmentation dusted over back and head. The peduncles are short and tipped, the eyes are placed inside the broad bases. The verge is strong and curved, with one duct only and without appendages or stylet. — The cutting edge of the trapezoidal rhachis has 7 cusps. Laterals also with 7 cusps, inner marginals with 8 cusps, outer with 25.

Type locality Klong Mun in Thonburi, Thailand.

Distribution: Known from several localities in Thonburi and from Satun in S Thailand.

Paludinella (Schuettiella) n. subgen.

A subgenus of *Paludinella* L. PFEIFFER which differs from the typical subgenus by its ovate-conoidal shape, its closed umbilicus and by its somewhat extended peristome.

The animal is of greyish colour with black pigment spots dusted over back and head. — The radula shows a triangular rhachis without basal cusps. Laterals and inner marginals have few cusps, the outer marginals many.

Type species *Paludinella daengsvangi* BRANDT.

Distribution Known from Thailand only.

This taxon is described as a monotypical subgenus, however, several of the known species of *Paludinella* may be assigned to it.

Paludinella (Schuettiella) daengsvangi BRANDT, 1968.

pl. 11 fig. 99.

1968 *Paludinella daengsvangi* BRANDT, Arch. Moll., 98: 264, pl. 10 fig. 51, textfig. 34 (several klongs in Bangkok and Thonburi and from the Bang Prakon River).

Shell rather small, elongately ovoidal-conic, thin, corneous, covered with a brownish periderm. The shell has the shape of an extremely small *Ena* or *Zebrina* species. The surface is smooth, the whorls are barely convex and separated by a very shallow suture. The umbilicus is closed. — Aperture pyriform, somewhat expanded; peristome connected by a very thin parietal callus. — Operculum corneous, thin, paucispiral with eccentric nucleus.

Size A 3.0-3.8 mm; D 1.7-2.4 mm.

Animal slate-grey with many small black pigment dots dusted over back, head and rostrum. Tentacles rather long for the subfamily; their tips carry a black pigment spot, the eyes are placed at the inside of their bases. The "head-flap" is straight with a triangular notch in the middle. — The radula shows a triangular rhachis with 9 cusps at the cutting edge. As typical for the genus there are no basal cusps. The laterals have the cusps formula 3-1-(3-4), the inner marginals 6-7 cusps, the outer 29-30.

Type locality Klong Premprachakon in Bangkok.

Distribution Several klongs in Bangkok and Thonburi and at the banks of the Bang Prakon River in Chachoengsao Province.

Cyclotropis TAPPARONE-CANEFRI, 1883.

Shell rather large for the subfamily, conoidal with pointed apex and rounded base. Umbilicus open and surrounded by a sharp periomphalic keel. — Operculum corneous, paucispiral with eccentric nucleus. — Rhachis squarish, without basal cusps. Outer marginals with many tiny cusps, inner marginals with few only. — Reproductive organs like those of the subfamily.

Type species: *Paludinella (Cyclotropis) papuensis* TAPPARONE-CANEFRI, 1883.

Distribution: SE Asia, Sumatra, Java, Borneo and New Guinea.

Biology The observed species of this genus live at or above the water mark of trenches in fresh-water in the tidal zone or in slightly brackish water; they are truly

amphibious. Egg-depositing and hatching has not yet been observed but from the habitat we may deduce that the species have no free-swimming veliger larvae like *Assiminea* FLEMING.

Key to the Thai species:

- | | |
|---|----------------------|
| 1. Shell unicoloured | 2 |
| — Shell with brown spiral bands | 3 |
| 2. Shell without spiral threads, suture deep | <i>bollingi</i> . |
| — Shell with subsutural spiral thread, suture shallow | <i>terae</i> . |
| 3. Suture deep, with subsutural spiral thread; all spiral bands almost continuous | <i>bedaliensis</i> . |
| — Suture shallow, without spiral thread, the two upper spiral bands always dissolved into patches | <i>carinata</i> . |

***Cyclotropis carinata* (LEA, 1856).**

pl. 12 fig. 1.

- 1856 *Assiminea carinata* LEA, Proc. Acad. nat. Sci. Philad., 8: 111 (Siam: Bangkok).
 1860 *Omphalotropis maculata* MARTENS, Proc. zool. Soc. London, 28: 11 (Bangkok, Siam).
 1862 *Hydrocena (Omphalotropis) fulvida* PFEIFFER, J. de Conch., 10: 44, pl. 6 fig. 4 (Siam).
 1862 *Hydrocena fasciolata* MORELET, Rev. Zool.: 478 (Bangkok).
 1866 *Hydrocena fulvida*, — MABILLE & LE MESLE, J. de Conch., 14: 132 (*Banona*, Cambodge).
 1867 *Assiminea carinata*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 119, pl. 22 fig. 13 (Siam).

Shell rather large with pointed apex and regularly conic spire. The whorls are almost flat and separated by a shallow, marginate suture. The 1 or 2 spiral bands around the open umbilicus are continuous, those on the periphery and below the suture are dissolved into brown patches. The colour of the periderm is opaque, that of the bands chestnut-brown. The umbilicus is surrounded by a sharp keel. There are no spiral threads or lines. — Aperture and operculum typical.

Size: A 7-10 mm; D 4-5 mm.

The animal is grey with few black pigment spots dusted over head and back. Above the eyestalks are clusters of whitish pigment spots. The eyestalks are short, somewhat tapering towards the tip on which the eyes are placed. Foot truncate in front and rounded behind. The rostrum is broad and flap-like and shows a distinct notch in the middle of the anterior end. — Radula with rounded rhachis without basal cusps. There are 2 or 3 cusps on either side of the central cusp on the cutting edge. No accessory plates were found; laterals with the formula 2-1-4, inner marginals with 8, outer marginals with numerous cusps.

Type locality: Bangkok.

Distribution: Tidal area of the coasts of Thailand, S Vietnam, Malaysia, Sumatra, Java and Borneo.

Biology This species lives amphibiously on plants above the surface or only somewhat submerged. It feeds on fresh vegetation but also on decaying organic matter.

***Cyclotropis terae* n. sp.**

pl. 12 fig. 2.

1956 *Syncera carinata*, — VAN BENTHEM JUTTING, Treubia, 23: 356, fig. 57 (Moulmein, Sarawak, Bangka, Sumatra, Java) [non LEA 1856].

Diagnosis: A species of *Cyclotropis* TAPPARONE-CANEFRI which differs from its closest relative, *C. carinata* (LEA), by its brownish colour, lack of spiral bands and by having a distinct peripheral thread.

Description: Shell of medium size for the genus, with regularly conical spire and broad, rounded body whorl. The 8 whorls are almost flat and separated by a very shallow suture. The colour is olive- to chestnut-brown, sometimes with darker brownish flames, that of *carinata* opaque. The shell is glossy, that of *carinata* dull. Colour bands have never been observed in examined specimens. Under strong magnification a delicate spiral microsculpture can be seen which is lacking in *carinata*. This sculpture is crossed by the fine growth lines. Except for the embryonic whorls there is a fine subsutural thread around the whorls. The body whorl carries also a more or less distinct peripheral thread which sometimes may be missing. The body whorl measures about $\frac{2}{3}$ of the length of the shell. The open umbilicus is surrounded by a distinct keel which ends in the base of the peristome forming a short canal. — Aperture pyriform, pointed above and well rounded at the base with a distinct basal angle. Peristome sharp, connected by a thin parietal callus. — Operculum corneous, paucispiral with eccentric nucleus.

Size A 6.5-7.8 mm; D 3.4-4.3 mm.

Animal greyish with black pigment spots. Peduncles rather short, with black tips; the eyes are placed in the bases of the peduncles. — Radula with oval pentagonal rhachis. This carries at the cutting edge 5-7 cusps. There are no basal cusps. The laterals have 9 cusps, the inner marginals 8 cusps and the outer marginals 28-30. — The verge of the male reproductive organs is long; it tapers to the pointed tip and has only one duct. There are no appendages.

Type locality: Ban Bang Mak, province of Trang.

Distribution In Thailand known from the type locality only. The author has studied specimens of this species from Sumatra. They were labeled as *Syncera carinata* (LEA). The distribution is still unknown as this species has been confused with *C. carinata*.

Material Holotype SMRL 4933/A; paratypes 4933/20.

Etiology This species is dedicated to Dr. WOUTERA S. S. VAN DER FEEN — VAN BENTHEM JUTTING.

***Cyclotropis bollingi* n. sp.**

pl. 12 fig. 3.

Diagnosis: A species of *Cyclotropis* TAPPARONE-CANEFRI which differs from the preceding species by its chestnut-brown colour and by lacking any spiral sculpture.

Description: Shell of medium size for the genus, with conical spire and ovate-conoidal body whorl, chestnut-brown, without any coloured spiral bands, glossy, smooth except for the delicate growth lines. There are neither spiral grooves nor is there any trace of a spiral microsculpture. The apex is pointed, the middle of the 7-8 whorls are more convex than in *terae* and

carinata and are separated by a rather well incised suture. The body whorl is well rounded at the base; the funnel-shaped umbilicus is surrounded by a distinct carina. — Aperture ovate, angled above and well rounded below. Peristome sharp, connected by a thin parietal callus. Columella moderately thickened, dirty-white or brownish, curved, with a small beak corresponding with the periomphalic carina. — Operculum ovate, thin, corneous, translucent, paucispiral with eccentric nucleus.

Size: A 5.2-5.8 mm; D 3.6-3.9 mm.

Animal slate grey with few black pigment dots, sole of brighter colour. — The ovate rhachis has 7 cusps on the cutting edge but no basal cusps. L with 7 cusps, M_1 with 9 cusps, M_2 with 26-30. — The verge of the male reproductive organs is conspicuously large during mating season. It is prong-shaped with pointed tip and without any appendages.

Type locality: Klong Bang O in Thonburi Province.

Distribution: Only known from several klongs in the province of Thonburi in Central Thailand.

Biology: The species lives in klongs (canals) with running water under tidal influence but, particularly so in the rainy season, with almost freshwater. It is found attached to plants above the water mark but submerged during high tide.

Material Holotype SMRL 4950/A; paratypes 4950/10; — 4936/7-Klong Bang Phlad; 4937/2-Klong Mon; 4938/7-Klong Toey; 4939/6-Klong Bang Phlu; 4940/10-Klong Dao Id; 4941/1-Klong Bang Naklong.

***Cyclotropis bedaliensis* (RENSCH, 1934).**

pl. 12 fig. 4.

1934 *Ariminia bedaliensis* RENSCH, Arch. Hydrobiol., (Suppl.) 13: 226, pl. 1 fig. 20 (Ostjava: Nymphenquelle und Wasserfall am Ranu Bedali).

1956 *Syncera bedaliensis*, — VAN BENTHEM JUTTING, Treubia, 23 (2): 350, fig. 63 (Java).

Shell ovate-conoidal, smaller than the preceding species, corneous, glossy, translucent, with 3-4 brown spiral bands, one below the suture, one on the periphery, one between suture and periphery and one on the base of the body whorl. The latter is often, the others are rarely absent. The fine growth lines are crossed by a very delicate spiral microsculpture. There is a spiral thread below the suture and another very feeble one around the open umbilicus. The $6\frac{1}{2}$ whorls are more convex than in any of the other species of the genus; they increase regularly in size and are separated by a rather well incised suture. The apex is pointed but not acute, the body whorl is well rounded. — Aperture ovate, pointed above and well rounded below. The peristome is sharp and connected by a thin parietal callus. The columella is curved, thickened and covers partly the umbilical pit. — Operculum ovate, thin, translucent, corneous, paucispiral with eccentric nucleus.

Size: A 3.8-4.4 mm; D 2.7-3.0 mm.

Animal greyish with black pigment dots and slate-coloured sole. — Rhachis oval with 5 cusps on the cutting edge and without basal cusps. L with the formula 3-1-4, M_1 with 7 cusps, M_2 with about 24-26.

Type locality: E-Java: Ranu Bedali.

Distribution: Java and Thailand. In Thailand only in the compound of the Faculty of Tropical Medicine in the small freshwater ditch running near the animal-house. This species seems to have been imported as it has never been found anywhere else in Thailand.

Habitat: The locality in Thailand is similar to those in W-Java (a small source near the palace of the former governor-general in Tjipanas; along a ditch near the hospital of Tjiandjur), a ditch with running water.

Tornidae WENZ, 1939.

Rissoid gastropods which differ from all other families of Rissoacea by their pallial processes and by the distinctly swollen tips of their tentacles. Shell small, generally depressed-trochoid, rarely conical, with large umbilicus and broad body whorl. — The large aperture is very oblique, the peristome sharp, not expanded. — Operculum corneous, paucispiral. — Mantle edge with 2 or 3 filiform processes. The bipectinate gill is extendable in several genera. The formerly examined species are understood to lack a verge. — Rhachis with one cusp on either side.

Distribution: Cosmopolitan.

Habitat: Predominantly marine.

Literature PILSBRY in OLSSON & HARBISON (1953): Monogr. Acad. nat. Sci. Philadelphia, 8: 411.

TAYLOR (1962: 14) argues the use of the family name Tornidae as Vitrinellidae has more often been used. In 1939 WENZ gave a sufficient description of this family and based the name on the oldest generic name *Tornus*. *Vitrinella* C. B. ADAMS 1850 is 20 years younger than *Tornus* TURTON & KINGSTON, 1830. Although THIELE established his family of Adeorbidae ten years before WENZ, his name had to be exchanged as *Adeorbis* is a synonym of *Tornus* described in 1842 by S. WOOD.

Chamlongia BRANDT, 1968.

This monotypical brackish water genus differs from the only other non-marine genus, *Phaneta* H. ADAMS, by its rounded whorls, lack of folds and spiral ridges. From all examined species of this family it differs also by having a distinct verge. The gill is not extendable.

Distribution: Thailand, not known extralimitarily.

Habitat: Klongs and drains of the brackish water area.

Type species: *Chamlongia harinasutai* BRANDT.

Chamlongia harinasutai BRANDT, 1968.

pl. 12 fig. 5.

1968 *Chamlongia harinasutai* BRANDT, Arch. Moll., 98: 265, pl. 10 fig. 53, textfig. 45 (Chantaburi; Glaeng; Bandon).

Shell very small, depressed, subglobose, thin, translucent, corneous, somewhat glossy, with very low spire and large body whorl. The 3½ whorls increase

rapidly in size. The open umbilicus is surrounded by a very weak carina. The shell is smooth except for the delicate growth lines. — Aperture large and ear-shaped. Peristome thin. — Operculum thin, oval, corneous, transparent, with 3½ whorls and subcentral nucleus.

Size: A 2.4-2.6 mm; D 2.9-3.1 mm; aperture 1.9 1.8 mm.

Animal greyish, with fine yellowish and much coarser blackish pigment dots. Foot in front extended into two triangular pseudopodia, pointed behind. Rostrum truncate, heavily pigmented with black patches. Tentacles long and filiform, blunt at the ends and covered with ciliate epithelium. Mantle edge with two filiform processes at the right side and one at the left. The gill can not be extended. Tentacles and pallial processes have black pigment segments of the same size and pattern. — Radula with trapezoidal rhachis with pointed wings and a blunt process in the middle of the lower margin. Cutting edge straight with 7-8 cusps at either side of the central cusp. There is 1 large basal cusp on each wing. Laterals with the cusp formula 4-1-5, marginals with 25 and more cusps.

Type locality: Brackish water trench along the highway between Rayong and Chantaburi, 2 km E of Glaeng near the bridge of the Klong Don Makok.

Distribution: In creeks and trenches in the estuarine area of the Maenam Chantaburi (Tachalaeb), Maenam Prasae (Ban Don Makok) and Maenam Tapi (Bandon), but probably at many more localities around the Gulf of Thailand.

Habitat: The water of the above localities is brackish during the dry season but almost fresh during the rainy season. This species is easily kept in freshwater tanks in the laboratory.

Cerithiacea (FLEMING) H. & A. ADAMS, 1858.

Shell generally turreted, sometimes ovoidal-conic, rarely subglobose. Smooth or with spiral and/or axial sculpture, sometimes with spiral microsculpture. Operculum corneous, generally spiral, rarely concentric; it is retractable into the shell. Radula with 7 teeth in one row. Male reproductive organs without verge. Female reproductive organs often with brood pouch, generally with egg-transfer groove. Many species seem to be parthenogenetic.

Distribution: Cosmopolitan.

Habitat: Marine, brackish and freshwater.

Key to the Thai families:

- | | | |
|---|-------|----------------|
| 1. Shell dextral | ..... | 2 |
| — Shell sinistral | | Triphoridae. |
| 2. Operculum spiral . . | ... | 3 |
| — Operculum (of the Thai species) concentric | | Pleuroceridae. |
| 3. Reproduction parthenogenetic; generally in freshwater. | | Thiaridae. |
| — Reproduction dioecious; always in brackish water | | Potamididae. |

The Triphoridae and Potamididae are restricted to brackish water habitats.

Literature: J. THIELE 1928; J. P. E. MORRISON 1954.

Pleuroceridae THIELE, 1929.

Rhachis always without glabella. Animals dioecious, functional males are always present.

Distribution America, Asia.

The typical subfamily is restricted to America only. In Thailand only one subfamily is represented.

According to MORRISON (1952: 8; 1954: 366) several Asian species of Thiariidae are considered to belong to Pleurocerinae and not into the above named family. That author places these species in the genus *Oxytrema* RAFINESQUE, previously considered to be an American genus. Neither representatives of this genus nor of any other genus related to Pleurocerinae have been found in Thailand. The genus *Semisulcospira* BOETTGER, found in several Asian countries, but not yet in Thailand, is now assigned to the Lavigerinae, a taxon formerly placed in the Viviparacea. It is mentioned here, since MORRISON reported this genus also from Thailand.

Paludominae GILL, 1871.

Shell rather small for the family, ovoidal-conical, subglobose or even neritoid. Operculum ovate, corneous, concentric. For further description see below under the only genus represented in Thailand.

Paludomus SWAINSON, 1840.

Shell ovoidal-conical, subglobose or neritoid; rather solid, covered with a thick, olive or brownish periderm; apex often eroded; the shell is sculptured with more or less distinct spiral lines and often with some spiral grooves below the suture; rarely the shell is completely smooth. Body whorl large, rounded or ovoidal, without umbilicus. Aperture large, peristome sharp, columella curved, bluish-white. Generally there are 1-3 more or less distinct colour bands, rarely there are 4. Operculum concentric. — Males present; females oviparous, with an egg-laying groove, but without brood-pouch.

Type species: *Melania conica* GRAY.

Distribution: S Asia, SE Asia, but not yet known from Cambodia, S Vietnam and W Malaysia.

Habitat: Mountain creeks and small rivers in mountainous area. Avoids sluggish water.

Key to the Thai species:

1. Shell index 13 10, surface smooth *petrosa*.
2. Shell index 15 10, surface with spiral lines *siamensis*.

Paludomus petrosus (GOULD, 1844).

pl. 12 fig. 6.

1844 *Paludina petrosa* GOULD, Proc. Boston Soc. nat. Hist., 1: 144 (Tavoy, British Burma).

1856 *Paludomus labiosa* BENSON, Ann. Mag. nat. Hist., (2) 17: 495 (Burma).

1881 *Paludomus labiosa*, — NEVILL, J. asiat. Soc. Bengal, 50 (2): 159, pl. 2 fig. 5 (Burma).

1915 *Paludomus petrosa*, — PRESTON, Fauna Brit. India, Moll.: 43 (Burma).

Shell of medium size for the genus, subglobose, solid, barely translucent, with eroded apex and 2 or 3 remaining whorls. The ground colour of the shell is whitish, but it is covered with a rather thick greenish or olive-brown periderm. Surface smooth except for the growth lines, but generally with 2 or 3 deep subsutural spiral grooves. Body whorl large, inflated, aperture wide, with sharp peristome. The shell is banded with 2 or 3, sometimes 1 or 4 brown spiral bands of different diameter. Rarely the shell is unicoloured. The peristome is sharp but thickened within. Columella rather broad, brownish or bluish-white. — Operculum typical for the genus.

Size A 10.5-13 mm; D 9-10.5 mm.

Radula with rounded-trapezoidal rhachis. Its cutting edge has a large, rounded middle cusp and 5 smaller cusps on either side of it, the outermost cusp being long and blade-shaped. Laterals with the cusp formula 1-4, inner marginals with 6-7 cusps, outer with 21. — Females with egg-transfer groove and pit; males without intromittant organ.

Type locality: Tavoy, Burma.

Distribution: Mountain area of S Burma and S Thailand. In Thailand the species is known from several mountain creeks in the provinces of Chumpon, Ranong, Nakon Sritammarat and Pattalung.

Parasitology: This species is common in areas where *Paragonimus westermani* was found in carnivores. Large numbers of specimens of this species have been examined for cercariae. No cercariae of a trematode infectuous for man has been found.

Paludomus siamensis BLANFORD, 1903.

pl. 12 fig. 7.

- 1903 *Paludomus siamensis* BLANFORD, Proc. malac. Soc. London, 5: 283, pl. 8 fig. 3 (Siam, in valle superioris Maenam fluminis).
1950 *Paludomus labiosus*, — SUVATTI, Fauna Thailand: 62 [non BENSON] (N of Lampang).
1954 *Paludomus labiosus* (?), — MORRISON, Proc. U. S. nat. Mus., 103: 384, pl. 11 fig. 6 (Lampang).
1966 *Paludomus siamensis*, — SOLEM, Spolia zool. Mus. haun., 24: 15 (Sai Yok, Ban Kao).

This species differs from the preceding species by its larger average size, higher spire and by its distinct spiral sculpture. The colour is of a chestnut-brown with a tint of olive. The bands show the following formulae: 0034 or 1034, rarely 0030, 0230 or 0000.

Size A 11-15 mm; D 7.5-10.2 mm.

The rhachis of this species differs from *P. petrosa* by having the wings protracted into short, pointed triangles.

Type locality: "Upper reaches of the Maenam Chao Praya" — This type locality is definitely wrong as in the Chao Praya River no *Paludomus* have been found. The original locality must either be looked for in the surrounding of Pitsanulok or in one of the tributaries to the Ping River.

Distribution: Known from Thailand only but probably conspecific with one of the many species of *Paludomus* described from Burma. It has been found in the provinces of Pitsanulok, Loei, Lampang, Prae and Kanchanaburi.

Thiaridae GRAY, 1847.

Shell elongately conic, turreted or ovate-conoidal, solid, rarely without sculpture; this consists of spiral ridges and/or axial ribs and often of a spiral microsculpture. Spire often eroded or truncate. Operculum corneous, pauci- or multispiral. The shell is generally covered with a thick brownish or olive periderm. The females are ovoviviparous and have a non-uterine, subhaemocoelic brood pouch. Functional males have only been found in few species. The females have an egg-transfer groove with a birth pore which is placed underneath the right tentacle. Rhachis with or without glabella.

Distribution S Europe, Africa, S, SE and E Asia, S America and Indopacific islands.

Key to the Thai subfamilies:

1. Mantle edge always fringed; rhachis without glabella; operculum paucispiral
.....
Thiarinae.
2. Mantle edge generally not fringed; rhachis with glabella; operculum generally multi-spiral
Melanatriinae.

Thiarinae GRAY, 1847.

Shell turreted or ovoidal conic, rarely without sculpture, often eroded or truncate. Animal with yellowish pigmentation; mantle edge always fringed. Rhachis without glabella, low, with large mesocone and 3-5 small cusps on either side. Laterals shoe-shaped, with the cusp formula (1-2)-1-(3-4), marginals with 8-9 cusps. Operculum ovate, paucispiral. Otherwise like the family. No males with functional gonads known.

Distribution Like that of the family.

Habitat: The animals live in fresh- or slightly brackish water; they are found in ponds, lakes, rivers and even mountain creeks.

Key to the Thai genera:

1. Shell ovoidal-conic, with moderately long or short spire 2
— Shell turreted, with long, often eroded, spire 4
2. Body whorl shouldered, upper half with ribs ... 3
— Body whorl not shouldered, upper half with tubercles *Tarebia.*
3. Whorls rounded, with delicate spiral ridges *Thiara.*
— Whorls somewhat cylindrical, with few deep spiral grooves *Sermyla.*
4. Shell with axial sculpture *Melanoides.*
— Shell without axial sculpture *Neoradina.*

Thiara RÖDING, 1798.

It is now generally agreed that the differences on which the numerous subgenera of this genus are based have no more than specific value. It would also be advisable to unite the following three genera as subgenera with this genus as neither shell characters nor anatomical findings justify a genetic separation.

Shell small or of medium size for the subfamily; always with axial ribs and generally also with spiral ridges. The ribs are shouldered and are often produced into subsutural spines. Otherwise like the subfamily.

Distribution Africa; S, SE and E Asia and numerous Indo-pacific islands.

Type species *Helix amarula* LINNAEUS.

Thiara scabra (O. F. MÜLLER, 1774).

pl. 12 fig. 8.

- 1774 *Buccinum scabrum* O. F. MÜLLER, Hist. Verm., 2: 136 (In paludosis littoris Coromandel Trangquebari Danorum maxime vulgare).
- 1791 *Helix aspera* GMELIN, Syst. Nat., XIII: 3656 (Hab. in paludosis littoris Coromandel).
- 1822 *Melania spinulosa* LAMARCK, Hist. nat. Anim. s. Vert., 6 (2): 166 (Ile de Timor).
- 1831 *Melania doreyana* LESSON, Voy. "La Coquille", 2 (1): 358 (Sur les bords du havre de Dorey ou Dorery, Nouvelle Guinee).
- 1831 *Melania spinescens* LESSON, Voy. "La Coquille", 2 (1): 363 (Nouvelle Guinee).
- 1842 *Melanium granum* VON DEM BUSCH, in PHILIPPI, Abb. Besch., 1: 4 pl. 1 fig. 7 (Java).
- 1848 *Melania scabrella* MOUSSON, Mitth. naturf. Ges. Zürich, 1: 268 (Java).
- 1850 *Melania acanthica* LEA, Proc. zool. Soc. London, 1850: 194 (Manila and the Isle of Negros).
- 1850 *Melania denticulata* LEA, Proc. zool. Soc. London, 1850: 194 (Isle of Negros).
- 1850 *Melania pagoda* LEA, Proc. zool. Soc. London, 1850: 197 (Isle of Guimaras).
- 1858 *Melania datura* DOHRN, Proc. zool. Soc. London, 1858: 135 (Ceylon).
- 1859 *Melania elegans* REEVE, Conch. Icon., 12: pl. 26 fig. et sp. 178 (Afghanistan, India).
- 1859 *Melania pugilis*, — REEVE, Conch. Icon., 12: pl. 26 fig. 180 [non HINDS, 1844] (Manila and Island of Negros, Philippines).
- 1860 *Melania rugosa* BROT, Rev. Mag. Zool., 1860: 257.
- 1880 *Melania snellemani* SCHEPMAN, Midden Sumatra Exp.: 15, pl. 1 fig. 5, pl. 3 fig. 9 (Moeara Laboe).
- 1881 *Melania boeckii* BROT, J. de Conch., 29: 157, pl. 6 fig. 3 (Paijo).
- 1884 *Melania savinieri* MORLET, J. de Conch., 32: 330, pl. 7 fig. 2 (Riviere de Tanabang, Batavia).
- 1890 *Melania subcancellata* BOETTGER, Ber. senckenb. naturf. Ges., 1890: 151, pl. 6 fig. 4 (See von Singkarah).
- 1897 *Melania pinguicola* MARTENS in WEBER, Erg. zool. Reise Niederl.-Ostind., 4: 74, pl. 4 fig. 17-20 (Danau di Bawah; Ajer Tabiet bei Pakakombo; See von Singkarah).
- 1904 *Melania varia* BULLEN, Proc. malac. Soc. London, 6: 110 (Java).
- 1914 *Melania intrepida* FULTON, Proc. malac. Soc. London, 11: 163 (Java).
- 1928 *Melania sykesi* DEGNER, Treubia, 10: 377 (Sumatra).
- 1950 *Melania* (*Plotia*) related to *spinulosa*, — SUVATTI, Fauna Thailand: 62 (Klong Ranode off Tale Sap).

Shell ovoid-conoidal, with large body whorl, olive-coloured, with reddish-brown flames and sometimes with 1-3 brown colour bands. Sculptured with fine spiral ridges and more or less strong ribs which are obsolete on the lower half of the body whorl; these ribs are often produced into subsutural spines or at least nodules. — Aperture ovoidal, peristome sharp. — Operculum typical for the genus.

Size: A 18·32 mm; D 8·14 mm.

Animal grey with yellow pigment dots dusted over head and back. Mantle edge with several fringes of varying sizes. — Rhachis of the radula low and

broad with curved basal margin. Cutting edge with 1 large middle cusp and 3 or 4 small cusps on either side of it. Laterals with the cusp formula 1-1-4, inner marginals with 11 cusps, outer with 10.

Type locality: Coromandel Coast (India).

Distribution: S and SE Asia, S China, Indonesia and W Pacific Islands. In Thailand this species is found in almost all provinces.

Habitat: Lakes, rivers, ponds, canals, streams and mountain creeks. It is found in strong current and in still water as well. Around Bangkok and Thonburi it is found in klongs together with species which are already counted to the brackish water fauna.

The large spectrum of habitats caused an extremely great variability. On these local and ecological variations the above given synonyms are based. No well defined races can be distinguished in the Thai fauna.

Parasitology: Specimens of this species were exposed to miracidia of *Paragonimus westermani*. The miracidia never made an attempt to enter the snails.

Melanoides OLIVIER, 1804.

Shell elongately turreted, with many whorls; apex generally eroded or truncate; the spire is long and consists of many whorls which increase slowly in diameter. The shell is sculptured with more or less strong spiral grooves and axial ribs. The latter are often obsolete; they may sometimes be dissolved into spiral rows of tubercles. The colour is brownish or olive; the shell is often ornated by brown flames and spiral bands. Aperture and peristome typical for the subfamily. Operculum always oval and paucispiral. — Animal with yellowish pigmentation. Mantle edge with fringes. Rhachis without glabella.

Distribution: Palaeotropic and subtropic.

Type species *Melanoides fasciolata* OLIVIER = *Nerita tuberculata* O. F. MÜLLER.

Key to the Thai species:

1. The whole whorl is sculptured with spiral lines; axial ribs weak *tuberculata*.
2. Only base of body whorl sculptured with spiral lines; ribs very strong *jugicostis*.

Melanoides tuberculata (O. F. MÜLLER, 1774).

pl. 12 fig. 9-12.

- 1774 *Nerita tuberculata* O. F. MÜLLER, Hist. Verm., 2: 191 (In littore Coromandel).
1779 *Strombus costatus* SCHROETER, Flußconch.: 373, pl. 8 fig. 14 (Küste von Koromandel).
1804 *Melanoides fasciolata* OLIVIER, Voy. Emp. Ottom.: VI, pl. 31 fig. 7 (Egypte).
1822 *Melania truncatula* LAMARCK, Hist. Anim. s. Vert., 6 (2): 167 (Rivière de l'île de Timor).
1834 *Melania virgula* QUOY & GAIMARD, Voy. Astrolabe, Zool., 3: 141, pl. 56 fig. 1-4 (Ile de France).
1836 *Melania pyramis* BENSON, J. asiat. Soc. Bengal, 5: 782 (River Hooghly, Calcutta).
1838 *Melania punctata* POTIEZ & MICHAUD, Gal. Moll. Mus. Douer, 1: 262, pl. 27 fig. 15-16 [non LAMARCK] (Les Indes Orientales).
1841 *Melania rothiana* MOUSSON, Coqu. terr. fluv. Pal.: 61 (Palestine).
1842 *Melania ornata* VON DEM BUSCH in PHILIPPI, Abb. Besch., 1 (*Melania*): 4, pl. 1 fig. 15-16 (Java).

- 1844 *Melania moesta* HINDS, Ann. Mag. nat. Hist., 14: 9 (Feejee Islands).
 1847 *Melania suturalis* PHILIPPI, Abb. Besch., 2: 173, pl. 4 fig. 6 (Java).
 1847 *Melania rivularis* PHILIPPI, Abb. Besch., 2: 174, pl. 4 fig. 17 (Java).
 1848 *Melania unifasciata* MOUSSON, Mitth. naturf. Ges. Zürich, 1: 269 (Java).
 1850 *Melania juncea* I. & H. C. LEA, Proc. zool. Soc. London, 1850: 189 (Lake of Taal, province of Batanos, and small streams in Luzon, Philippines).
 1850 *Melania turriculus* I. & H. C. LEA, Proc. zool. Soc. London, 1850: 190 (Small rivers, Chalanang, Province of Bai, Luzon).
 1850 *Melania tigrina* HUTTON, J. asiat. Soc. Bengal, 19: 658 (Bengal).
 1855 *Melania judaica* MOUSSON, Malak. Bl., 2: 53, pl. 2 fig. 1-3 (Palestina).
 1858 *Melania layardi* DOHRN, Proc. zool. Soc. London, 1858: 135 (Ceylon).
 1859 *Melania exusta* REEVE, Conch. Icon., 12: pl. 12 fig. 74 (Salomon Isl.).
 1859 *Melania punctulata* REEVE, Conch. Icon., 12: pl. 15 fig. 100, 109 (Java).
 1859 *Melania crepidinata* REEVE, Conch. Icon., 12: pl. 17 fig. 120 (Java?).
 1860 *Melania beryllina* BROT, Rev. Mag. Zool., 1860: 8, pl. 17 fig. 8 (Pondichéry).
 1865 *Melania rubropunctata* TRISTRAM, Proc. zool. Soc. London, 33: 541 (Dead Sea).
 1874 *Melania distinguenda* BROT, Conch. Cab., 1 (24): 190, pl. 21 fig. 15 (Borneo).
 1874 *Melania waigiensis* BROT, Conch. Cab., 1 (24): 195, pl. 22 fig. 6 (I. Waigiou, Baie d'Offak).
 1874 *Melania denisoniensis* BROT, Conch. Cab., 1 (24): 234, pl. 25 fig. 6-6a (Port Denison, Queensland).
 1874 *Melania javanica* BROT, Conch. Cab., 1 (24): 246, pl. 26 fig. 7 (Java).
 1874 *Melania malayana* BROT, Conch. Cab., 1 (24): 253, pl. 26 fig. 5-5a (Sarawak, Tangiou-Datou, Borneo).
 1874 *Melania parreyssi* BROT, Conch. Cab., 1 (24): 254, pl. 27 fig. 3 (Java).
 1877 *Melania singularis* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 9: 284 (Sorong).
 1880 *Melania wilkinsonii* and *M. scalariformis* TENISON WOODS, Proc. linn. Soc. N. S. Wales, 4: 25, pl. 4 fig. 4 (New Guinea).
 1883 *Melania pellicens* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 19: 30, pl. 1 fig. 18 (Isola di Sarong).
 1883 *Melania dominula* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 19: 31, pl. 1 fig. 16 (Wokan, Is. Aru).
 1883 *Melania petiti* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 19: 37 (Wokan, Is. Aru).
 1883 *Melania nicobarica* TAPPARONE-CANEFRI, Ann. Mus. civ. Stor. nat. Genova, 19: 38 (Wokan, Is. Aru).
 1889 *Melania tuberculata*, — MORLET, J. de Conch., 37: 146 (Streng-Dontri à Kassan-Pno, Cambodge; Kampong-Kal, rivière Battambang, Siam).
 1904 *Melania tuberculata*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 418 (Rivière Ménam Ping et ses marais à Xieng-Mai).
 1950 *Melanoides tuberculata*, — SUVATTI, Fauna Thailand: 62 (Bangkok).
 1950 *Melanoides ningpoensis*, — SUVATTI, Fauna Thailand: 61 (Bangbert Bay; Klong Ranode off Tale Sap; Bangkok).
 1962 *Melanoides tuberculata*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 9 (Udon).
 1964 *Melanoides tuberculata*, — HABE, Nature Life S. E. Asia, 3: 53, pl. 1 fig. 18 (Bangkok).
 1966 *Melanoides tuberculata*, — SOLEM, Spolia zool. Mus. haun., 24: 15 (Muak Lek; Sai Yok).

Shell moderately thick, elongate, turreted, with 12-16 whorls; apex and postnuclear whorls often decollated. The whorls are either somewhat convex or nearly flat; they increase regularly in size. The shell is covered with a brownish, yellowish or olive periderm. There are chestnut-brown flames and

bands (generally 2) on the body whorl. The sculpture consists of many narrow spiral ridges which are often crossed by obtuse ribs. These ribs may be dissolved into spiral rows of tubercles on the upper half of the body whorl. — Aperture ovate, with sharp peristome and curved columella. — Operculum typical for the subfamily.

Size A 22-42 mm; D 7-14 mm.

Animal dark grey with yellowish pigment spots. Mantle edge with the typical fringes. Reproductive organs of the males without functional gonads. Rhachis very low and broad. Radula of the formula C 4-1-4, L 1-1-4, M₁ 9, M₂ 10.

Type locality: Coromandel Coast, India.

Distribution From S Europe through Africa and Asia to the West Pacific Islands and Australia. — Thailand: This species is found in all provinces of the kingdom in abundance. As the synonymy shows the variability of this species is extremely great and caused the creation of numerous taxa which have hardly subspecific value.

Habitat Lakes, ponds, trenches, rivers, brooks and mountain creeks. The species may be found in slightly brackish water and is abundant in the tidal areas around Bangkok and Thonburi.

Although valuable studies by former authors (RENSCH, VAN BENTHEM JUTTING) have partly elucidated the nomenclatorial jungle of this species a general revision of this genus seems still necessary to fix the limits of this rassenkreis. After a careful study of the available type material many species of *Melanoides* not yet included in above synonymy will prove to belong to this species.

Parasitology: *M. tuberculata* has been reported to act as intermediate host for *Paragonimus westermani*. No naturally infected snails have been found in Thailand nor have attempts to infect snails experimentally shown positive results.

Melanoides jugicostis (HANLEY & THEOBALD, 1876).

pl. 12 fig. 13.

1876 *Melania jugicostis* (BENSON) HANLEY & THEOBALD, Conch. Ind.: pl. 110 fig. 8-9 [no description] (Tenasserim).

1877 *Melania jugicostis*, — BROU, Conch. Cab., 1 (24): 275, pl. 28 fig. 2 (Tenasserim River, Burma).

1877 *Melania jugicostis*, — NEVILL, J. asiat. Soc. Bengal, 46: 33 (Myadoug, Burma).

1915 *Tiara (Melanoides) jugicostis*, — PRESTON, Fauna Brit. India, Moll.: 28, fig. 1 (Tenasserim River; Myadoug).

Shell rather small, turreted, solid, olive green, with strong, distantly placed, varicose ribs and several strong spiral basal ridges. There are 8-9 ribs on the last whorl. Apex generally eroded. Unicoloured or with a brown basal band.

Size A 14-17 mm; D 5.5-6.7 mm.

Animal sand-coloured, with numerous blackish pigment dots all over the body. Sole greyish, rostrum with transverse wrinkles. Mantle with the fringes, 3 of which are very prominent. The examined animals were preserved in alcohol and did not show any yellowish pigmentation.

Type locality: Tenasserim River in Burma.

Distribution Known from Burma, Thailand and Java. — In Thailand found at few localities only but in abundance: Bangkok, klong around the Chittlada Palace; pond and klong in the Dusit Zoo; Huai Muak Lek, Saraburi Province; Ban Lam Go near Lom Sak, Petchabun Province.

***Tarebia* H. & A. ADAMS, 1854.**

Shell slightly fusiform, elongately ovate-conoidal or turreted, but shorter than *Melanoides*. Rather thick, greenish or brownish, with strong axial ribs which are dissolved into 2 or 3 spiral rows of tubercles, and with distinct spiral grooves and ridges. The axial sculpture is obsolete on the lower half of the body whorl but the spiral sculpture is stronger at the base. — Operculum typical for the subfamily. — No males with functional gonads were found in this genus. Females ovoviviparous.

Type species *Melania granifera* "VON DEM BUSCH" — This is evidently an error for *M. semigranosa* VON DEM BUSCH, which, however, is now considered a synonym of *Melania granifera* LAMARCK. This species was already included in the list of species attributed by H. & A. ADAMS to the subgenus *Plotia* (see MORRISON, Amer. malac. Union News Bull. & Annu. Rep., 1952: 8; Proc. U. S. nation. Mus., 103: 379, 1954). Because of the synonymy there is no change in the choice of a type species as it was designated by later authors (BROT, PRESTON, WENZ, THIELE).

Distribution S and SE Asia, S China and numerous islands of the Western Pacific.

***Tarebia granifera* (LAMARCK, 1822).**

pl. 12 fig. 14-18.

- 1822 *Melania granifera* LAMARCK, Hist. Anim. s. vert., 6 (2): 167 (Ile de Timor).
1828 *Helix lineata* GRAY in WOOD, Index test., Suppl.: 24, fig. 68 (Ganges).
1834 *Melania celebensis* QUOY & GAIMARD, Voy. Astrolabe, Zool., 3: 152, pl. 56 fig. 26-29 (Célèbes).
1836 *Melania lirata* BENSON, J. asiat. Soc. Bengal, 5: 782 (River Hooghly near Calcutta).
1842 *Melania semigranosa* VON DEM BUSCH in PHILIPPI, Abb. Besch., 1: 2, pl. 1 fig. 13 (Java).
1843 *Melania coffea* PHILIPPI, Abb. Besch., 1: 60, pl. 2 fig. 4 (Java?).
1843 *Melania batana* GOULD, Proc. Boston Soc. nat. Hist., 1: 144 (Tavoy, Burma).
1844 *Melania flavida* DUNKER in PHILIPPI, Abb. Besch., 1: 164, pl. 3 fig. 15 (Teria Ghat, Java).
1844 *Melania verrucosa* HINDS, Ann. Mag. nat. Hist., 14: 9 (New Ireland).
1850 *Melania lateritia* LEA, Proc. zool. Soc. London, 1850: 184 (Philippines).
1850 *Melania rudis* LEA, Proc. zool. Soc. London, 1850: 185 (Ceylon, Amboyina).
1850 *Melania microstoma* LEA, Proc. zool. Soc. London, 1850: 185 (Colombo, Ceylon).
1850 *Melania crenifera* LEA, Proc. zool. Soc. London, 1850: 192 (Java).
1857 *Melania granospira* MOUSSON, J. de Conch., 6: 61 (Java).
1859 *Melania broti* REEVE, Conch. Icon., 12: pl. 22 fig. 160 (Ceylon).
1859 *Melania lyrata* REEVE, Conch. Icon., 12: pl. 24 fig. 170 (Java).
1860 *Melania chocolatum* BROT, Rev. Zool., 1860: pl. 16 fig. 2 (Ceylon).
1860 *Melania granospiralis* ZOLLINGER, Natuurk. Tijdschr. Nederl. Ind., 18: 424 (Java).
1868 *Melania asperula* BROT, Matér. Mélan., 2: 30, pl. 1 fig. 11 [non LAMARCK, 1822] (Java).
1879 *Melania junghubni* MARTIN, Tertiärsch. Java: 89, pl. 14 fig. 20 (Java).

- 1904 *Melania lateritia*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 418 (Rivière Ménampin à Xien-Mai, Laos occidental).
- 1905 *Melania tjariangensis* MARTIN, Samml. geol. Reichsmus. Leiden, (NF) 1: 235 (Java).
- 1905 *Melania kritjianensis* MARTIN, Samml. geol. Reichsmus. Leiden, (NF) 1: 235 (Tjariang; Kritjian, Java).
- 1914 *Melania tjibodasensis* LESCHKE, Mitt. naturh. Mus. Hamburg, 31: 219 (Tjibodas, Java).
- 1914 *Melania margaritana* LESCHKE, Mitt. naturh. Mus. Hamburg, 31: 258, fig. 12 (Tjibodas, Java).
- 1935 *Melania martini* OOSTINGH, Wet. Meded. Dienst Mijnb. Nederl. Ind., 26: 25 [non SCHEPMAN, 1898].
- 1950 *Melanoides lateritia*, — SUVATTI, Fauna Thailand: 62 (Klong Ranode off Tale Sap).
- 1952 *Thiara (Tarebia) granifera*, — ABBOTT, Proc. U. S. nation. Mus., 102: 72, 113, pl. 8 fig. 1-2 (Guam Island; Naujan River, Mindoro Island; Lithia Spring, Florida).

Shell thick, of medium size for the genus and subfamily, brownish or olive-coloured, moderately turreted or ovoidal-conical, sometimes somewhat fusiform. Apex pointed but often eroded. The body whorl is large and measures about half the length of the shell. The sculpture consists of spiral grooves and axial ribs. The latter are crossed by 2 deep spiral grooves, thus forming 3 spiral rows of tubercles. Base with spiral ridges only. — Aperture oval with sharp peristome and curved columella. — Operculum thin, corneous, paucispiral with basal nucleus.

Size A 12-44 mm; D 6-16 mm.

Animal grey with yellow and blackish pigmentation. Males with functional gonads unknown; females with subhaemocoelic brood pouch.

Type locality: Timor.

Distribution India, Ceylon, SE Asia, S China, Indonesia, Philippines and numerous western Pacific Islands. — In Thailand this species is found in abundance in almost all provinces. It is common in lakes, ponds, rivers, canals and creeks and enters also the tidal zone. It never tolerates such high salinity as the following species. Its populations are sharply separated from those of *S. riqueti*.

For detailed data on anatomy, biology and parasitology see ABBOTT (1952: 71).

Parasitology: This species is the only proven intermediate host for *Paragonimus westermani*, a lung-fluke which also infects man.

Variability: Most of the taxa listed in the synonymy of this species are local forms which do not even deserve a subspecific name. Two ecologic forms, however, may be mentioned from Thailand. The race from the Bang Pra Lake E of Bangkok (fig. 18) is almost identical with the Indian form which was described as *Melania laevis* by BAVAY from Manikion and has also been found in several other countries. A race from S Thailand is identical with a form known as *Melania melvilli* PRESTON, 1907.

Sermyla H. & A. ADAMS, 1854.

Shell very similar to that of *Tarebia*, but without upper spiral grooves; therefore the ribs are not dissolved into tubercles. The base shows several strong spiral ridges. The ribs may be produced into spines like those of *Thiara*. Operculum, animal and radula typical for the subfamily.

Type species: *Melania tornatella* LEA = *Melania riqueti* GRATELOUP.

Distribution: S and SE Asia, China, islands of the western Pacific.

Habitat: Brackish water in the estuarine areas of rivers.

All forms found in Thailand may be assigned to one species.

Sermyla riqueti (GRATELOUP, 1840).

pl. 12 fig. 19-22.

- 1840 *Melania riquetii* GRATELOUP, Act. Soc. linn. Bordeaux, 11: 433, pl. 3 fig. 28 (Bombay, India).
1844 *Melania harpula* DUNKER in PHILIPPI, Abb. Besch., 1 (*Melania*): 161, pl. 3 fig. 6 (Java?).
1847 *Melania semicostata* PHILIPPI, Abb. Besch., 2: 171, pl. 4 fig. 12 (Java).
1850 *Melania tornatella* LEA, Proc. zool. Soc. London, 1850: 185 (Philippines).

Shell rather small or of medium size for the subfamily, turreted or even somewhat cylindrical; generally with eroded apex. The large body whorl measures about half the length of the shell or even more. The upper half of the body whorl is sculptured with strong, curved ribs. This sculpture begins already on the postnuclear whorls. The base of the shell shows 8-10 obtuse spiral ridges. There is one population known where about on third of the specimens show a spiral row of subsutural spiny tubercles. These specimens may be mistaken for a *Thiara* species. — Aperture piriform with sharp peristome and curved columella. — Operculum typical for the subfamily.

Size A 9-17 mm; D 3.5-7.0 mm.

Animal greyish with the typical yellow pigmentation and a fringed mantle edge. Females with egg-transfer groove, birth pore and subhaemocoelic brood pouch. There were about 0.5% males in the examined populations. However, no males with functional gonades have been found.

Type locality: Bombay, India.

Distribution Coasts of the Indian and western Pacific Ocean.

Habitat: Brackish water or estuarine areas under tidal influence. It has been observed that the specimens from mud-flats are more turreted, those from creeks with sandy ground more cylindrical. An exception is the spiny form from the Chao Praya River. This species has been found in almost all estuaries of large and small rivers in Thailand.

Parasitology Large numbers of this species have been checked for cercariae. It seems that it is of no importance for medical parasitology.

Variability This species varies considerably in size and shape. An extremely large race with 30% spiny specimens was found in the Chao Praya River at Bangkok. As 70% of the specimens are typically sculptured a subspecific name does not seem to be justified.

Neoradina n. gen.

Diagnosis: A genus of Thiariidae (Thiarinae) which differs from *Stenomelania* by being oviparous and having a brood-pouch, and from *Melanoides* by lacking the axial sculpture.

Description: Shell rather large for the subfamily, subulate or elongately turreted, with extended, sharp and pointed spire and 10-14 whorls. These may show spiral grooves at the postnuclear whorls and a subsutural ridge on the body whorl. — Operculum paucispiral.

Distribution: India, Andamans, Nicobars, Ceylon, S Thailand: here only known from the Province of Grabi.

Type species: *Neoradina prasongi* n. sp.

Remark In 1915 PRESTON created a new taxon for a group of Indian and Ceylonese species which had also relatives on the Nicobar and Andaman Islands: *Radina*. Unfortunately he chose by mistake *M. hastula* LEA as type for his new subgenus. *M. hastula* LEA is a genuine *Stenomelania*, this group, however, does not reproduce through veliger larvae, but is ovoviviparous. The name *Radina* being placed in the synonymy of *Stenomelania* this group needs a new generic name.

***Neoradina prasongi* n. sp.**

pl. 12 fig. 23.

Diagnosis: A species of *Neoradina* n. which differs from its closest relative, *N. expatriata* (PRESTON), by being less truncate and of olive-green colour. The postnuclear whorls show a dense spiral striation, not only on the lower half of the whorls.

Description: Shell subulate or elongately turreted with long, pointed spire. Only the embryonic shell is eroded. The upper whorls are sculptured with densely placed spiral grooves. The first 2 whorls are smooth, the 3rd to 7th whorl are completely sculptured with spiral grooves. On the 8th whorl these grooves are restricted to the lower half of the shell and on the next 2 whorls only few lines are seen above the suture. The large body whorl carries a sharp subsutural ridge. The part between suture and ridge appears somewhat concave. The shell is covered with an olive-green periderm. The upper whorls may show some relicts of brownish flames. — Aperture ovate, pointed above, with curved columellar and basal margin. It is dark bluish within. Peristome sharp, not expanded, connected by a bluish parietal callus. — Operculum corneous, thin, translucent, paucispiral with eccentric nucleus.

Size A 44-48 mm; D 14-16 mm.

Rhachis of the radula without glabella, typical for Thiarinae. — Females with subhaemocoelic brood-pouch with many small embryonic shells in all stages of development. No males were found.

Type locality Stream about 7 km from Grabi to Kao Tong.

Distribution Only known from the type locality.

Material: Holotype SMRL 3950/A; paratypes 3950/25.

Remarks This species forms with below named Asian Thiarid species a well defined genus within the Thiarinae. These species are: *N. multistriata* (PRESTON), *charon* (PRESTON), *expatriata* (PRESTON) and *solidiuscula* (NEVILL), all from the Andamans; *nana* (NEVILL), *zelebori* (BROT), *fuscata* (BORN), *perdecollata* (NEVILL), *plana* (VON DEM BUSCH), *sobrius* (LEA) and *pirenoidea* (NEVILL) from the Nicobars; *confusa* (DOHRN) from Ceylon and two unidentified species from India (Puniar River, Cuddalore, Vizagapatam) which PRESTON erroneously identified with *Stenomelania hastula* (LEA) and *M. crenulata* (DESHAYES).

Melanatriinae THIELE, 1929.

Shell turreted or ovate-conoidal, generally rather thick; covered with a brown or olive periderm. Smooth or sculptured with spiral ridges or axial ribs which may carry tubercles or spines. Peristome sharp, with a tongue-shaped basal projection. Operculum round or oval, with 3-6 whorls; nucleus almost

central. Mantle edge generally smooth, only one species is known with a fringed mantle edge.

The species of this subfamily differ from those of Thiarinae mainly by the form of their radulae. The squarish rhachis shows on the front of its plate a shield-like process (glabellum) which among Cerithiacea is unique for Melanatriinae. The cusps on the cutting edge of the rhachis are rounded, never pointed like in Thiarinae. The laterals are similar to those of Thiarinae, the marginals, however, have only few or no cusps at all.

The animals are, as far as examined, dark grey or blackish and dusted with fine orange or yellow pigment spots. Foot rounded behind, truncate in front. Tentacles thin and moderately long; the eyes are placed in distinct sockets at their bases. Females with subhaemocoelic brood pouch. The egg-transfer groove (ETG) runs parallel to the margin of the foot on the right side of the body. The birth pore is placed below the right tentacle. Males with or without functional gonads.

Distribution W Africa, Madagascar, S and SE Asia and several Indonesian islands.

There are three genera represented in Thailand.

Key to the Thai genera:

- | | |
|---|-----------------------|
| 1. Mantle edge smooth; shell unicoloured or with spiral bands | 2 |
| — Mantle edge fringed; shell with variegated axial brown flames | <i>Adamietta</i> . |
| 2. Shell turreted; operculum round with central nucleus | <i>Brotia</i> . |
| — Shell ovate-conoidal; operculum oval with lateral nucleus | <i>Paracrostoma</i> . |

Adamietta n. gen.

Diagnosis: A genus of Melanatriinae (Thiaridae) which differs from all other genera of the subfamily by its paucispiral operculum, axial colour flames and by its fringed mantle edge. From the genera of Thiarinae it differs by having a glabella on the rhachis like *Brotia* and *Melanatria*.

For further description see below under the monotype.

Type species: *Melania housei* LEA.

Distribution: Like that of the monotype.

Etiology: This genus is dedicated to Prof. W. ADAM, Bruxelles, Institut Royal des Sciences Naturelles, as a token of gratitude for his valuable help.

Adamietta housei (LEA, 1856).

pl. 12 fig. 24.

1856 *Melania housei* LEA, Proc. Acad. nat. Sci. Philad., 8: 144 (Takrong River, Siam).

1860 *Melania schomburgki* REEVE, Conch. Icon., 12 (*Melania*): pl. 14 fig. 93 (Siam).

1867 *Melania housei*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 125, pl. 22 fig. 22 (Siam, River Takrong).

1875 *Melania schomburgki*, — BROU Conch. Cab., 1 (24): 104, pl. 13 fig. 4 (Siam).

1876 *Melania housei*, — BROU, Conch. Cab., 1 (24): 178, pl. 22 fig. 1 (Siam).

1950 *Melania schomburgki*, — SUVATTI, Fauna Thailand: 62 (Rajaburi; Sikuk River; Tale Sap at Patalung).

1962 *Stenomelania brunnescens* ? — ITO & al., Jap. J. med. Sci. Biol., 15: 250, pl. fig. 10 [non TRYON] (no locality).

Shell of medium size, elongately turreted, smooth except for the growth lines; yellowish olive, with brown, axial flames; somewhat glossy. Apex pointed, but generally eroded; the 12-14 whorls are almost flat or moderately convex; they increase slowly and regularly in diameter. The body whorl measures about $\frac{2}{5}$ of the length of the shell. Fully adult shells may show 1-4 weak periomphalic spiral ridges. — Aperture ovate, angled above and well rounded below. Peristome sharp, connected by a thin parietal callus. It is somewhat protracted at the base but less so than in *Brotia*. The curved columella is bluish-white. — Operculum oval, paucispiral with about $2\frac{1}{2}$ whorls. Muscle scar large, with raised margin; nucleus almost lateral.

Size: A 40-47 mm; D 18-22.5 mm.

Animal with black head and back and grey sole, mottled with straw-coloured patches and dusted with fine yellow dots. Tentacles often black and yellow variegated. — Rhachis with a squarish glabella, cutting edge with 3 rounded cusps on either side of the large middle cusp. Laterals with the cusp formula 3-1-2, marginals with 2 broad cusps. — Females with lateral ETG; birth pore below the right tentacles. The subhaemocoelic brood pouch contains many small embryonic shells of equal size with 2 whorls. There is a rather high percentage of males (varying among the different populations). Whether they have functional gonads has not yet been studied. Copulation has never been observed.

Type locality Takrong River near Nakon Ratchasima.

Distribution: Thailand, Laos and Cambodia. In Central, W, N, E and SE Thailand common. The southernmost locality was found in Ratburi Province, but the species has been reported from Pattalung.

Brotia H. ADAMS, 1866.

Shell thick or moderately so, smooth or sculptured with spiral ridges and/or axial ribs which may be ornate with tubercles or spines. Turreted, with elongate apire and generally with eroded apex. Body whorl moderately large. Operculum round, with 4-6 whorls. — Rhachis with broad, squarish glabella which is composed of several parts. Laterals and marginals with few cusps on the cutting edge. — Among the examined species functional males have been found in few species only. Reproduction seems to be predominantly parthenogenetic. Females with ETG, birth pore and subhaemocoelic brood pouch.

Type species *Melania pagodula* BROU.

Distribution: India, Ceylon, Burma, Thailand, Laos, Cambodia, Tonkin, S China, Malaysia, Java, Sumatra and several other Indonesian Islands.

Key to the Thai subgenera:

1. Shell with pointed apex which is generally eroded; peristome protracted at the base
..... *Brotia* s. str.
2. Shell with obtuse apex; peristome not protracted
Senckenbergia.

Brotia (Brotia) s. str.

Shell turreted, of medium or large size for the family; smooth or with spiral ridges and/or axial ribs; these are often ornate with spines or tubercles. Aper-

ture large, ovate; peristome at the base protracted. Operculum and animal typical for the genus.

Distribution Like that of the genus.

Habitat: Rivers and mountain creeks, rarely also in still water. In Thailand found in almost all drainage systems.

Key to the Thai species and subspecies:

- | | |
|--|-------------------------|
| 1. Shell with spines or tubercles | 2 |
| — Shell without spines or tubercles | 6 |
| 2. Shell with 3 or 4 rows of tubercles | 3 |
| — Shell with 1 or 2 rows of tubercles or spines | 4 |
| 3. Shell with 3 rows of obtuse tubercles, about 15 on one row on the penultimate whorl | |
| ..... | <i>baccata.</i> |
| — Shell with 4 rows of sharp tubercles, about 20 on one row on the penultimate whorl | |
| ..... | <i>c. peninsularis.</i> |
| 4. Shell with 1 row of spines or tubercles | 5 |
| — Shell with 2 rows of spines, about 15 on the penultimate and 17 on the body whorl | |
| ..... | <i>b. binodosa.</i> |
| 5. With 8 large spines on the body whorl | <i>pagodula.</i> |
| — With about 18 sharp tubercles on the body whorl | <i>pseudoasperata.</i> |
| 6. Surface without sharp microsculpture | 7 |
| — Surface with sharp spiral microsculpture | <i>microsculpta.</i> |
| 7. Shell with spiral macrosculpture | 8 |
| — Shell without spiral macrosculpture but sometimes with carinae | 9 |
| 8. Shell with many spiral lines | <i>citrina.</i> |
| — Shell with few spiral ridges | <i>c. costata.</i> |
| 9. Shell diameter more than 20 mm | <i>b. subgloriosa.</i> |
| — Shell diameter less than 20 mm | 10 |
| 10. Shell smaller than 35 mm | <i>insolita.</i> |
| — Shell larger than 35 mm | <i>manningi.</i> |

Brotia (Brotia) pagodula (GOULD, 1847).

pl. 12 fig. 25.

1847 *Melania pagodula* GOULD, Proc. Boston Soc. nat. Hist., 2: 219 (Thoungyin River, Burma).

1859 *Io pagodula*, — REEVE, Conch. Icon., 12 (*Io*): pl. 3 fig. 10 (Thoungyin River, Burma).

1915 *Tiara (Acrostoma) pagodula*, — PRESTON, Fauna Brit. India, Moll.: 32 (Thoungyin River, Burma).

Shell turreted, apex always eroded; thick, covered with a brown periderm; sculptured with several spiral ridges. The subsutural ridge is shouldered and carries tubercles on the middle whorls and 6 strong spines on the body whorl. Peristome distinctly projecting at the base. Operculum round, with 4 whorls.

Size A 38-52 mm; D 22-27 mm.

Animal blackish with yellow pigmentation. — Rhachis with 3 rounded cusps on the cutting edge. Laterals with the cusps formula 1-1-(1-2), marginals with 1-2 cusps. — No functional males have been found.

Type locality: Thoungyin River, probably between Mae Sot and Kawkareik.

Distribution: Known from above river only. This river is called Maenam Moei in Thai. The examined material was collected W of Mae Sot and at Mae Ramat.

Habitat: The species lives attached to rocks but also in quiet parts of the river where it was found half buried in the sand. It had been generally accepted that the spinous species of *Brotia* live in rapids on rocks and the smooth forms (*Antimelania*) in quiet parts of the rivers. This has been proven incorrect. *B. pagodula* and *pseudasperata* were found on sandy ground in quiet parts of rivers and streams, *B. citrina*, *insolita* and *microsculpta* have been found in rapids and even in falls attached to rocks. Several species have smooth and spinous races which live in equal habitats.

Brotia (Brotia) binodosa binodosa (BLANFORD, 1903).

pl. 12 fig. 26.

1903 *Melania binodosa* BLANFORD, Proc. malac. Soc. London, 5: 282, pl. 8 fig. 2 (Siam, in fluminibus majoribus).

1966 *Brotia binodosa*, — SOLEM, Spolia zool. Mus. haun., 24: 15, textfigs. 1a, b (Tungsa-laeng Luang waterfall at 200 m).

Very similar to the type species in size and shape. There are two rows of spiny tubercles on the whorls and these tubercles are more numerous than the spines in *B. pagodula*.

Shell conical, elongate, thick, covered with a brownish or olive-brown periderm, glossy, with distinct growth lines and sculptured with 2 spiral rows of closely set spiny tubercles and 3-4 subperipheral spiral cord. The apex is always eroded; the 3-4 remaining whorls are almost flat or moderately convex and are separated by a well impressed suture. The second row of tubercles is placed somewhat above the periphery and therefore well visible on the middle whorls. The first row is placed in the middle between the suture and the second row. There are generally 4 spiral ridges on the base of the body whorl, rarely 3 or 5. There are about 12 tubercles in each spiral row on the penultimate whorl and 14 on the body whorl. The shells are generally unicoloured but specimens with brown colour bands are not rare. The predominant band formula is 0030; other observed formulae are 0034 and 1034. — The aperture is ovate and angled above; it is bluish white within. The peristome is sharp and neither lipped nor expanded. It is connected by a thin, bluish-white parietal callus. Columella well curved. The base is tongue-like produced and forms an angle. — Operculum almost round, inner surface glossy, with 4 whorls and almost central nucleus.

Size: A 35-52 mm; D 22-28 mm.

Animal blackish with densely placed yellow pigmentation. This is not dusted regularly over the body but arranged in single fields or clusters of dots and in stripes which are separated by black wrinkles. The sole is grey with yellow pigment dots at the margins. The round, rather short tentacles are mottled with yellowish patches. The eyes are placed at their bases in rather thick, short sockets. The rostrum is short and thick. — The brood pouches of mature females are rarely empty which proves that a permanent reproduction takes place. There are numerous embryonic shells in all stages of development. The younger shells carry a nutritive sack at the open apex (see also SOLEM 1966: 16) which is closed later by a layer of shell substance. The body whorl of the embryonic shell is obtusely angled and ornate with a brownish band. Unicoloured embryonic shells are not rare, shells with a second (subsutural) band are rare. ETG,

birth pore (BP) and brood pouch typical for the genus. Males have been found, but as functional gonads have not been found, completely parthenogenetic reproduction has been assumed. A monograph on the genus *Brotia* is in progress; there more detailed data on anatomy and biology of the studied species will be given. — The rhachis of the radula has a broad, triangular middle cusp and 3 curved, finger-shaped cusps on either side of it. Laterals with the cusp formula 1-1-2, marginals with 1 large cusp and 1 small.

Type locality: "Siam, in fluminibus majoribus"

Above type locality is definitely incorrect. Therefore as exact locality the Kaek River at Sopa Falls is designated, as it is highly probable that DALY collected his typical material at this spot.

Distribution: The distribution of this species is limited to two rivers which are tributaries to the Nan River S and N of Pitsanulok. These rivers are the Maenam Kaek, also called Klong Talo at its lower reaches, and the Maenam Kwae Noi at Nakon Thai. This river is not to be confused with another river of the same name in the Kanchanaburi Province. The distribution in the Kaek River W of Lom Sak and E of Pitsanulok is not continuous. The localities where this species has been found in the Kaek River are (from E of Pitsanulok given in km): Tap Ta Mi Falls, 35 km; Ban Palo, 38.5 km; Poy Falls, 59 km; Gaeng Song, 65 km; Sopa Falls, 71 km and Tong Salaeng Luang Botanical Garden, 80 km. The smooth race is restricted to the upper reaches of the Kaek River and to some of its upper branches.

Habitat: This species lives attached to rocks in rapids and near falls, feeding on algae.

***Brotia (Brotia) binodosa subgloriosa* BRANDT, 1968.**

pl. 13 fig. 28.

1968 *Brotia (Brotia) binodosa subgloriosa* BRANDT, Arch. Moll., 98: 269, pl. 10 fig. 56, textfig. 38 (Kaek River in Thailand between 65 km E of Pitsanulok and Huai Chieng Nam).

This race differs from the type subspecies by its complete lack of sculpture. Specimens with few spiny tubercles are a rare exception. These specimens look very similar to those with reduced sculpture which were found among the populations of the typical subspecies.

The shell is of the same size and shape as that of the type subspecies. The apex is always eroded, the remaining 4-5 whorls are almost flat, only the body whorl is well rounded in adult specimens, but it shows a feeble keel when the specimens are young. The aperture is large and measures about $\frac{2}{3}$ of the height of the body whorl. It is bluish-white within and shows, unless the specimens are unicoloured, the colour bands. When colour bands are present they show the formulae 0030, 0034, 0004 or 1034. The base of the aperture is produced into a tongue-like process. Operculum and animal are like those of the type subspecies.

Size A (decollated) 38-52 mm; D 24-29 mm.

Soft parts typical. The radula differs by having marginals with 3 cusps. The dissected males did not show functional gonads as those of some species of *Paracrostoma* did. The brood pouch of the females contained between 40-120 embryonic shells in all stages of development.

Type locality: Huai Chieng Nam, a tributary to the Kaek River, about 92 km E of Pitsanulok at the bridge of the "Friendship-Highway".

Distribution Kaek River E of km 65 E of Pitsanulok, and several tributaries to this river. A small number of dead shells almost identical to this race was found in the Pong River S of Dan Sai. This river is a tributary to the Heung River which opens into the Mekong NW of Loei.

Brotia (Brotia) binodosa spiralis n. subsp.
pl. 12 fig. 27.

Diagnosis: A subspecies of *Brotia binodosa* (BLANFORD) which differs from the type subspecies by its complete lack of tubercles and spines. The sculpture is reduced to several obtuse spiral ridges.

Description: Shell regularly conic, eroded, with 4 remaining whorls. These are flattened and carry 4-6 obtuse spiral ridges. The first subsutural ridge is often missing. The second ridge which carries in the typical form the spines, is sometimes granulated.

Size A (decollated) 35-44 mm; D 18-23 mm.

Animal, radula and soft parts like those of the type subspecies.

Type locality Kaek River, 38.5 km E of Pitsanulok.

Distribution: Known from the type locality only.

Remark: This subspecies was found very near to a population of *binodosa*, in which *b. binodosa* and *b. subgloriosa* were collected with all intermediate forms. This is not an intermediate form between the smooth and the spinous race of *binodosa* but a separate local race which differs by its spiral ridges, thicker texture and more flattened whorls from both above forms.

Material Holotype SMRL 3881/A; paratypes 3881/8.

Brotia (Brotia) insolita (BROT, 1868).
pl. 13 fig. 29-30.

1868 *Melania insolita* BROT, Mater. Fam. Melan., 2: 11, pl. 3 fig. 4 (Inde ?).

1875 *Melania insolita*, — BROT, Conch. Cab., 1, 24: 107, pl. 13 fig. 7 (Siam).

This is one of the small *Brotia* species from Thailand. Shell small, solid but not thick, elongately ovoidal-conic or turreted, eroded, with 3-5 remaining whorls which are well rounded and increase regularly in size. The large body whorl measures about half the length of the eroded shell. The thick olive periderm shows sometimes rudiments of a spiral microsculpture. The shell is generally unicoloured but brown colour bands are not rare. The predominant formula is 1-2-0-4. One or two very weak carinae may be seen and sometimes there are traces of spiral ridges at the base of the body whorl. The whorls are moderately convex and separated by a well marked suture. — Aperture large, ovate, angled above, protracted at the base; whitish or brown within, with bluish-white, well curved columella. — Operculum rather small, round, with 5 whorls and almost central nucleus.

Size: A 20-34 mm; D 12-20 mm.

Animal typical for the subgenus. — Rhachis with 3 finger-shaped, curved cusps on either side of the large, rounded middle cusp. Glabella rather simple, with straight side-lines and rounded base. Laterals with the cusp formula 2-1-2, inner marginals with 1 large cusp and 1 small. — The number of specimens

collected is too small to render reliable informations on the percentage of "males" among a population. Those males which were dissected did not show functional gonads. Adult females carry numerous small embryonic shells of all stages of development in the brood pouch. These are of conic shape and have a smooth surface.

Type locality: "Siam" The collector of the original material was GEALE, but no assumption with regard to the provenance can be made. As the Kaek River E of Pitsanulok is the most easily accessible locality of this species, the Sopa Falls are herewith designated as type locality. It is, however, surprising, that BROT did not know *B. binodosa* which is more common and more conspicuous at that locality than this species.

Distribution: Known from Thailand only. It was collected at the following localities: Kaek River at Sopa Falls, E of Pitsanulok; Huai Nam San at the Tad San Falls, Loei Province; Huai Kao Man, 68 km W of Loei; Phung River, 45 km N of Lam Sak, Loei Province; Phung River at Ban Phung Sai, Dan Sai District.

Remarks: There are several more *Brotia* species known from Thailand which are very similar to *B. insolita*. The differences between them and this species will be pointed out under their descriptions but some words on their relationship may be allowed here. *B. microsculpta* differs from all other species by its fine and regular spiral microsculpture, *B. citrina* BROT has distinct and irregular spiral sulci and *B. manningi* BRANDT is completely smooth and has much more flattened whorls and a higher body whorl.

***Brotia (Brotia) pseudoasperata* BRANDT, 1968.**

pl. 13 fig. 31.

1881 *Melania asperata*, — ROCHEBRUNE, Bull. Soc. philom. Paris, 7: 23 [non LAMARCK] (Touranne, Annam).

1891 *Melania asperata*, — MORLET, J. de Conch., 39 [non LAMARCK] (Kam-Mon, bassin du Nam-Kading, Laos).

1968 *Brotia (Brotia) pseudoasperata* BRANDT, Arch. Moll., 98: 270, pl. 10 fig. 57, textfig. 39 (Maenam San and its tributary, the Huai Kao Man).

Shell in size and shape similar to *B. insolita*, but sculptured with several spiral ridges. Of these the upper two are generally ornate with spiny tubercles. The tubercles on the second spiral ridge are often missing, those on the first rarely. The shell is either unicoloured or shows the band formula 1034; rarer formulae are 1000, 1030, 1034 and 1004. Peristome distinctly protracted at the base. In spite of the oval aperture the operculum is circular; it has 6 whorls and a central nucleus, and it does not close the aperture completely.

Size A 38-48 mm, D 14-19 mm (type locality); A 30-32 mm, D 11-13 mm (Huai Kao Man).

Animal black and head blackish, dusted with sand-coloured and orange pigment spots which may be arranged in stripes on head and rostrum. — No functional males have been found. Females typical for the subgenus with ETG and BP. The subhaemocoelic brood pouch contains many eggs and embryonic shells in all stages of development. The immature embryo has an open apex to which a "yolk sac" is attached. Older embryonic shells close the apex with shell-substance. The shape of the embryonic shell is conic, with a weak sub-peripheral carina. The shells are unicoloured or with 2 or 3 brown spiral bands. — Radula with the formula C 3-1-3, L 1-1-2 and M 1-1.

This species has been confused with "*Melania*" *asperata* LAMARCK, a species which is probably not even a *Brotia*.

Type locality: San River at Ban Gaeng Hai, Dan Sai District.

Distribution: Known from the San River and one of its tributaries, the Huai Kao Man, only. Extralimitarily known from Annam and N Laos.

Brotia (Brotia) baccata (GOULD, 1847).

pl. 13 fig. 32.

1847 *Melania baccata* GOULD, Proc. Boston Soc. nat. Hist., 2: 219 (Thoungyin River, Burma).

1876 *Melania baccata*, — HANLEY & THEOBALD, Conch. Ind.: 32, pl. 75 fig. 1, 2, 4 (Thoungyin River; Shan States, Burma).

1928 *Acrostoma baccata*, — RAO, Rec. Ind. Mus., 30: 442 (Namtu River at Hsenwi; stream near Tangyan; Lashio).

1954 *Brotia baccata*, — MORRISON, Proc. U. S. nat. Mus., 109: 384, pl. 11 fig. 10 (Salween River).

1964 *Melania baccata*, — JOHNSON, Bull. U. S. nat. Mus., 239: 45, pl. 44 fig. 1 (Thoungyin River, Burma).

This species is said to be found together with the type species and with *B. costula* (RAFINESQUE). From the type species it differs by its lack of spines, from the latter by its regular, broad spiral ridges which are dissolved into spiral rows of tubercles or nodules. The SMRL team never found this species in the Thoungyin (= Moei) River but in the Salween and other tributaries to the Salween on the Thai side of the border.

Shell turreted or even somewhat cylindrical, eroded, with 4-6 remaining whorls which are moderately convex but separated by a rather deep suture. The shell is covered with a chestnut- or olive-brown periderm. There are 3 spiral ridges on the upper whorls and 6-7 on the body whorl. The upper spiral ridges are generally dissolved into tubercles or obtuse nodules. Sometimes these nodules are axially connected thus forming short ribs. — Aperture about $\frac{2}{3}$ of the height of the body whorl, ovate, barely expanded. Peristome sharp, not greatly produced at the base, but retracted at the curved, brown columella. — Operculum round, small, with 5-6 slowly increasing whorls.

Size: A 45-54 mm; D 16-21 mm.

Animal black with orange pigment spots dusted over back, head, tentacles and rostrum. — The rhachis has 3 curved cusps on either side of the large, rounded middle cusp on the cutting edge; the 2 innermost cusps are processes of the socket of the middle cusp. Laterals with the cusp formula 2-1-2, marginals with 1 large cusp and 1 small. — The brood pouches of the females contain numerous embryonic shells in all stages of development, the younger shells still showing the apical "yolk sac" Embryonic shell conic, with rather flat whorls. All examined specimens showed neither sculpture nor colour bands.

Type locality: Thoungyin River (Moei River) between Burma and Thailand. (Our collecting team never found *B. baccata* in the Moei River).

Distribution: With its various races and forms, *B. baccata* inhabits the drainage systems of two large rivers, Salween and Irawady. In Thailand it was found in the Salween W of Mae Sarieng and in the Maenam Samat S of Mae Hongson. Another locality, a swamp in the town of Mae Hongson, is a surprising habitat for a *Brotia*.

Habitat: In rivers and creeks with strong current, but also in almost still water.

Brotia (Brotia) citrina (BROT, 1868).

pl. 13 fig. 33-34.

1868 *Melania citrina* BROT, Mater. Melan., 2: 11, pl. 3 fig. 3 (Siam).

1886 *Melanica citrinoides* BROT, Rec. zool. Suisse, 4: 101, pl. 5 fig. 4 (Siam).

1893 *Melania dugasti* MORLET, J. de Conch., 41: 153, pl. 6 fig. 1-1a (Nam-Si, province d'Aubone, Laos).

1964 *Stenomlenaia* (sic!) *dautzenbergiana*, — HABE, Nature Life SE Asia, 4: 55, pl. 1 fig. 19 (Laos, Thailand) [non MORLET].

It is generally much larger than *B. insolita* although small populations of this species are known. The shell is rather solid, not translucent. It is of yellowish-green, olive-green or brownish colour, but generally covered with a thick black layer of mineral deposit. The apex is often eroded. There are 9-11 convex whorls which increase slowly and regularly in size. The upper whorls are smooth except for the growth lines; the last whorls show several subsutural sulci and fine spiral lines. On the base of the body whorl there are several weak periomphalic ridges. — Aperture ovate, base distinctly protracted. The colour of the shell is greyish, the above given colour is restricted to the periderm only. It is either unicoloured or ornate with 1-3 brown spiral bands. Columella greatly curved.

Size A (complete) 36-49 mm, D 13-17 mm; Aperture A 12-15 mm, D 8-10 mm.

Animal dark grey, densely dusted with yellowish pigment dots. — Females with numerous conic embryonic shells of all stages of development in the brood pouch. Functional males have not been found. — Cutting edge of the rhachis with a large, rounded middle cusp and 3 small cusps on either side of it. Laterals with the cusp formula 1-1-2 or 0-1-2, inner marginals with 1 large cusp and 2 small, outer marginals with 2 cusps.

Type locality: "Siam" As the provenance of CUMING's material which BROT used is still unknown, no type locality can be designated.

Distribution: N Thailand: Provinces of Chiang Mai, Prae, Nan, Chiang Rai, Tak, Uttaradit, Lampang, Pitchit, Loei and Pitsanulok. The species is only known from Thailand and Laos but it is very probable that it is also found in Burma. It has not been found by our team in the Lam Chi River.

Brotia (Brotia) manningi BRANDT, 1968.

pl. 13 fig. 35.

1968 *Brotia (Brotia) manningi* BRANDT, Arch. Moll., 98: 272, pl. 10 fig. 58 (Provinces of Nan, Loei and Petchabun).

This species differs from *B. insolita* by its more conic shape, broader base and flatter whorls. It is also larger than *insolita*. From *B. citrina* it differs also by its lack of spiral ridges. The shell is generally smooth except for the growth lines. Two populations with few spiral angles are attributed to this species. — The operculum is not round but has the shape of a three-quarter moon. Shape of the shell and operculum are in between those of *Brotia* s. str. and *Paracrostoma*. The operculum has only $3\frac{1}{2}$ whorls and a subcentral nucleus.

Size: A 36-48 mm; D 14-20 mm.

Animal blackish, dusted with yellowish pigment dots. All examined specimens were females. The brood pouches were filled with numerous small, conic embryonic shells whose apices were always closed.

Type locality: Huai Lan at Ban Dam Pon, Lom Sak District, Petchabun Province.

Distribution Known from the Provinces of Nan, Loei, Prae and Petchabun.

***Brotia (Brotia) microsculpta* BRANDT, 1968.**

pl. 13 fig. 36.

1968 *Brotia (Brotia) microsculpta* BRANDT, Arch. Moll., 98: 272, pl. 10 fig. 59 (Maenam Kaek; Huai Chieng Nam).

This species differs from all other species of *Brotia* by its small size and sharp spiral microsculpture. The shell is conic, eroded, brownish or olive, dull, sculptured with a sharp spiral microsculpture which renders the shell a silky lustre. The body whorl carries a distinct subperipheral keel. — Aperture large, measuring about $\frac{2}{3}$ of the height of the body whorl. Peristome not continuous, connected by a bluish-white or brownish parietal callus. Base of the body whorl sometimes with 1 or 2 brown spiral bands. — Operculum circular, with $5\frac{1}{2}$ -6 whorls.

Size A (truncate) 17-28 mm; D 15-18 mm.

Animal almost black, dusted with minute orange-coloured pigment spots. Sole lead-grey. All collected adult specimens were females. Their brood pouches contained 12-20 fully developed embryonic shells and many eggs and embryos of all stages of development. The apices of the small and half mature embryos carry an apical "yolk sac" The embryonic shells are conic, with a substutural brown band and brown base. — The rhachis has only 5 cusps on the cutting edge. The glabella is very simple. The cusp formula of the laterals is 3-1-2, those of the marginals 1-4 and 1-3 respectively.

Type locality Maenam Kaek at the Tong Salaeng Luang Rest Garden, 80 km E of Pitsanulok).

Distribution: Known from the Kaek River and the Huai Chieng Nam, a tributary to the Kaek River, only.

The Rassenkreis of *Brotia costula* (RAFINESQUE).

This rassenkreis contains the largest forms of the genus *Brotia* ever found but also forms of medium size. The wide distribution and great spectrum of habitats caused an extremely large variety of forms which gave reason for the establishment of numerous taxa many of which can not even be considered as races or local forms. The distribution reaches from N India over Burma to S China, continental SE Asia and to Sumatra, Java and Borneo. Three different races are recognized in Thailand: *costula* s. str. (= *siamensis* BROT, *jullieni* DESHAYES), *varicosa* TROSCHER and *peninsularis* n. subsp.

Brotia (Brotia) costula costula (RAFINESQUE, 1833).

pl. 13 fig. 37-38.

- 1833 *Melania costula* RAFINESQUE, Atlantic J., 5: 166 (Ganges River).
1836 *Melania variabilis* BENSON, J. asiat. Soc. Bengal, 5: 746 [non DEFRANCE, 1823] (Goomty River at Impur and Tolly's Nullah near Calcutta).
1846 *Melania herculea* GOULD, Proc. Boston Soc. nat. Hist., 2: 100 (Tavoy River).
1852 *Melania indica* SOULEYET in EYDOUX & SOULEYET, Voyage La Bonite, Zool., 2: pl. 31 fig. 12.
1859 *Melania corrugata*, — REEVE, Conch. Icon., 12: pl. 3 fig. 10a-b, pl. 11 fig. 67 [non LAMARCK, 1804, nec LEA, 1841] (India, Java).
1862 *Melania herculea*, — GOULD, Otia Conch.: 199 (Burma).
1874 *Melania variabilis*, — BROU, Conch. Cab., 1, 24: 85, pl. 10 fig. 1, 1a-d (Burma; Ganges; Indien; Assam; Calcutta; Hindustan; Tenasserim).
1876 *Melania jullieni* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 143, pl. 7 fig. 7-9 (Banc de sable des rapides de Tio-Compéh, au-dessus de Lomboc).
1889 *Melania jullieni*, — MORLET, J. de Conch., 37: 145 (Grand fleuve; Cambodge).
1889 *Melania peguensis*, — MORLET, J. de Conch., 37: 145 [non ANTHONY, 1865] (Ruisseau de Phom-Ksach, Tap-Cheany; Cambodge).
1891 *Melania variabilis*, — MORLET, J. de Conch., 39: 233 (Rivière de Menam-Pinh, de Raheng à Xieng-Moi, dans les ruisseaux du plateau de Xieng-Moi et dans ceux qui se jettent le Menam-Pinh) [non DEFRANCE, 1823].
1954 *Antimelania costula*, — MORRISON, Proc. U. S. nat. Mus., 103: 382.
1966 *Brotia variabilis*, — SOLEM, Spolia zool. Mus. haun., 24: 15 [non DEFRANCE, 1823] (Kwae Noi River at Sai Yok and north of Ban Kao).

Shell large for family and genus; it is the largest representative of the family in Thailand and one of the largest freshwater species of the superfamily. Shell elongately turreted, solid to thick, covered with a dark brownish or olive-brown periderm. The apex is generally truncate thus leaving 4-8 of the 9-12 whorls. The sculpture consists of numerous spiral grooves which are weaker on the upper half of the body whorl and may be even obsolete on the middle and postnuclear whorls. The upper spiral ridges may carry nodules which, when well developed, may appear as short spines. The axial ribs are more or less strongly developed; they never attain the suture and do not reach beyond the periphery of the body whorl. The variability with regard to size, shape and costulation caused BENSON's choice of the name. The shells are either unicoloured or show 1-3 brown spiral bands. — Aperture brown or milky-white within. Peristome greatly produced at the base. — Operculum almost circular, with 5 whorls.

Size: A 55-74 mm; D 22-31 mm.

Animal dark grey with orange or yellow pigment spots. — Females with many small, conical embryonic shells in the brood pouch. The reproductive organs of the males (about 3% in examined populations) seem to have no functional gonads. — Rhachis with narrow glabella and large middle cusp on the cutting edge. On either side of it are 2 curved, finger-shaped small cusps. The irregularly shaped laterals have the cusp formula 1-1-1(2), the marginals have 2 cusps.

Type locality: River Ganges.

Distribution India, Burma, Thailand, Laos, Cambodia and (?) Hainan. Reports from other countries refer to other races of this species.

Note Several authors connect all recognized subspecies under one name. Although in Malaya and Indonesia local forms are not rare which resemble the type form, it may be more convenient to consider some Malayan-Indonesian forms as a separate race some of which reach beyond the Thai-Malaysian border into S Thailand. One of these races is a small form which is found in S Thailand and in the northern States of Malaysia. It is just as variable as the type form and the Indonesian race but always smaller and generally almost smooth.

Brotia (Brotia) costula varicosa (Troschel, 1837).

pl. 13 fig. 39.

- 1837 *Melania varicosa* Troschel, Wiegmann's Arch., 3: 174 (Java).
 1842 *Melania meukiana* (sic!) Lea, Proc. amer. phil. Soc., 2: 242 [misprint for *menkeana*] (no locality).
 1842 *Melania torquata* von dem Busch in Philippi, Abb. Besch., 1 (*Melania*): 3, pl. 1 fig. 18 (Java).
 1848 *Melania infracostata* Mousson, Mitth. naturf. Ges. Zürich, 1: 269 (Java).
 1850 *Melania episcopalis* I. & H. Lea, Proc. zool. Soc. London, 1850: 184 (A sluggish river, Malacca).
 1868 *Melania zollingeri* Brot, Matér. Mélan., 2: 42, pl. 2 fig. 4 (Java).
 1874 *Melania sumatrensis* Brot, Conch. Cab., 1, 24: 87, pl. 10 fig. 2b, pl. 13 figs. 1, 1a, 1b (Palembang, Sumatra; Java).
 1880 *Melania sumatrensis* var. *mitescens* Schepman, Midden Sumatra Exp.: 13 (Soepajang; Alahan Pandjang).
 1880 *Melania subplicata* Schepman, Midden Sumatra Exp.: 14, pl. 1 fig. 6 (Bedar Alam).
 1881 *Melania boeana* Brot, J. de Conch., 29: 154, pl. 6 fig. 1 (Boea).
 1881 *Melania provisorio* Brot, J. de Conch., 29: 156, pl. 6 fig. 2 (Boea).
 1885 *Sermyla chaperi* Morgan, Bull. Soc. zool. France, 10: 420, pl. 8 fig. 14a-f [here *S. perakensis*] (dans les rivières de Pérak).
 1885 *Sermyla perakensis* Morgan, Bull. Soc. zool. France, 10: 421 (in the text called *M. kintanensis*; the figures under this name refer to *M. chaperi*) (vallée de Kinta).
 1886 *Melania verbecki* Boettger in Brot, Rec. zool. Suisse, 4: 90, pl. 6 figs. 9, 9a-b (Lac de Singkarah, gouvernement de Padang, Sumatra occid.).
 1897 *Melania curvicosta* Martens in Weber, Zool. Ergebn. Reise Niederl. Ostind., 4: 37, pl. 2 fig. 14, pl. 4 fig. 27 (See von Manindjau).
 1897 *Melania palembangensis* Strubell, Nachr. Bl. dtsh. malak. Ges., 29: 12 (S-Sumatra).
 1900 *Melania indragirica* Martens, Nachr. Bl. dtsh. malak. Ges., 32: 10 (Indragiri-Fluß).
 1900 *Melania stricticosta* var., — Martens, Nachr. Bl. dtsh. malak. Ges., 32: 11 (Belawan-Fluß).
 1906 *Melania curvicosta* var. *prestoniana* Bullen, Proc. malac. Soc. London, 7: 15, pl. 2 fig. 8 (Mt. Merapi).
 1908 *Melania kobelti* Rolle, Nachr. Bl. dtsh. malak. Ges., 40: 69 (Padang).
 1921 *Acrostoma variabile* var. *pseudospinosa* Prashad, Rec. ind. Mus., 22: 488 (Soengei Deli near Medan; Sungei Kalau near Bohorok).
 1928 *Melania papillosa* Degner, Treubia, 10: 374 (Sumatra).
 1956 *Brotia costula*, — van Benthem Jutting, Treubia, 23: 374 [partim, non DeFrance, 1823] (India, Burma, Malay Peninsula, Java, Sumatra).
 1959 *Brotia costula*, — van Benthem Jutting, Beaufortia, 7 (83): 92 [non DeFrance] (many localities from Sumatra).

The typical form of this subspecies differs from the type subspecies by its strong, varicose axial ribs and the obsolete spiral sculpture on the middle whorls

and the upper part of the body whorl. It is also more slender than the type subspecies. However, many populations within its area are known where the spiral sculpture is well developed and the axial ribs are rudimentary. These shells resemble more the type subspecies than this one. At the upper ends, the ribs may be produced into spines. Certain forms have 1 or 2 rows of nodules on the whorls.

Size: A 45-75 mm; D 19-32 mm.

Operculum, animal, radula and anatomy not different from those of the type subspecies.

Type locality Java.

Distribution S Thailand; Java; Sumatra, Borneo and Malaysia. In Thailand only known from the provinces of Nakhon Sritammarat, Grabi and Songkhla.

***Brotia (Brotia) costula peninsularis* n. subsp.**

pl. 13 fig. 40.

1964 *Brotia (Antimelania) costula*, — HABE, Nature Life SE Asia, 3: 54, pl. 1 fig. 17 (Yala).

Diagnosis: A subspecies of *B. costula* (RAFINESQUE) which differs from the type subspecies and from *B. c. varicosa* (TROSCHEL) by its small size, slender shape and reduced sculpture.

Description: Shell small for the species, turreted (similar to *B. pseudoasperata*) or even elongately ovate-conoidal and similar in shape to *Tarebia granifera*. Thin to moderately thick, brown or olive-green. The sculpture is generally weak; the spiral lines are restricted to the base of the body whorl only. There are, however, populations with strong sculpture. The form from the Bo Ka Ra Ni Falls in Pang Nga Province has regular spiral lines similar to those of *B. spadicea* (REEVE); other look like small typical *costula* or may even show spines like *B. pseudoasperata* BRANDT.

Size A 36-56 mm; D 16-22 mm.

Animal typical for the species. The cutting edge of the radula, however, shows always 3 — sometimes even 4 — finger-shaped cusps on either side of the large, rounded middle cusp. The laterals have the cusp formula 1-1-2(3), the marginals have 1 large cusp and 1 small.

Type locality: Maenam Lampa, Province of Pattalung.

Distribution From the Chumpon Province in S Thailand to the Malayan state of Pahang. In Thailand this subspecies has been found in the following Provinces: Chumpon, Ranong, Nakhon Sritammarat, Songkhla, Grabi, Pang Nga, Pattalung, Trang and Yala. A more intensive survey of S Thailand will definitely result in the finding of many more localities.

Material Holotype SMRL 496/A; paratypes 496/50. — SMRL 489/15-Ban Chongkao, Tobyai, Tung Song; 497/60-Maenam Rab, Prov. of Trang; 498/60-Bok Kara Ni Falls, Pang Nga; 531/15-Klong Chumpon, W of Chumpon; 532/10-Tanto Falls near Ban Nong Star, Yala; 533/15-Stream near Na Pupo, Yala; 534/20-Stream SW of Kampong Batu Tujok Kedah; 535/8-Stream 21 km S Kuala Lipis, Pahang; 3903-Klong Sag, Ban Nai Sra, Grabi; 3904- 63.5 km from Pumpin to Takua Pa, Suratthani.

Parasitology: Forms of the Malayan race have been reported as infected with cercariae of *Paragonimus westermani* in Malaysia. Therefore this species has been carefully studied, but no infected snails have been found in Thailand.

***Brotia (Senckenbergia)* YEN, 1939.**

Original description (translated from German): "Shell turreted, solid but not thick, with regularly increasing whorls. These are almost flat and shouldered below the suture. Weakly sculptured or smooth, spiral lines always stronger than the growth lines. — Aperture broadly ovate. Outer margin of peristome more or less thickened but simple, somewhat expanded. Columellar margin callous."

The author stated furthermore a close relationship with *Semisulcospira* O. BOETTGER. The glabella at the rhachis and the subhaemocoelic brood pouch, however, show a close relationship with *Brotia*, with which it is here united.

Type species: *Melania pleuroceroides* BAVAY & DAUTZENBERG.

Distribution China, Thailand, probably also Burma.

***Brotia (Senckenbergia) wykoffi* n. sp.**

pl. 13 fig. 41.

Diagnosis: A species of *B. (Senckenbergia)* YEN which differs from the type species by the lack of subsutural spiral lines and shoulder.

Description: Shell regularly turreted, solid, somewhat translucent, covered with a reddish-violet periderm and ornate with 3 spiral bands, 1 below the suture (only this band is visible on the upper whorls), 1 below the periphery and 1 on the base of the body whorl. The growth lines are rather rough; there are several weak spiral ridges on the base of the body whorl. Apex generally eroded; the 6-7 remaining whorls are somewhat convex and separated by a rather deep suture. — Aperture ovate, pointed above and well rounded below and at the columella, violet within; all bands are well visible interiorly. Peristome sharp, connected by a weak parietal callus. — Operculum ovate, corneous, with $4\frac{1}{2}$ whorls and eccentric nucleus.

Size A 27-30 mm; D 10.5-12.0 mm.

Rhachis with glabella. — Females with subhaemocoelic brood pouch.

Type locality Creek at Sai Yok, Kanchanaburi Province.

Distribution Known from the type locality only.

Material: Holotype SMRL 471/A; paratypes 471/10.

Etiology: This species is dedicated to Colonel E. WYKOFF, WRAIR Washington, the initiator of our survey.

***Paracrostoma* COSSMANN, 1900.**

This genus differs from *Brotia* by its ovate-conic shape, thicker texture and by its operculum which is oval and has only $3\frac{1}{2}$ whorls. These increase more rapidly than in *Brotia*. The apex is generally eroded. The body whorl measures more than half of the height of the shell. The aperture is ovate, the peristome less produced at the base than in *Brotia*. The nucleus of the ovate operculum

is sublateral. Animal and soft parts like that of the subfamily, however, in some species there are males with functional gonads. This is a rare exception in the family. Like *Brotia* some species of this genus have been found to harbour a species of Sabellidae (*Caobangia billeti* GIARD; personal communication of M. L. JONES, Washington). These worms burrow in the shell substance of the eroded apex or in spinous species in the spines of the shell. Several species of this genus have been carefully checked for cercariae of *Paragonimus westermani*, but as far without success. — Radula similar to that of *Brotia*.

Type species: *Melania huegeli* PHILIPPI.

Distribution S and SE Asia and some islands in the western Pacific.

Note THIELE (1929: 190) placed this taxon in the synonymy of *Sulcospira* TROSCHEL. WENZ (1939: 688) followed him. The type species of this genus is not congeneric with *Sulcospira sulcospira* (MOUSSON) although both genera are closely related.

Key to the Thai species and subspecies:

- | | |
|---|------------------------------|
| 1. Shell smooth or almost so | 2 |
| — Shell with tubercles or spines | 4 |
| 2. Suture shallow, whorls barely convex, aperture bluish-white within | 3 |
| — Suture deep, whorls convex, aperture dark violet within | <i>paludiformis.</i> |
| 3. Height of the aperture $\frac{2}{3}$ of the body whorl or less | <i>solemiana.</i> |
| — Height of the aperture more than $\frac{2}{3}$ of the body whorl | <i>ps. pseudosulcospira.</i> |
| 4. Texture thin, aperture brownish-violet within | 5 |
| — Texture thick, aperture bluish-white within | <i>ps. armata.</i> |
| 5. Body whorl with 1 spiral row of spiny tubercles, size 25 15 mm | <i>pal. dubiosa</i> |
| — Body whorl with 2 rows of spiny tubercles, size 20 15 mm | <i>morrisoni.</i> |

Paracrostoma pseudosulcospira pseudosulcospira (BRANDT, 1968).

pl. 13 fig. 42.

1968 *Brotia* (*Paracrostoma*) *pseudosulcospira* BRANDT, Arch. Moll., 98: 274, pl. 10 fig. 61, textfig. 40 (Maenam Kaek at Wang Nok Nang Aen, Wang Tong).

This species differs from *P. huegeli* (PHILIPPI) by its more conic spire, flatter whorls, thicker shell and the lack of periomphalic grooves.

Shell ovate-conoidal, very thick, covered with a dark olive-brown periderm which shows under strong magnification a very delicate wavy spiral micro-sculpture. This sculpture gives the surface a silky lustre. The apex is always eroded, the remaining few whorls are almost flat. The large body whorl measures $\frac{3}{4}$ of the height of the shell. — Aperture large, ovate, angled above and well rounded below with a moderately protruding base. It is bluish-white within. There are no colour bands. — Operculum typical for the genus.

Size: A 26-39 mm; D 18-24 mm.

Animal dark grey, dusted with fine orange-coloured pigment spots. Among 200 dissected animals 3 males were found. These animals, however, did not reveal any functional gonads. The brood pouch of the adult females contains often more than 200 embryonic shells of all stages of development. The embryonic shell differs from that of *Brotia* by its depressed, subglobose shape; it consists of $1\frac{1}{2}$ whorls only. It shows a brown basal band and 3 spiral threads. — The rhachis of the radula shows a long middle cusp at the cutting edge and

1 smaller cusp on either side. Cusp formula of the laterals 2-1-2, inner marginals with 1 large cusp, outer marginals with a smooth cutting edge.

Type locality Maenam Kaek at Wang Nok Nang Aen, Wang Tong District, E of Pitsanulok.

Distribution: Only known from the type locality.

Paracrostoma pseudosulcospira armata (BRANDT, 1968).

pl. 13 fig. 43.

1968 *Brotia* (*Paracrostoma*) *pseudosulcospira armata* BRANDT, Arch. Moll., 98: 275, pl. 10 fig. 62 (Maenam Kaek at Gaeng Song, 60 km E of Pitsanulok).

This race differs from the typical subspecies by showing 3 spiral cords on the upper whorls and 3-5 cords on the body whorl. The first and second spiral cords carry tubercles which are generally produced into spines. The whorls are often less flattened than in the type race. On the average the size is a little smaller. The base of the aperture is more protracted but less so than in *Brotia*.

Size A 26-38 mm; D 18-24 mm.

Animal, radula and soft parts like those of the type race.

Type locality Maenam Kaek at Gaeng Song Rapids, about 60 km E of Pitsanulok.

Distribution Maenam Kaek, between about 60-71 km E of Pitsanulok.

Paracrostoma solemiana (BRANDT, 1968).

pl. 13 fig. 44.

1968 *Brotia* (*Paracrostoma*) *solemiana* BRANDT, Arch. Moll., 98: 273, pl. 10 fig. 60 (Maenam Pong at Ban Pa Nok Kao, Loei Province).

This species differs from *P. pseudosulcospira* by its more slender shape, thinner texture, less flattened whorls, lower body whorl and lower aperture. The colour is of a lighter olive-brown. From *P. huegeli* it differs by lacking the periomphalic spiral grooves. The aperture is bluish-white within, with a less bluish tint than in *pseudosulcospira*. Operculum comparatively small for the size of the species, semicircular, with 3½ whorls. The base of the aperture is more rounded and less protracted than in *pseudosulcospira*.

Size A 31-38 mm; D 18-21 mm.

The rhachis differs from that of the preceding species by having 2 curved cusps on either side of the middle cusp. The socket of the middle cusp has pointed tips on either side. Laterals with the cusp formula 1-1-2, marginals with triangular, simple cutting edges. — The animal is almost black with yellow pigment spots dusted over back and head. All 36 collected specimens were females. They contained numerous embryonic shells in their brood pouches. The embryonic shells differ considerably from those of the preceding species. They are conical like those of *Brotia*. The periphery is angled but there are no spiral threads.

Type locality: Maenam Pong at Ban Pa Nok Kao, Loei Province.

Distribution Only known from the Pong River between the provinces of Loei and Kon Kaen.

Paracrostoma paludiformis paludiformis (YEN, 1939).

pl. 14 fig. 45.

- 1939 *Semisulcospira paludiformis* YEN, Abh. senckenb. naturf. Ges., 444: 55, pl. 4 fig. 73 (Lu-ho-wan, Inneres Hainan).
1966 *Paracrostoma paludiformis*, — SOLEM, Spolia zool. Mus. haun., 24: 17, textfig. 2, pl. 1 figs. H-J (Tungsalaeng Luang waterfall at 200 m).

It is with just as much hesitation as SOLEM (1966: 17) that I assign a population of Thai *Paracrostoma* to the Hainanese species. As the type material is lost the identification is based on the picture and description alone. To avoid an unnecessary creation of a synonym we follow SOLEM in identifying the Thai *Paracrostoma* with the species from Hainan.

The description of YEN is incomplete. He does neither mention the colour of the periderm and aperture nor the spiral microsculpture, provided the Hainanese population shows such a sculpture. The weak spiral lines which YEN mentioned are visible in most of our specimens.

Shell ovoidal-conic, with short, eroded spire. There are 2-3 remaining whorls. These are much more convex than in all other Thai species of the genus. The body whorl is large and rounded. It shows an indistinct peripheral carina and generally some very weak spiral lines. Under strong magnification a feeble spiral microsculpture can be seen. This gives the shell a silky lustre. — The aperture is broadly ovate, of whitish ground-colour within, but with a brownish or brownish-violet band on the parietal callus and columella; the palatal wall of the aperture is generally tinted brownish or brownish-violet. — Operculum ovate, with $3\frac{1}{2}$ whorls.

Size A (eroded) 24-30 mm; D 18-22 mm.

Animal dark grey to almost black. It differs from all other species by its lack of yellow pigmentation. — Rhachis with 3 curved cusps on either side of the middle cusp. Laterals with the cusp formula 2-1-3, inner marginals with 2 small cusps and 1 large, outer marginals with a rounded, triangular cutting edge. — SOLEM (1966: 18) found 3 males among 5 specimens, we found 7 males among 30 dissected specimens. All males showed fully or partly developed reproductive organs. Histological examination of stained slides of the gonads revealed spermatozoa in the stratum germinativum. Copulation has never been observed. The brood pouches of the females contained numerous conical embryonic shells in all stages of development. The embryonic shell is similar to that of *P. solemiana* and differs considerably from that of *P. pseudosulcospira*.

Type locality: Lu-ho-wan, central Hainan.

Distribution: Known from Hainan and from the Kaek River E of Pitsanulok only. It was found only in the river at the Sopa Falls, about 71 km E of Pitsanulok. As this locality has an altitude of 200 m it is the locality called Tung Salaeng Luang waterfall in the publication of SOLEM. The whole area E of Pitsanulok is called Tung Salaeng Luang ("The great noxious field"). At the Tung Salaeng Luang Rest Area, about 80 km E of Luang there is no waterfall, but only a rapid. At that place the next race was found.

Holotype The holotype and the 2 paratypes were destroyed during World War II.

Paracrostoma paludiformis dubiosa n. subsp.

pl. 14 fig. 46.

Diagnosis: A race of *P. paludiformis* (YEN) which differs from the typical subspecies by a spiral row of closely placed spinous tubercles.

The shell is generally somewhat smaller than that of the type form and the body whorl is less inflated. The colour of the periderm is chestnut-brown. The violet-brown band on the columella and parietal callus is often missing; the palatal wall of the peristome is deep violet-brown.

Size A (eroded) 21-27 mm; D 16-20 mm.

Animal not different from that of the type subspecies. Among 45 dissected animals 10 males were found.

Type locality Kaek River, 80 km E of Pitsanulok.

Material Holotype SMRL 3898/A; paratypes 3898/50.

Paracrostoma morrisoni n. sp.

pl. 14 fig. 47.

Diagnosis: A species of *Paracrostoma* COSSMANN which differs from *P. pseudosulcospira* (BRANDT) by its much smaller size and thinner texture, and from *P. p. dubiosa* n. by its smaller size and by having 2 spiral rows of spiny tubercles.

Description: Shell small for the genus, ovate-conoidal, with eroded spire and generally with 2 remaining whorls. These are very convex and separated by a deep suture. Solid but not thick, not translucent. The shell is covered with an brownish or olive-brown periderm. There are very delicate spiral microlines which are crossed by stronger growth lines thus rendering the shell a silky lustre when completely clean. The macrosulpture consists of 2 spiral rows of short, sharp spines and a peripheral spiral ridge. The base of the body whorl is either smooth or carries 1 or 2 spiral threads. — Aperture large, ovate, sharply angled above and obtusely angled at the base. It is violet-brown within, with 3 darker bands corresponding with the outer spiral ridges, and with a dark patch at the bottom. There is generally a second dark patch on the parietal callus. The columella is bordered by a narrow zone of the same brown-violet colour. The inner edge of the curved columella is white. Peristome sharp, connected by a parietal callus, at the base protracted into a short, sharp beak. — Operculum ovate, with 3½ whorls and lateral nucleus.

Size A (eroded) 20-24 mm; D 14-16 mm.

Animal dark grey or blackish with slate-coloured sole. The whole animal is dusted with fine orange-coloured pigment spots. Among 36 dissected animals there were 9 males with developed gonads but without any trace of sperm. The mature females showed many eggs and embryonic shells in their sub-haemocoelic brood pouches in all stages of development. The smaller embryonic shells have an open apex connected with a sac of nutritious material ("yolk sac"). The mature embryonic shell has a low conic spire with closed apex and a subglobose body whorl with 1-3 spiral threads. — The squarish rhachis with labella and 3 finger-shaped cusps on either side of the middle cusp, the laterals

have the cusp formula 2-1-2 (1-1-3), the inner marginals have 3 cusps, the outer a smooth cutting edge.

Type locality Maenam Kaek at Sopa Falls, 71 km E of Pitsanulok.

Distribution: Known from the type locality only.

Material Holotype SMRL 3888/A; paratypes 3888/80.

Relations The large number of males (25%), the large, rounded body whorl and the operculum prove the species to belong to the genus *Paracrostoma* as understood by SOLEM (1966: 15). SOLEM reported 1 of his 5 specimens of *Brotia binodosa* (largest specimen with 22.7 mm height) as a mature female with embryonic shells in the brood pouch. No specimen of 23 mm height of *binodosa* was found to be mature. As SOLEM also reported the operculum of *P. paludiformis* to be very similar to that of *binodosa*, it has to be assumed that SOLEM examined specimens of this species and not of *binodosa*. He said furthermore that 3 of his specimens had no basal spiral threads which are typical for *binodosa*. The operculum of *binodosa* is almost circular and has 5-6 whorls, the operculum of *P. morrisoni* is ovate and has 3½ whorls.

P. morrisoni could have been considered the spinous form of *P. paludiformis* were it not found together with this species without any intermediate forms and had it not shown the typical orange pigmentation which seem always be lacking in *paludiformis*. The spinous form of *paludiformis* is found at another locality in the Kaek River.

POTAMIDIDAE H. & A. ADAMS, 1853.

Shell elongate, turreted, rather thick and solid, rarely smooth, generally sculptured with axial ribs and/or spiral ridges or sulci. Aperture always with a deep siphonal incision at the base, rarely with a second incision at the upper insertion. Operculum corneous, multi- or paucispiral.

Distribution: Circumtropical, but also found in moderate climates.

Habitat: Brackish or freshwater. Several groups live almost amphibiously in the mangrove and nipa palm swamps.

Key to the Thai genera:

1. Shell always with axial sculpture 3
- Shell only with spiral sculpture 2
2. With strong spiral sculpture and with 2 columellar folds, diameter larger than 40 mm greyish .. *Telescopium*.
- With very weak spiral sculpture; without columellar folds; diameter less than 30 mm black ... *Faunus*.
3. Columella with spiral fold (but not visible from the exterior) and with distinct incision at the upper part of the aperture .. *Terebralia*.
- Columella without fold; upper part of the peristome without incision *Cerithidea*.

Cerithidea SWAINSON, 1840.

Shell elongate, conical or turreted, thick, sculptured with spiral ridges and/or axial ribs, sometimes with thick varices. Aperture large, oval or squarish, with a deep incision at the base. Operculum corneous, multispiral, with subcentral nucleus.

Animal grey or blackish, sometimes with bright, brick-coloured pigmentation. Tentacles moderately long, eyes placed at their bases in distinct swellings.

Rhachis without glabella. The animals are monosexual; the female has no brood pouch, it is oviparous. Penial complex without true verge and without appendages.

Type species: *Cerithium obtusum* LAMARCK.

Distribution Circumtropical.

Habitat: Brackish water in mud-flats and mangrove forests.

Key to the Thai subgenera:

- | | |
|-----------------------------|---------------------------|
| 1. Peristome continuous | <i>Cerithideopsilla</i> . |
| 2. Peristome not continuous | <i>Cerithidea</i> . |

Cerithidea (Cerithideopsilla) THIELE, 1929.

Axial ribs crossed by spiral grooves and generally divided into 3 spiral rows of tubercles. Peristome of adult specimens continuous.

Type species: *Cerithium fluviatilis* POTIEZ & MICHAUD = *Murex cingulatus* GMELIN.

Distribution like that of the genus.

Habitat: Lagoons and mud-flats. Contrary to the species of the type subgenus, the animals do not climb nipa palms and mangrove trees but live in the mud on the ground ("mud-creepers").

Key to the Thai species:

- | | |
|--|------------------------|
| 1. Second spiral groove as deep as the first | 2 |
| — Second spiral groove much shallower than the first groove below the suture | ..... |
| ..... | <i>cingulata</i> . |
| 2. Upper part of the peristome wing-like extended | 3 |
| — Upper part of the peristome not extended | <i>djadjariensis</i> . |
| 3. Base with peristome broader than 15 mm | <i>microptera</i> . |
| — Base with peristome less than 15 mm broad | <i>alata</i> . |

Cerithidea (Cerithideopsilla) cingulata (GMELIN, 1790).

pl. 14 fig. 48.

1791 *Murex cingulatus* GMELIN, Syst. Nat., ed. 13: 3561 (Habitat Tranquebariae).

1838 *Cerithium fluviatile* POTIEZ & MICHAUD, Gal. Moll. Mus. Douet, 1: 363, pl. 31 fig. 19-20 (Le Malabar).

1866 *Tympanotonos fluviatilis*, — REEVE, Conch. Icon., 15: pl. 2 fig. 9 (India).

1889 *Tympanotomus fluviatilis*, — MORLET, J. de Conch., 37: 144 (à Kampot, Pnom-Penh, de Kampot à Bangkok).

1950 *Potamides fluviatilis*, — SUVATTI, Fauna Thailand: 60 (Lem Sing; Koh Pipidon; Chantaburi River; Bandon Bight; Talui Isl.; Koh Samui).

Shell comparatively small for the genus, elongately conoidal or turreted, solid, not translucent, dark or violet-brown, with brighter zones or even whitish spiral bands. There are 3 strong spiral ridges on each whorl; these are crossed by axial grooves thus cutting the ridges into 3 spiral rows of tubercles. These tubercles become obsolete on the body whorl. The base of the body whorl is sculptured with several spiral grooves. The second spiral groove on the whorls is much shallower than the first below the suture. The grooves are generally of darker colour than the tubercles. The yellowish or whitish zone is placed on the third row tubercles. The 12-15 whorls increase regularly and slowly in size;

they are almost flat; the body whorl is delicately angled at the periphery. — Aperture oval, angled above and below, with short siphonal canal at the base. Peristome connected by a strong adnate callus; outer margin somewhat thickened and expanded; columella thick, not twisted.

Size A 18-36 mm; D 8-15 mm.

Animal without reddish pigmentation. Rhachis broad, without cusps on the cutting edge.

Type locality Tranquebar Coast.

Distribution India, Ceylon, Farther India, New Guinea, Indonesia, China, Philippines, Taiwan, Japan.

Habitat: In Thailand common on mud-flats and in lagoons.

Cerithidea (Cerithideopsilla) djadjariensis (MARTIN, 1899).

pl. 14 fig. 49.

1899 *Potamides djadjariensis* MARTIN, Samml. geol. Reichsmus. Leiden, (NS) 1: 216, pl. 33 fig. 502, 502a (Tji Djadjar bij Parungdjadja in Madjalengka).

Shell generally somewhat larger than that of the type species. It differs from *C. cingulata* by its second spiral groove being as deep as the first. Generally chest-nut brown, rarely with a whitish spiral band.

Size A 28-44 mm; D 16-21 mm.

Type locality Tji Djadjar near Parungdjadja, Madjalengka District on Sumatra.

Distribution: Farther India, Indonesia, Madagascar, Mauritius, Burma. In Thailand common, found together with the preceding species.

Cerithidea (Cerithideopsilla) alata (PHILIPPI, 1849).

pl. 14 fig. 50.

1849 *Cerithium alatum* PHILIPPI, Abb. Besch., 3: 17, pl. 1 fig. 11 (Mergui in ditione quondam Birmanorum).

1866 *Tympanotonos eurypterus* REEVE, Conch. Icon., 15: pl. 2 fig. 8 (Island of Negros).

1889 *Tympanotomus eurypterus*, — MORLET, J. de Conch., 37: 144 (Bords de la mer à Kampot).

1950 *Potamides eurypterus*, — SUVATTI, Fauna Thailand: 59 (Gulf of Siam).

Shell very similar to that of the preceding species and only distinguished by the extended upper part of the peristome which forms a wing with a pointed angle. It is probable that this species and the preceding are conspecific.

Size: A 28-42 mm, D 8-12 mm.

Type locality: Mergui, Burma.

Distribution: Burma, Thailand, Malaysia, Indonesia, Philippines.

Habitat: Mud-flats on the Gulf of Thailand and on the coast of the Indian Ocean. It is much rarer in Thailand than the two preceding species.

Cerithidea (Cerithideopsilla) microptera (KIENER, 1842).

pl. 14 fig. 51.

1842 *Cerithium micropteron* KIENER, Icon. spec. coqu. viv. (*Cerithium*): 93, pl. 30 fig. 3 (Océan Indien).

1897 *Potamides micropterus*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl. Indien, 4: 185 (Borneo, Philippinen).

Shell larger than the preceding species but because of the wing-shaped peristome very similar to it. The colour is generally of a brighter brown, the whitish spiral band is more distinctive. The spiral grooves are somewhat shallower than in the preceding species.

Size: A 38-52 mm; D 15-19 mm.

Type locality "Indian Ocean", later amended to Borneo.

Distribution Formerly known from Borneo and the Philippines only. In Thailand this species was found in mud-flats at two localities: Klong Ta Som in Trad Province and at Palian in Trang Province.

***Cerithidea (Cerithidea)* s. str.**

Shell generally somewhat broader than that of the preceding subgenus, with more-or-less strong axial ribs and with or without spiral sulci. The apex is generally decollate. Peristome reflected, with a siphonal canal at the base; it is not continuous.

Distribution: Tropical belt.

Habitat: Mangrove and nipa palm swamps.

Key to the Thai species:

1. Shell without spiral ridges 2
- Shell with spiral ridges . . . 3
2. Carina at the base rounded; ribs strong; without varices *weyersi.*
- Basal carina sharp; ribs weak; with 1-2 varices . *charbonnieri.*
3. Diameter at the base more than 22 mm; basal spiral ridges strong, base rounded; Peristome generally cream-coloured *obtusa.*
- Diameter less than 18 mm; basal spiral ridges weak; base with obtuse keel, peristome brownish *quadrata.*

***Cerithidea (Cerithidea) obtusa* (LAMARCK, 1822).**

pl. 14 fig. 52.

1822 *Cerithium obtusum* LAMARCK, Hist. Anim. s. vert., 7: 71 (Mers de Timor).

1860 *Cerithium obtusum*, — MARTENS, Proc. zool. Soc. London, 28: 17 (Siam).

1889 *Cerithidea obtusa*, — MORLET, J. de Conch., 37: 144 (De Kampot à Bangkok).

1950 *Potamides obtusa*, — SUVATTI, Fauna Thailand: 59 (Tachin; Koh Chang; Bandon).

Shell large, rather thick and broad at the base, not translucent, with brown or purplish spire and a brighter zone below the suture; sculptured with axial ribs (about 4-6 on a cm) and spiral ridges (6-7 on the upper whorls). The spiral sulci at the rounded base are distinct. A varix may occur on the last whorl but it is never as distinct as in the other species. The expanded peristome is brownish in young specimens but of cream-colour when adult. — Operculum as in the genus.

Size A 38-56 mm (decollated); D 24-28 mm.

Animal black with a greyish sole, with brick-red margin of the foot and pigment dots of the same colour dusted over the head and back. Rostrum long, with a brick-red tip and a ring in the middle of the same colour. It is transversely furrowed and pigmented with yellow dots at its root. The eyes are placed on the tips of short stalks.

Type locality: Timor.

Distribution: Coasts of the Indian Ocean from Madagascar to SE Asia, Philippines, Moluccas and N Australia. In Thailand this species is common in mangrove forests and nipa palm swamps at almost all coasts.

This species serves as food in SE Asia and Indonesia. Several thousand specimens have been examined for cercariae and metacercariae. It does not seem to have any importance for human parasitology.

***Cerithidea (Cerithidea) quadrata* SOWERBY, 1866.**

pl. 14 fig. 53.

1866 *Cerithidea quadrata* SOWERBY, Conch. Icon., 15: pl. 1 fig. 5 (Malacca).

1889 *Cerithidea quadrata*, — MORLET, J. de Conch., 37: 144 (Bords de la mer, à Kampot).

1950 *Cerithidea obtusa quadrata*, — SUVATTI, Fauna Thailand: 59 (Talui Island).

This species has often been confused with the preceding species. It is very similar to it, but it is not only easily to distinguish from *C. obtusa*, but also lives together with it.

Shell smaller and thinner than that of the preceding species, generally of darker colour. It is more densely sculptured, as there are 8-11 axial ribs on a cm. The spiral ridges are less pronounced and the spiral ridges or grooves on the angulate base are weak. The varix (rarely there are 2) is sharp. — Aperture brownish and glossy within, peristome expanded and of the same colour as the aperture. — Operculum typical for the genus.

Size A 32-52 mm; D 14-20 mm.

Animal greyish black, without any trace of reddish or yellowish pigmentation. This is a help for distinction when the animals are collected alive.

Type locality: Malacca.

Distribution: SE Asia, Indonesia, Philippines. In Thailand common in nipa palm and mangrove forests. The animals climb up the trees and feed on algae growing at the roots and stems. It is often found together with the preceding species.

Parasitology: Like the preceding species *C. quadrata* also serves as food in SE Asia. No metacercariae have been found in the examined specimens.

***Cerithidea (Cerithidea) weyersi* DAUTZENBERG, 1899.**

pl. 14 fig. 54-55.

1899 *Cerithidea (Aphanistylus) weyersi* DAUTZENBERG, Ann. roy. Soc. malac. Belge, 34: 8, pl. 2 fig. 1a-1b (Indrapoera, Sumatra).

1890 *Cerithidea ornata*, — BOETTGER, Ber. senckenb. naturf. Ges., 1890: 167 [non A. ADAMS, 1855] (Tandjok Prock, Java).

Shell relatively small, not very thick but solid, sand-coloured or greyish-brown, sometimes with 1 or 2 darker spiral bands. The sculpture consists of distinct axial ribs (about 20-26 on the penultimate whorl); these ribs are crossed by delicate spiral lines. There are several weak spiral lines on the rounded base of the body whorl. — The subcircular aperture is wide and shows the typical siphonal canal at the base. Peristome expanded, reflected, deeply incised at the base. — Operculum typical for the genus.

Size A 29-38 mm; D 12-14 mm.

Animal without reddish or yellowish pigmentation.

Type locality: Indrapura, Sumatra.

Distribution: Thailand, Malaysia, Sumatra, Java, Buru, Sumba, Timor, Luzon, Negros, Moluccas. In Thailand this species is only known from the provinces of Grabi and Trang. It lives together with the preceding species.

Cerithidea (Cerithidea) charbonnieri (PETIT, 1851).

pl. 14 fig. 56.

1851 *Cerithium charbonnieri* PETIT, J. de Conch., 2: 264, pl. 7 fig. 7 (Borneo).

1889 *Aphanistylus charbonnieri*, — MORLET, J. de Conch., 37: 144 (Bords de la mer, à Kampot).

1950 *Cerithidea charbonnieri* & *Potamides (Aphanistylus) charbonnieri*, — SUVATTI, Fauna Thailand: 59, 60 (Bandon, Pakpun).

The shell differs from that of *C. obtusa* and *quadrata* by its lacking of spiral ridges. There are very obtuse and weak axial ribs and traces of a delicate spiral sculpture may be found. The base of the body whorl is sharply keeled. The spiral lines are more distinct below the keel. — Aperture with a short siphonal canal at the base; the peristome is expanded at the outer margin and somewhat reflected, with a tongue-shaped process beside the siphonal canal.

Size A 35-50 mm; D 16-20 mm.

Animal without reddish or orange pigmentation.

Type locality Borneo.

Distribution: SE Asia: Thailand, Cambodia, S Vietnam. KOBELT (1890: 47) reported this species from Java and Sumatra but neither MARTENS nor VAN BENTHEM JUTTING included it in their reports. In Thailand this species is only known from Paknam Bandon in the Surat Thani Province.

Note: *Cerithium unicarinatum* METCALF (Proc. zool. Soc. London, 1851: 73) seems to be conspecific with this species. As the name is preoccupied by *C. unicarinatum* WOODWARD, 1833, it is irrelevant that METCALF's paper appeared few weeks earlier than that of PETIT.

Terebralia SWAINSON, 1840.

Shell elongately conical or turreted, thick, sculptured with axial ribs and spiral ridges and covered by a thick, brown periderm. Last whorl with a thick varix, its base with spiral ridges only. Columella with a thick spiral fold; a second fold is seen in the corner between columella and last whorl. — Aperture with siphonal canal at the base. — Rachis of the radula with 5 cusps at the cutting edge.

Type species: *Strombus palustris* LINNAEUS.

Distribution: Brackish water along the coasts of the Indian and Pacific Oceans.

Terebralia palustris (LINNAEUS, 1767).

pl. 14 fig. 57-58.

1767 *Strombus palustris* LINNAEUS, Syst. Nat., ed. 12: 1213 (In Indiae paludibus).

1845 *Cerithium crassum* LAMARCK in DESHAYES, Hist. nat. anim. s. vert., (2) 9: 294 (no locality).

- 1897 *Potamides palustris*, — MARTENS in WEBER, Zool. Erg. Reise Niederl. Ostindien, 4: 176 (Vom Rothen Meer und Mossambique bis Australien; here many localities, Siam included).
- 1932 *Potamides palustris*, — TOMLIN, J. Siam Soc. nat. Hist., 8: 317 (In a cave at Buang Bep, Surat).
- 1950 *Potamides palustris*, — SUVATTI, Fauna Thailand: 60 (in a cave at Buang Bep, Surat).

Shell elongate, turreted, thick, sometimes with lighter spiral bands or vertical flames; the sculpture consists of strong, obtuse and irregularly placed axial ribs which are crossed by spiral sulci. These sulci divide the axial ribs into several spiral rows of tubercles. The sulci are very closely placed on the base of the body whorl. There are several varices showing the intervals of growth. The 13-19 whorls are almost flat. — Aperture brownish and glossy within, with short siphonal canal at the base. Peristome not continuous; columella with 2 spiral folds. — Operculum round, multispiral, corneous, with a central nucleus.

Very old specimens lose the periderm and the sculpture and are distinctly flattened ventrally.

Size: A 70-160 mm; D 25-50 mm.

Type locality: Amboina.

Distribution In brackish water in the coastal areas of the Indian and Pacific Oceans from E Africa to N Australia and the Philippines. In Thailand common in mud flats at the coasts.

Note: In almost all areas of distribution there are two forms of this species, a small form with seldom more than 90 mm length and a large form which can reach a length of 160 mm. As the examined specimens of the large form have a smooth cutting edge at the rachis, the small form, however, shows 5 cusps, it is still doubtful whether these two forms are conspecific.

Terebralia sulcata (BORN, 1778).

pl. 14 fig. 59.

This species is distributed from Madagascar to N Australia and to the Philippines. The species is found in abundance on the coasts of the Malayan peninsula and in S Vietnam, but has never been found alive in Thailand. It is mentioned here, because sometimes dead specimens were found washed ashore at Thai beaches.

Telescopium MONTFORT, 1810.

Shell very large, conical, thick, with numerous, almost flat whorls, sculptured with deep spiral grooves which disappear with age. — Aperture brown, glossy within, columella strongly twisted, with 2 spiral folds.

Type species: *Trochus telescopium* LINNAEUS.

Distribution: From Madagascar to the Philippines and N Australia.

For further details see below the monotype. A second species was recently described but careful study of the available material proved that the typical *T. telescopium* is based on not fully adult specimens, while *T. mauritsi* BUTOR is the fully adult form of this species.

Telescopium telescopium (LINNAEUS, 1758).

pl. 15 fig. 61.

- 1758 *Trochus telescopium* LINNAEUS, Syst. Nat., ed. 10: 760 (no locality).
1811 *Telescopium indicator* MONTFORT, Conch. Syst., 2: 438 (no locality).
1817 *Potamides fuscum* SCHUMACHER, Essai vers test.: 233 (no locality).
1937 *Potamides (Telescopium) telescopium*, — SERENE, Inst. Ocean. l'Indochine, 30: 39 (Gulf de Siam).
1950 *Potamides (Telescopium) telescopium*, — SUVATTI, Fauna Thailand: 60 (Gulf of Siam).
1954 *Telescopium mauritsi* BUTOT, Basteria, 18: 7, pl. 1 fig. 3-4, pl. 2 fig. 2-3 upper row, textfig. 1 (S-part of Legon Tengah, Pulo Panaitan, in Sunda Strait).

Shell very large, conical, with 12-14 regularly increasing whorls, the last whorl being relatively broader in fully adult specimens. Body whorl with keel when not fully adult. The strong spiral grooves may disappear with age. — The comparatively small aperture is irregularly shaped with well rounded outer and basal margin. The columella bears a thick, twisted fold which is covered with a thick layer of enamel-like shell substance. There is another spiral fold on the base of the whorls. The peristome is thickened at the outer margin; it is not continuous; at the base it is deeply incised and forms a tongue-shaped process. — The operculum is comparatively small, with 7-16 whorls (according to the age of the shell) and central nucleus.

Size: A 95-130 mm; D 45-63 mm.

Cutting edge of the rachis with 4 cusps on either side of the mesocone; there are 8 cusps on the lateral tooth and 5-6 or 7 cusps respectively on the marginals.

Distribution From Madagascar and Reunion to N Australia and the Philippines. Not rare in mud-flats at the coasts of the Indian Ocean and Gulf of Thailand.

Parasitology This species is eaten in certain areas in SE Asia and Indonesia. No metacercariae have been found in the examined specimens.

Note: In 1964 BUTOT described another species of this genus after TAPPARONE CANEFRI (1883: 57) and MARTENS (1897: 180) had already pointed out that there are two different forms of this species to distinguish. The one form which may be called the typical form, shows a regular conical shape with strong spiral grooves and a multi-spiral operculum with 16-17 whorls. The other form is smooth, suddenly broadened at the body whorl, has a much stronger columellar fold and the operculum shows only 6-7 whorls. BUTOT (1954: 8) also said to have observed that the typical form lives among *Lummitzera* and *Sonneratia* near to the sea side, while the other form, his *mauritsi*, is found more inland in the *Rhizophora mucronata* belt. This observation could not be corroborated by our studies. We found both forms together in muddy irrigation trenches, drainages and swamps in the mud-flats, but as both forms are connected by an uninterrupted chain of intermediate forms, we came to the conclusion that *mauritsi* is but a fully adult of *telescopium*. The spiral sculpture is partly worn off, partly covered by a secondary layer of unknown origin. As it does not cover the young part of newly grown substance at the peristome this substance is not shell substance. However, there are specimens with a thick layer of this calcareous substance, others with a thin layer and again others without any trace of it. The thicker this layer is the broader is the body whorl. Another distinguishing characteristic is said to be the number of whorls of the operculum. We have never found specimens of the form called *mauritsi* with only 6-7 whorls, they had at least 9 whorls. There are opercula with all numbers of whorls between 9-17 in the local populations. The opercula of old specimens are generally fringed at the margin.

Faunus MONTFORT, 1810.

Shell turreted, with 16-20 flat whorls, covered with a blackish periderm. Aperture at the base deeply incised, less so at the upper part.

Type species: *Strombus ater* LINNAEUS.

Distribution From Mauritius and Ceylon to Malaysia, Thailand, Indonesia, New Guinea, N Australia and the Philippines.

Faunus ater (LINNAEUS, 1758).

pl. 14 fig. 60.

- 1758 *Strombus ater* LINNAEUS, Syst. Nat., ed. 10: 746 (In Asiae paludibus).
1791 *Buccinum acicula* GMELIN, Syst. Nat., ed. 13: 3503 (no locality).
1791 *Strombus dealbatus* GMELIN, Syst. Nat., ed. 13: 3523 (no locality).
1807 *Cerithium fluviatile* FÉRUSAC, Syst. Conch.: 69.
1822 *Pirena terebralis* LAMARCK, Hist. anim. s. vert., 6: 169 (Hab. dans les eaux douce de Grandes Indes et Moluques).
1831 *Pirena acus* LESSON, Voy. Coquille, Zool.: 360.
1834 *Melanopsis princeps* LEA, Trans. amer. phil. Soc., (NS) 5: 82, pl. 19 fig. 74.
1859 *Pirena nana* REEVE, Conch. Icon., 12: pl. 1 fig. 1 (New Caledonia).
1859 *Pirena cantori* REEVE, Conch. Icon., 12: pl. 1 fig. 2 (Penang).
1959 *Pirena picta* REEVE, Conch. Icon., 12: pl. 1 fig. 3 (Ceylon).
1859 *Pirena pagodus* REEVE, Conch. Icon., 12: pl. 1 fig. 4 (no locality).
1859 *Pirena atra*, — REEVE, Conch. Icon., 12: pl. 1 fig. 5 (Philippines and Moluccas).
1885 *Pirena cantori*, — MORGAN, Bull. Soc. zool. France, 10: 422 (P. Pinang).

Not much has to be added to the generic description and it seems after careful study of available typical material of the above mentioned synonyms, that this genus is monotypical. *Faunus* has been placed into the Melanid sub-family Melanopsinae but it seems to be closer related to the genera of Potamididae.

The elongately turreted shell has a regularly conical spire and an ovate body whorl. The coarse growth lines are crossed by a distinct, however fine, spiral sculpture which is stronger on the body whorl below the periphery. The aperture is ovate; it is white or brownish within. The peristome is connected by a porcelaneous parietal callus and is deeply incised at the base. The columella is curved. — Operculum corneous, ovate, subspiral with only one whorl; its nucleus is placed near the basal margin.

Size A 65-90 mm; D 16-23 mm.

Animal blackish-grey, without any yellowish pigmentation. — Rachis with 7 cusps at the cutting edge, laterals and marginals with 3 cusps each.

Distribution: Ceylon, Nicobars, Andaman Islands, Burma, Thailand, Malaysia, India, Indonesia, Philippines, N Australia, New Guinea, New Hebrides. In Thailand this species is found in the provinces of Trad, Chantaburi, Songkla and Narativat. It lives in fresh as well as in slightly brackish water near the coast in creeks, small rivers and lagoons.

Parasitology Several thousand specimens collected in a small river opposite of Songkla have been examined for metacercariae. The species seems to be without importance for human parasitology.

Muricacea HINDS, 1844.

Shell of varying shape and size, always spiral, generally heavily sculptured. Foot large; mantle edge with purple gland. Radula with few rows, each row generally with 3 teeth. Rhachis generally with 3 cusps, rarely 2 additional cusps are placed between the larger cusps. Marginals with 1 pointed cusp.

Muricidae FLEMING, 1821.

Shell spiral, dextral, of medium size or moderately large, thick, sculptured with spiral ridges or grooves, often with tubercles or spines. Aperture with a more or less long siphonal canal. Operculum thin, corneous, oval, concentric, with basal nucleus.

Animal with small head, long filiform tentacles and large foot. Siphon long. Radula generally with 3 teeth in one row but rudimentary laterals may sometimes appear. Rhachis with 3 large cusps on the cutting edge and often with 2 or more additional smaller cusps. Verge large, placed behind the right tentacle.

Distribution Cosmopolitan.

Habitat: Predominantly marine, only few species are known from brackish water.

Muricinae FLEMING, 1821.

The rhachis has never more than 2 additional cusps otherwise like the family. There is only one genus with one species represented in Thailand. Distribution and habitat like those of the family.

Chicoreus MONTFORT, 1810.

Shell conical- ovoidal, thick, with several more or less spinous varices and generally with spiral ridges. Siphonal canal very narrow, often completely closed, of medium length for the family.

Type species *Murex ramosus* LINNAEUS, 1758.

Distribution: Tropics and Subtropics. — One species is known from the mangrove swamps of Thailand.

Chicoreus capucinus (LAMARCK, 1822).

pl. 15 fig. 62.

1822 *Murex capucinus* LAMARCK, Anim. s. vert., 7: 164 (Coromandel).

1866 *Murex capucinus*, — MABILLE & LE MESLE, J. de Conch., 14: 120 (Poulo-Condor).

1889 *Murex capucinus*, — MORLET, J. de Conch., 37: 137 (Golfe de Siam).

1950 *Murex capucinus*, — SUVATTI, Fauna Thailand: 71 (Gulf of Siam).

Shell of medium size for the genus, thick, not translucent, greyish, with strong, irregular spiral ridges and a lateral and a dorsal row of varices. These carry scaly spines below the suture. Siphonic canal very narrow, but siphonic process very broad. — Aperture brownish-violet within, with a thick varix at

the peristome and a thinner lip within; lip and varix are bordered by a deep internal groove parallel to the peristome. — Operculum ovate, concentric with basal nucleus.

Size A 26-38 mm; D 16-26 mm.

Type locality: Coromandel.

Distribution Coasts of E Asia, eastern Indian Ocean and western Pacific, N Australia.

Habitat: Mangrove forests and nipa palm swamps. — In Thailand not rare at the coasts of the Gulf of Thailand and the Indian Ocean.

Buccinacea HINDS, 1841.

Shell of varying shape, mostly fusiform or subglobose conoidal, generally with rather long siphonal canal. Radula with 3 teeth in one row. Rhachis with few cusps. Animal without purple gland, shell always with operculum. This is typical for the suborder.

Two families are represented in brackish water, Nassariidae and Buccinidae, the latter also in freshwater.

Distribution Cosmopolitan.

Key to the Thai families:

- | | |
|---|--------------|
| 1. Foot with two pointed processes behind. Rhachis with 2 cusps | Nassariidae. |
| 2. Foot without processes behind. Rhachis with 3 or more cusps | Buccinidae. |

Buccinidae FLEMING, 1821.

Shell like that of the superfamily. The eyes are placed in broad sockets at the bases of the round, medium-sized tentacles. Proboscis longer than the tentacles when extended. Foot large, without posterior processes.

Several attempts have been made to subdivide the Buccinidae into subfamilies. As long as these subfamilies are not based on well defined anatomical findings, they are not generally accepted. No shell characteristics or anatomical finding justify a separate subfamily for the freshwater species of this family.

Distribution: Cosmopolitan.

Habitat: Predominantly marine; two genera, *Clea* and *Afrocanidia* are known from freshwater.

Clea A. ADAMS, 1855.

This genus was established by A. ADAMS for a buccinoid species from Sarawak (Borneo), *C. nigricans*, which he described in the same paper. Representatives of the type subgenus are found in Malaysia, on Sumatra, Java and Borneo, but have not yet been found in Thailand.

Clea (Anentome) COSSMANN, 1901.

Shell rather small for the family, fusiform, ovate-conoidal or turreted, rarely somewhat subglobose. Surface generally with distinct spiral sculpture

and sometimes with tubercles or even spines, normally also with axial ribs. The siphonal canal is moderately long and not greatly narrowed. The siphon of the animal is long. The radula has 3 teeth in each row. Rhachis with 6-7 cusps (*Clea* s. str. has 10-11), marginals with 3.

Type species *Canidia fusca* H. ADAMS.

Distribution: ?India, Thailand, Laos, Cambodia, S Vietnam, Malaysia, Indonesia.

The subgenus *Canidia* was established by H. ADAMS in 1862 (Proc. zool. Soc. London, 1861: 383) for his new species *C. fusca*. He also assigned *Melania helena* PHILIPPI to this taxon. As the name *Canidia* was preoccupied it was later replaced by *Anentome*. Only two species had been reported from Thailand, *helena* (PHILIPPI) under various synonymous names and *cambodjensis* (REEVE). The latter has not yet been found by our team. Several other species described from the Mekong in Laos or Cambodia have been found in the Mekong at Bandan in E Thailand. Only *helena* was found in the drainage systems of several other rivers. *C. cambodjensis* was reported from the Rayong River, but has not yet been relocated. All other species are restricted to the Mekong.

Clea (Anentome) helena (PHILIPPI, 1847).

pl. 15 fig. 64-65.

- 1847 *Melania helena* PHILIPPI, Abb. Besch. 2: 170, pl. 4 fig. 4 (Java).
1848 *Melanopsis helena*, — MOUSSON, Mitth. naturf. Ges. Zürich., 1: 268 (Java).
1853 *Melania theminckiana* PETIT, J. de Conch., 4: 255, pl. 7 fig. 11 (Java).
1860 *Melanopsis helena*, — MARTENS, Proc. zool. Soc. London, 28: 14 (Siam).
1866 *Hemisinus baudonianus* MABILLE & LE MESLE, J. de Conch., 14: 133, pl. 7 fig. 1 (Cambodge: Les marais du Grand Lac, aux environs de Houdong).
1874 *Canidia fusiformis* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Bull., 10: 151, pl. 8 fig. 21-22, pl. 3 fig. 30-32 (Ca-Lgnieu, Cambodge).
1876 *Canidia tenuicostata* BROT, J. de Conch., 24: 351, pl. 12 fig. 5 (Pexabury, Siam).
1876 *Canidia bocourti* BROT, J. de Conch., 24: 352, pl. 12 fig. 6 (Pexabury, Siam).
1881 *Canidia harmandiana* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 50 (Pexabury; marécages de Peck-Schol).
1881 *Canidia stomatodonta* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 51 (Pexabury; marécages de Preck-Schol).
1891 *Canidia helena*, — MORLET, J. de Conch., 39: 233 (Rivière de Menam-Pinh, à Xieng-Moi).
1908 *Canidia helena*, — DAUTZENBERG & FISCHER, J. de Conch., 56: 195 (Luang Prabang).
1964 *Clea (Anentome) bandoniana* (sic!), — HABE, Nature & Life SE Asia, 3: 56, pl. 1 fig. 24, pl. 2 fig. 16-17 (Bangkok).

Shell of medium size for the genus, turreted or elongately ovate-conoidal, sometimes somewhat fusiform, straw-coloured or olive-brown; unicoloured or with 1-3 dark brown spiral bands, one below the suture, one at the periphery and one on the base of the body whorl; rather solid, not translucent, with strong axial ribs which are rarely obsolete. There are 14-24 ribs on the last whorl. On the upper half of the whorls are fine spiral lines which become coarser on the base of the body whorl. The 6-8 whorls are somewhat convex or almost flat. The embryonic shell is often eroded, rarely the postnuclear whorl. Base of the body whorl produced into a broad siphonal process. — Aperture rather large, about $\frac{2}{3}$ of the height of the body whorl, ovate, with

the peristome and a thinner lip within; lip and varix are bordered by a deep internal groove parallel to the peristome. — Operculum ovate, concentric with basal nucleus.

Size: A 26-38 mm; D 16-26 mm.

Type locality Coromandel.

Distribution: Coasts of E Asia, eastern Indian Ocean and western Pacific, N Australia.

Habitat: Mangrove forests and nipa palm swamps. — In Thailand not rare at the coasts of the Gulf of Thailand and the Indian Ocean.

Buccinacea HINDS, 1841.

Shell of varying shape, mostly fusiform or subglobose conoidal, generally with rather long siphonal canal. Radula with 3 teeth in one row. Rhachis with few cusps. Animal without purple gland, shell always with operculum. This is typical for the suborder.

Two families are represented in brackish water, Nassariidae and Buccinidae, the latter also in freshwater.

Distribution: Cosmopolitan.

Key to the Thai families:

- | | |
|---|--------------|
| 1. Foot with two pointed processes behind. Rhachis with 2 cusps | Nassariidae. |
| 2. Foot without processes behind. Rhachis with 3 or more cusps | Buccinidae. |

Buccinidae FLEMING, 1821.

Shell like that of the superfamily. The eyes are placed in broad sockets at the bases of the round, medium-sized tentacles. Proboscis longer than the tentacles when extended. Foot large, without posterior processes.

Several attempts have been made to subdivide the Buccinidae into subfamilies. As long as these subfamilies are not based on well defined anatomical findings, they are not generally accepted. No shell characteristics or anatomical finding justify a separate subfamily for the freshwater species of this family.

Distribution Cosmopolitan.

Habitat Predominantly marine; two genera, *Clea* and *Afrocanidia* are known from freshwater.

Clea A. ADAMS, 1855.

This genus was established by A. ADAMS for a buccinoid species from Sarawak (Borneo), *C. nigricans*, which he described in the same paper. Representatives of the type subgenus are found in Malaysia, on Sumatra, Java and Borneo, but have not yet been found in Thailand.

Clea (Anentome) COSSMANN, 1901.

Shell rather small for the family, fusiform, ovate-conoidal or turreted, rarely somewhat subglobose. Surface generally with distinct spiral sculpture

and sometimes with tubercles or even spines, normally also with axial ribs. The siphonal canal is moderately long and not greatly narrowed. The siphon of the animal is long. The radula has 3 teeth in each row. Rhachis with 6-7 cusps (*Clea* s. str. has 10-11), marginals with 3.

Type species *Canidia fusca* H. ADAMS.

Distribution ?India, Thailand, Laos, Cambodia, S Vietnam, Malaysia, Indonesia.

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Clea (Anentome) helena (PHILIPPI, 1847).

pl. 15 fig. 64-65.

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1881 *Canidia stomatodonta* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 51 (Pexabury; marécages de Preck-Schol).
1891 *Canidia helena*, — MORLET, J. de Conch., 39: 233 (Rivière de Menam-Pinh, à Xieng-Moi).
1908 *Canidia helena*, — DAUTZENBERG & FISCHER, J. de Conch., 56: 195 (Luang Prabang).
1964 *Clea (Anentome) bandoniana* (sic!), — HABE, Nature & Life SE Asia, 3: 56, pl. 1 fig. 24, pl. 2 fig. 16-17 (Bangkok).

Shell of medium size for the genus, turreted or elongately ovate-conoidal, sometimes somewhat fusiform, straw-coloured or olive-brown; unicoloured or with 1-3 dark brown spiral bands, one below the suture, one at the periphery and one on the base of the body whorl; rather solid, not translucent, with strong axial ribs which are rarely obsolete. There are 14-24 ribs on the last whorl. On the upper half of the whorls are fine spiral lines which become coarser on the base of the body whorl. The 6-8 whorls are somewhat convex or almost flat. The embryonic shell is often eroded, rarely the postnuclear whorl. Base of the body whorl produced into a broad siphonal process. — Aperture rather large, about $\frac{2}{3}$ of the height of the body whorl, ovate, with

a short, broad siphonal canal at the base. Peristome sharp, connected by a parietal callus. Columella moderately curved. — Operculum almond-shaped, concentric, with basal nucleus. Muscle scar small, knob-like.

Size A 18-28 mm; D 7-13 mm.

Radula with the formula 1-1-1; rhachis with 7 cusps of which 1-3 may be missing. Marginals with 1 large, curved cusp and 2 smaller cusps.

Type locality: Java.

Distribution SE Asia, Malaysia and Indonesia. — In Thailand the species was found in almost every province.

Habitat This is the only Thai species which is not restricted to running water as it is also found in lakes and ponds.

Biology: The species feeds predominantly on decaying protein, but has been observed to attack living snails and worms.

Remark This species is extremely variable with regard to size, shape and costulation.

***Clea (Anentome) cambojiensis* (REEVE, 1861).**

1861 *Melania cambojiensis* REEVE, Conch. Icon., 13: pl. 59 fig. 468 (Cambodia).

1866 *Hemisinus cambodjensis*, — MABILLE & LE MESLE, J. de Conch., 14: 132, pl. 7 fig. 3 (Le Grand Lac et les environs de Battambang; Cambodge).

1889 *Semisinus cambodgensis*, — MORLET, J. de Conch., 37: 146 (Grand Lac, Cambodge; forêt et bords du Ragoug = Rayong, Siam).

Shell turreted, solid, dark olive-brown, apex eroded, the 4-5 remaining whorls increase regularly in size; they are well rounded and carry a spiral row of large tubercles above the periphery. There are about 8-9 tubercles on the penultimate whorl and 9-11 on the body whorl. The body whorl measures about $\frac{2}{3}$ of the height of the shell. — Aperture ovate, with short, broad siphonal canal. — Operculum unknown.

Size A 23-24 mm; D 14-15 mm.

Animal and soft parts unknown.

Type locality: Tonle Sap, Cambodia N of Battambang.

Distribution Known from the Tonle Sap and from Battambang in Cambodia and reported from the Rayong River in Thailand.

Note: The present author surveyed the Rayong River and the banks of the Tonle Sap carefully for this species, however, without any success.

***Clea (Anentome) spinosa* TEMCHAROEN, 1971.**

pl. 15 fig. 66.

1971 *Clea (Anentome) spinosa* TEMCHAROEN, Arch. Moll., 101: 105, pl. 7 fig. 16 (Mekong at Khong Island).

It is the second species described with thick, long spines. The species is less slender than *C. cambojiensis*. The body whorl is large and inflated, the spire short and conic; it measures only $\frac{1}{4}$ of the height of the shell. The sculpture consists of 2 spiral ridges on the middle whorls; on the body whorl there is also a strong peripheral ridge and 4-5 ridges on the base. The subsutural ridge carries

long, obtuse spines; the second ridge only tubercles. On old, adult specimens the spines are generally eroded. — Aperture large, ovate, with a short, broad siphonal canal. — Operculum typical for the genus.

Size: A 9-17 mm; D 6-11 mm.

Type locality Mekong at Khong Island in Laos.

Distribution Mekong between Bandan and Khong.

Clea (Anentome) jullieni (DESHAYES, 1876).

pl. 15 fig. 67.

1876 *Canidia jullieni* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Bull., 10: 155, pl. 8 fig. 23-24 (Ca-Lgnou, Cambodge).

Shell similar to the preceding species, but smaller and sculptured with strong axial ribs; there are 18-19 ribs on the last whorl. The base and siphonal process are sculptured with several spiral grooves of about equal size. Sometimes the axial ribs are also crossed by fine spiral lines. Generally there are 2 brown spiral bands, one between the suture and periphery and one on the base of the body whorl. — Aperture and operculum typical for the genus.

Size: A 17-27 mm; D 11-16.5 mm.

Animal dark grey with comparatively long tentacles. Proboscis extended about 4 mm long, siphon 12 mm.

Type locality: Kas Lognieu Island in N Cambodia.

Distribution Mekong between Bandan and Sambor.

Several authors considered *C. broti* and *bizonata* DESHAYES conspecific with this species. We consider *jullieni* a valid species because of its strong axial costulation and its size. *C. broti* and *bizonata* are identical and may be synonymous with *fusca* H. ADAMS.

Remark: BROT (1876: 347, 248) gives Tonkin as locality for *jullieni*, *broti*, *bizonata*, *fusiformis* and *scalarina* DESHAYES. The type locality of all these species is the island of Kas Lognieu (Ca-Lgnou apud DESHAYES) in the Mekong N of Sambor.

Clea (Anentome) scalarina (DESHAYES, 1876).

pl. 15 fig. 68.

1876 *Canidia scalarina* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Bull., 10: 153, pl. 8 fig. 18-20 (Ile de Ca-Lgnou, Cambodge).

Shell ovate-conoidal, rather thick, not translucent, with 4 convex whorls, the postnuclear whorls narrowly ribbed, the body whorl with distantly placed ribs, about 10-11 on the last whorl. The spire is regularly conic. The whorls are moderately flattened below the suture thus rendering the shell a scalarid appearance which is still more accentuated through the knobby upper ends of the ribs. — Aperture ovate, angled above and produced into a siphonal canal at the base.

Size: A 15-27 mm; D 7.5-12 mm.

Type locality: Mekong at Kas Lognieu, Cambodia.

Distribution: Mekong between Bandan and Sambor.

Note: The original description is based on a juvenile specimen. Fully adult specimens look more elongately fusiform than the holotype.

***Clea (Anentome) wykoffi* n. sp.**

pl. 15 fig. 69.

Diagnosis: A species of *Clea (Anentome)* COSSMANN which differs from *C. helena* (PHILIPPI) by its well rounded whorls, narrower costulation, thinner texture and shorter siphonal canal. From large populations of *C. scalarina* (DESHAYES) it differs by its lack of a tuberculated shoulder.

Description: Shell regularly conic, solid but not thick, olive or brownish, generally with a subperipheral brown band and brighter lower half of the body whorl. With exception of the nuclear whorls, the shell is sculptured with narrow, obtuse axial ribs which end at the periphery. These ribs are crossed by delicate spiral lines which grow coarser at the base of the body whorl. The 5 whorls are well rounded and separated by a deep, simple suture. The body whorl measures about $\frac{2}{3}$ of the length of the shell; at the base it is produced into a moderately long siphonal canal. — The large aperture measures about $\frac{1}{2}$ of the length of the shell; it is oval, angled above and protracted below into a short, broad siphonal canal. Peristome not expanded, simple, sharp, connected by a callus which is thickened at the inner side of the siphonal canal. — Operculum almond-shaped, concentric, corneous, with basal nucleus.

Size (Holotype): A 19.0 mm; D 8.5 mm.

Soft parts and radula unknown as only a few dead shells were collected.

Type locality: Mekong at Bandan in E Thailand.

Distribution Known from the type locality only.

Material: Holotype SMRL 3973/A; paratype 3973/4.

Relationship This species seems to be most closely related to *C. scalarina* (DESHAYES). If it were not found together with that species, it would have been considered as an unshouldered race of *scalarina*. It looks like a *Buccinum undatum* L. in miniature, or like certain species of the genus *Phos*.

Volutacea PHILIPPI, 1853.

This predominantly marine superfamily is represented by one freshwater species from Thailand. This species belongs to the following family.

Marginellidae GRAY, 1847.

Shell pyriform or reversely conic, with very low, depressed spire and large, conic body whorl. — Aperture long and narrow, outer wall and parietal wall almost parallel, pointed above and with a very short, truncate siphonal canal at the base. — Operculum lacking. — Radula with one pectinate tooth in each row.

Distribution Cosmopolitan.

Habitat: Marine, few species live estuarine, only one species is known from freshwater. It has been assigned to a separate genus.

Rivomarginella BRANDT, 1968.

This monotypical genus is similar to *Eratoidea* WEINKAUFF, but differs from it by its smooth inner lip on the outer wall of the aperture and by being completely covered with a secondary layer of enamel-like shell substance.

Rivomarginella morrisoni BRANDT, 1968.

pl. 15 fig. 70.

- 1916 *Marginella* sp., — ANNANDALE, J. nat. Hist. Siam Soc., 2 (2): 92 (Tale Sap at Pattalung).
1950 *Marginella* sp., — SUVATTI, Fauna Thailand: 82 (Bangkok; Tale Sap at Pattalung).
1968 *Rivomarginella morrisoni* BRANDT, Arch. Moll., 98: 276, pl. 10 fig. 63, textfig. 41 (Tonle Luang = Tale Sap at Pattalung; Maenam Mae Klong; Klong Rapipat and Maenam Pasak at Ban Ta Luang; Prachin River at Kabinburi; Nan River; klongs in and around Bangkok and Thonburi).

Shell of moderate size for the family, reversely piriform-conoidal, solid, somewhat translucent, glossy, sand-coloured, smooth, unicoloured or with 1-2 olive-coloured spiral bands. The basal surface is delicately granulated but it is covered with a secondary layer of enamel-like shell substance which is very glossy. The small, depressed, almost flat spire consists of 2 whorls. — Aperture very narrow and long, with short, truncate siphonal canal at the base. The peristome is very thick, but only moderately so within. The internal lip on the outer wall of the aperture does not show any traces of dentition. — An operculum is lacking.

Size: A 9.8-11.3 mm; D 7.2-8.3 mm.

Animal of light grey colour with large, black pigment dots on head and back. The large foot is rounded, triangular; the mantle covers almost the entire shell. The eyes are placed at the outside of the bases of the moderately long tentacles, without sockets or swellings. The proboscis is long and cleft in front. — The radula consists of about 40 single teeth which are comb-shaped. There are 28-29 cusps, 7-9 of these being rather large and the other cusps being placed in groups of 1-3 in between the larger cusp. — The animals are monosexual (in the original description "ambisexual" was an error) or dioecious. The verge is long and simple and does not carry any appendages. It is coiled in the neck on the right side of the mid-line. The females are oviparous.

Type locality: Maenam Mae Klong at Ban Pong, Ratburi.

Distribution: Known from Thailand only.

Euthyneura SPENGLER, 1881.

Only few of the non-marine families are without a shell. Shell — when present — coiled or cap-shaped, sometimes rudimentary, generally without operculum. Reproduction hermaphroditic; animals with gills which are never true ctenidia, or with lungs. The nervous system is not or only slightly crossed; it is secondarily orthoneurous.

Key to the orders represented in the Thai non-marine fauna:

- | | | |
|--|-------|------------------|
| 1. Animal with shell which sometimes may be internal only | ..... | 2 |
| — Animal without shell | .... | Systemmatophora. |
| 2. Radula with few teeth or missing; animal with true gill | ..... | 3 |
| — Radula always present and with many teeth in one row; animal with lung or secondary gill | ..... | 4 |
| 3. Animal without radula; shell with conic spire | .. | Entomotaeniata. |
| — Animal with radula; shell bubble-shaped, spire low | ... | Cephalaspidea. |
| 4. Animal with one pair of tentacles; generally aquatic or amphibious | ..... | Basommatophora. |
| — Animal generally with two pairs of tentacles; terrestrial | ..... | Stylommatophora. |

The Stylommatophora as terrestrial gastropods will be dealt with in a separate paper.

Entomotaeniata COSSMANN, 1896.

This order comprises only one recent superfamily:

Pyramidellacea GRAY, 1847.

For the description of the only recognized recent family see below. Animal without radula and jaw.

Pyramidellidae GRAY, 1847.

Shell generally small, ovate-conic or turreted, often with heterogyrous apex. Operculum thin, corneous, paucispiral. Head with cephalic shield and one pair of tentacles. The eyes are placed on the fore-head between the tentacles. Head with genuine proboscis (retractable "acrembolic" rostrum) and often with a mentum. This is a pad-like swelling at the anterior end of the foot. A blind (? glandular) sac opens into this organ.

Distribution: Cosmopolitan.

Habitat: Marine and brackish water.

Chrysallida CHARPENTIER, 1857.

This predominantly marine genus is represented in E Asia by several brackish water species but only one species was found in Thailand. This species is tentatively assigned to the subgenus *Salasiella*.

Chrysallida (Salasiella) DALL & BARTSCH, 1909.

Shell turreted or subcylindrical, rather small, somewhat transparent, with axial ribs and often with fine spiral lines. Parietal callus with or without fold or denticle. Operculum thin, paucispiral, ovate, corneous. Animal typical for the family.

Type species: *Chrysallida laxa* DALL & BARTSCH.

***Chrysalida (Salasiella) eppersoni* BRANDT, 1968.**

pl. 15 fig. 71.

1968 *Chrysalida (Salasiella) eppersoni* BRANDT, Arch. Moll., 98: 277, pl. 10 fig. 16 (Ban Ampoe).

Shell of average size for the subgenus, elongately turreted, moderately thick, somewhat translucent when fresh and young, old specimens not transparent, dull, covered with a yellowish or olive-green periderm. The apex is smooth and normally truncate. The remaining 6-8 of the 10-12 whorls are sculptured with strong, obtuse axial ribs. There are 26-28 on the penultimate whorl. These ribs are crossed by wavy, minute spiral lines. The body whorl measures about $\frac{1}{3}$ of the length of the truncate shell. It shows a very obtuse keel below the periphery. — Aperture pyriform, peristome not extended, sharp without, not continuous, connected by a thin, brown parietal callus; callus straight, glossy, brown, without fold or denticle. — Operculum like that of the genus.

Size A 10-12.5 mm; D 4.0-4.5 mm.

Animal with yellowish-brown back and grey foot. Dusted with fine yellow pigment particles and with few large black patches or dots. The eyes are placed closely together on the fore-head between the triangular tentacles. The head-shield is flap-like, with a notch in the middle of the straight front.

Type locality: Brackish water lagoon at Ban Ampoe, Satahip District, Chonburi Province, on silt ground.

Distribution: Known from the type locality only.

***Morrisonietta* BRANDT, 1968.**

Shell small, very thin, whitish, but in general covered with a brownish periderm; elongately ovate-conoidal or turreted, with homoeostrophic or heterostrophic apex. Umbilicus closed. Aperture angled above and rounded below, peristome sharp, columella without fold or tooth. The sculpture of the shell consists of more or less delicate spiral lines. It differs from that of *Miralda* A. ADAMS and *Menestho* MÖLLER which have similar shells, by its lack of the subsutural axial riblets. The operculum is typical for the family.

Animal greyish with large, sand-coloured or orange pigment spots and a fine, black pigmentation dusted over head and back. The tentacles are short, grooved; the eyes are placed between the tentacles closely together. The mentum is rudimentary.

Type species: *Morrisonietta krungtepensisi* BRANDT.

Distribution: Known from the coastal area of Thailand only, but several other species from SE Asia may belong to this genus. These species were described as *Bacteridium*, *Eulimella*, *Kleinella* or *Miralda*.

Habitat: Klongs with tidal water or drainages of mud-flats with brackish water of low degree of salinity.

Key to the species:

- | | |
|--|-------------------|
| 1. D of shell 1.8 mm and broader, A of shell 5.0 mm and longer | 2 |
| — D of shell 1.7 mm and smaller, A of shell generally 4.5 mm and smaller | ... 4 |
| 2. Body whorl with 10-13 spiral lines | <i>spiralis</i> . |
| — Body whorl with 22 and more spiral lines | 3 |

3. Whorls with distinct subsutural shoulder; aperture almost $\frac{1}{2}$ of the height of the shell *krungtepensis*.
 — Whorls without shoulder; aperture about $\frac{2}{5}$ of the height of the shell *siamensis*.
 4. Aperture about $\frac{1}{4}$ of the height of the shell 5
 — Aperture about $\frac{1}{3}$ of the height of the shell *gracilis*.
 5. Whorls well rounded, low, with very weak spiral sculpture . . . *bandonensis*.
 — Whorls almost flat, shouldered, very high, with sharp spiral sculpture *acicula*.

***Morrisonietta krungtepensis* BRANDT, 1968.**

pl. 15 fig. 72

1968 *Morrisonietta krungtepensis* BRANDT, Arch. Moll., 98: 279, pl. 10 fig. 65 (Bangkok, Thonburi, Glaeng, Paknam Bandon).

Shell conoidal-ovate or turreted, with 5 barely convex whorls. The embryonic whorls are smooth, whitish, glossy, mostly heterostrophic; the other whorls are covered with a thin, brown periderm and sculptured with spiral lines between the shoulder and suture below. The area between shoulder and upper suture is smooth or only exceptionally sculptured with 1 spiral line. The first postnuclear whorl has 4, the next whorl 6-7, the penultimate whorl 10-12 and the body whorl more than 30 spiral lines, including those on the lower half. Umbilicus closed. — Aperture narrowly ovate, angled above and well rounded below. Peristome sharp, not continuous, connected by a feeble callus only. Columella almost straight, milky-blue. Outer margin neither expanded nor thickened. — Operculum and animal typical for the genus.

Size: A 5.2-7.0 mm; D 2.1-2.5 mm.

Type locality Klong Premprachakon in Bangkok-Dusit.

Distribution In klongs in and around Bangkok and Thonburi. Drainage trenches in the estuarine area of Glaeng in Rayong Province and Paknam Bandon in Surat Thani Province.

***Morrisonietta spiralis* BRANDT, 1968.**

pl. 15 fig. 73.

1968 *Morrisonietta spiralis* BRANDT, Arch. Moll., 98: 279, pl. 10 fig. 69 (Paknam Bandon).

This species is very similar to *M. krungtepensis* and differs mainly from it by its fewer and stronger spiral lines and by having also 2 or 3 spiral lines between shoulder and upper suture.

Shell conic, with 5 regularly increasing whorls. The embryonic whorl is whitish, smooth and somewhat glossy, the other whorls are covered with a brownish periderm and are sculptured with few strong spiral lines. Between the distinct shoulder and the upper suture there are generally 2 or 3 weak spiral lines. The penultimate whorl has 6-7, the body whorl 11-13 spiral lines; the spiral line on the shoulder is strengthened to a strong carina. Otherwise not different from the type species except for the size.

Size: A 5.0-5.2 mm; D 1.8-2.0 mm.

Animal typical for the genus.

Type locality Paknam Bandon, Surat Thani Province.

Distribution Surat Thani and Rayong Provinces.

Relation: This species would be considered a race of *krungtepensis* were it not found together with that species without intermediate forms.

Morrisonietta siamensis BRANDT, 1968.

pl. 15 fig. 74.

1968 *Morrisonietta siamensis* BRANDT, Arch. Moll., 98: 280, pl. 10 fig. 67 (Klong Bang Pueag at Glaeng).

This species differs from the type species by its more slender shape, smaller size and lack of the shoulder. The aperture is also of smaller size.

The shell has 6 whorls which are not shouldered. There are 8-9 spiral lines on the penultimate whorl and 22-24 on the body whorl. In between these sharp spiral lines there are 2-3 delicate spiral striae in the interspaces which are crossed by the fine growth lines. The body whorl measures about $\frac{1}{2}$ of the length of the shell, the aperture about $\frac{1}{3}$ of it. — Peristome thin, disconnected, sharp. Operculum typical for the genus.

Size A 5.2-5.6 mm; D 1.8-2.0 mm.

Animal sand-coloured with minute grey pigment dots. No orange and black pigment has been seen. Otherwise the animal is typical.

Type locality: Klong Pong Pueag at Ban Tangkwien, Glaeng District, Rayong Province.

Distribution: Known from Glaeng District in Rayong and from Khlung District in Chantaburi Province only.

Relations: The preceding two species and the latter look very similar to *Miralda (Ivara) turricula* (DALL & BARTSCH), but differ from that species by lacking the short, subsutural axial riblets.

Morrisonietta gracilis BRANDT, 1968.

pl. 15 fig. 75.

1968 *Morrisonietta gracilis* BRANDT, Arch. Moll., 98: 282, pl. 10 fig. 69 (Province of Thonburi).

This species differs from the preceding species by its smaller size and weaker spiral sculpture. The 4 whorls have no shoulder or only a trace of it. There are 10-12 spiral lines on the second or postnuclear whorl, 14-17 on the third or penultimate whorl and 26-29 on the body whorl. The spiral lines around the rimate umbilicus are stronger than on the upper half of the body whorl, contrary to the preceding species.

Size A 3.7-4.5 mm; D 1.5-1.7 mm.

The animal is typical for the genus, but generally shows a rosy tint which may even be seen through the transparent shell. Tentacles with few sand-coloured dots on the ends, head and back with few blackish pigment dots only.

Type locality: Klong Bang O in Thonburi.

Distribution: Known from several Klongs in Thonburi.

Morrisonietta acicula BRANDT, 1968.

pl. 15 fig. 76.

1968 *Morrisonietta acicula* BRANDT, Arch. Moll., 98: 281, pl. 10 fig. 68 (Klong Don Makok, Rayong; Ban Praya Samut; Paknam Bandon).

This species differs from all other species of the genus by its extremely slender shape like that of *Cecilioides*. Its 6 whorls increase regularly in size. They are sculptured with very fine spiral lines. There are 5-6 lines on the postnuclear whorl, 7-8 on the fourth whorl, 15-17 on the fifth or penultimate whorl and about 29 on the body whorl. The 12 spiral lines on the lower half of the last whorl are weaker than those on the upper half. The body whorl measures about $\frac{1}{2}$ of the length of the shell, the aperture about $\frac{1}{4}$ of it.

Size A 4.8-5.3 mm; D 1.5-1.7 mm.

The sand-coloured animal is dusted with grey and black pigment dots. The tentacles are shorter than in the type species, otherwise the animal is typical for the genus.

Type locality Trench at Ban Don Makok, E of Rayong.

Distribution Known from the Districts of Glaeng (Rayong); Ban Praya Samut (Samut Prakan) and Bandon (Surat Thani).

Morrisonietta bandonensis BRANDT, 1968.

pl. 15 fig. 77.

1968 *Morrisonietta bandonensis* BRANDT, Arch. Moll., 98: 282, pl. 10 fig. 70 (Paknam Bandon).

This species differs from the preceding species by its low, well rounded whorls. The species is only tentatively placed into this genus. It may belong to *Syrnola*, *Ebala* or *Bacteridium*.

Shell very small, turreted, terebrella-shaped, thin, transparent, whitish, without periderm, somewhat glossy; 6-7 regularly increasing, well rounded whorls which are separated by a deep suture. There is no shoulder on the whorls. The sculpture consists of delicate spiral lines crossed by fine growth lines. The first whorl is smooth and very glossy. A narrow zone below the suture is free of spiral sculpture. The umbilicus is rimate. Body whorl a little less than half the height of the shell. — Aperture semilunar, rounded above and below, about half the size of the body whorl; outer margin of the interrupted peristome almost straight, sharp. — Operculum very thin, translucent, paucispiral.

Size A 2.9-3.6 mm; D 0.8-1.0 mm.

Animal typical for the genus, but with few large dark pigment patches only.

Type locality: Muddy brackish water creek along the road at Paknam Bandon, Province of Surat Thani.

Distribution Known only from the type locality.

Basommatophora KEFERSTEIN, 1864.

This order, together with *Stylommatophora* A. SCHMIDT, formerly formed the subclass *Pulmonata* CUVIER. The representatives of *Basommatophora* always

have a shell, though only one family has an operculum. The head carries one pair of non-invincible tentacles. The eyes are placed at their bases without stalks. The head is flap-like, the rostrum very short. The animals are hermaphroditic (ambisexual, monoecious); the genital openings are generally separated. A jaw is generally present; the radula has numerous rows with many small teeth.

Distribution Cosmopolitan.

Habitat: Freshwater, brackish water, littoral, rarely terrestrial or marine.

Key to the superfamilies:

- | | |
|---|-------------|
| 1. Shell cap-like or discoidal; if ovate, always sinistral | Ancylacea. |
| — Shell not cap-like or discoidal, always more or less elongate and dextral | 2 |
| 2. Shell rather thin, aperture without teeth or folds | Lymnaeacea. |
| — Shell generally very solid, aperture with teeth or folds | Ellobiacea. |

Ellobiacea H. & A. ADAMS, 1858.

This superfamily comprises only one amphibious family in Thailand. No freshwater species are known. For further details see below Ellobiidae.

Ellobiidae H. & A. ADAMS, 1858.

Shell generally dextral, of different size and shape, reverse-conoidal, ovate, cylindrical or fusiform. Columella with one or more folds, aperture often with teeth within. The adult animal dissolves the inner walls of the spire. Tentacles round, tapering to the end.

Distribution: Cosmopolitan.

Habitat: Most of the species live amphibiously in nipa palm and mangrove swamps, some are littoral species, few are terrestrial.

The Ellobiidae have been divided into several subfamilies which have not yet found general acceptance. The identification key is therefore given for the genera, not for the subfamilies.

Key to the Thai genera:

- | | |
|--|-----------------------|
| 1. Outer wall of aperture with folds or teeth within | 2 |
| — Outer wall of aperture smooth within | 3 |
| 2. Shell greatly compressed dorso-ventrally, with lateral varix | <i>Pythia</i> . |
| — Shell not compressed, without varix | 4 |
| Shell shorter than 30 mm | .. . 5 |
| — Shell higher than 35 mm | <i>Ellobium</i> . |
| 4. Shell solid, broad, with dark periderm | 6 |
| — Shell thin, slender, cylindrical, corneous, without periderm | <i>Cylindrotis</i> . |
| 5. Shell broad, conoidal, diameter 10 mm and larger | <i>Cassidula</i> . |
| — Shell slender, fusiform, diameter 6 mm and smaller | <i>Auriculastra</i> . |
| 6. Surface smooth or with weak spiral sculpture; aperture with folds | <i>Melampus</i> . |
| — Surface with strong spiral sculpture, aperture with teeth within | <i>Laemodonta</i> . |

Pedipedinae THIELE, 1931.

Shell below medium size of the family, ovate, with low spire; smooth or with spiral sculpture. Columella with 1 fold and generally with additional folds on the parietal margin and on the palatal wall of the aperture.

Radula with a narrow rhachis which carries 1 pointed cusp. Laterals with additional cusp, marginals with 4 or more cusps, rarely with 3 only.

Distribution: Cosmopolitan but preferably on the coasts of the warmer oceans.

Habitat: Beaches and mud flats of nipa palm and mangrove forests.

There is only one genus represented in Thailand:

Laemodonta PHILIPPI, 1846.

Shell rather small, solid, ovoidal or ovate-conoidal, with spiral grooves or spiral rows of pits. Aperture rather small and narrowed by dentition, folds and an inner lip on the outer wall.

Radula with many teeth. Rhachis and inner laterals with simple cutting edge, outer laterals and marginals with 2 or 3 cusps respectively.

Type species: *Laemodonta striata* PHILIPPI.

Distribution: Coasts of the western Pacific and eastern Indian Ocean.

Habitat: Mud flats, nipa palm and mangrove forests.

Key to the Thai species:

- | | |
|--|--------------------------|
| 1. Sculptured with pitted spiral lines | 2 |
| — Sculptured with spiral grooves | 3 |
| 2. With 2-3 subsutural grooves; apex pointed; unicoloured, pits very small | |
| ..... | <i>punctatostriata</i> . |
| — Without subsutural grooves; apex dome-shaped; generally with brown bands | |
| ..... | <i>punctigera</i> . |
| 3. Base with distinct periomphalic keel | 4 |
| — Base without periomphalic keel | <i>monilifera</i> . |
| 4. Size not larger than 6.5 mm; sculpture without axial lines | <i>typica</i> . |
| — Size larger than 7 mm; sculpture with axial lines | <i>siamensis</i> . |

Laemodonta typica (H. & A. ADAMS, 1853).

pl. 15 fig. 78.

1853 *Plecotrema typicum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 120 (Pulo Penang).

1853 *Plecotrema liratium* H. & A. ADAMS, Proc. zool. Soc. London, 21: 121 (Moreton Bay).

1853 *Plecotrema concinnum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 122 (no locality).

1956 *Plecotrema typica*, — HUBENDICK, Proc. malac. Soc. London, 32: 114, pl. 23 fig. 1-2 (Siam, Okinawa, New Caledonia, Tonga Islands, Aden, Mauritius, N Madagascar and Eastern Australia).

This species belongs to the small group of species of this genus which carry a distinct carina around the omphalic area. The sculpture consists of deep fur-

rows which are about as broad as the interspaces. Parallel to the peristome is an external varix. — Aperture with the typical columellar fold, 2 parietal folds and 2 palatal teeth.

Size: A 4.3-6.2 mm; D 2.4-3.7 mm.

Type locality: Penang.

Distribution: In Thailand known from Palian only. HUBENDICK gives „Siam“ without exact locality. Extralimitarily known from the western coast (Penang, Singapore, Pegu) of the Indian Ocean. From Java to the Philippines and Okinawa and to E Australia, New Caledonia and the Tonga Islands.

Laemodonta punctigera (H. & A. ADAMS, 1853).

pl. 15 fig. 79.

1853 *Plectotrema punctigerum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 120 (Borneo).

1864 *Plectotrema punctigera*, — CROSSE & FISCHER, J. de Conch., 12: 330 (Embouchure de Vaico, Cochinchine).

1853 *Plectotrema imperforatum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 120 (Negros, Philippines).

1875 *Plectotrema punctigera*, — MORELET, Sér. Conch., 4: 273 (Siam; Cochinchine).

1956 *Plectotrema punctigera*, — HUBENDICK, Proc. malac. Soc. London, 32: 120 (Bandra, N of Bombay; Vizagapatam; Irvady delta; Coasts of the South China Sea from Singapore to Swatow; Philippines).

1959 *Laemodonta punctigera*, — VAN BENTHEM JUTTING, Beaufortia, 7: 107 (Tandjong Tiram, Sumatra).

This species is easily identified by its brown bands (usually 3) on the body whorl, the lack of subsutural sulci and the spiral rows of comparatively large pits. The spire is obtusely dome-shaped, the umbilicus closed or a narrow perforation. Aperture with the typical 3 folds and with 3 (2-4) palatal teeth.

Size: A 4.5-6.4 mm; D 3.2-4.0 mm.

Type locality: Borneo.

Distribution: In Thailand common in all mud flats, mangrove and nipa palm swamps. Extralimitarily known from almost all countries bordering the Indian Ocean and the South China Sea, India, Burma, Thailand, Malaya, Indonesia, S China, Philippines, S Vietnam. Not yet reported from Taiwan.

Laemodonta punctatostriata (H. & A. ADAMS, 1853).

pl. 15 fig. 80.

1853 *Plectotrema punctatostriatum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 121 (Borneo).

1885 *Plectotrema punctatostriata*, — MORGAN, Bull. Soc. zool. France, 10: 395 (Borneo, Singapore).

1939 *Laemodonta punctatostriata*, — YEN, Abh. senckenb. naturf. Ges., 444: 64, pl. 5 fig. 32 (Tshing-tshou, Macao).

This species which has often been confused with *L. punctigera*, differs from the latter by its 2 or 3 distinct subsutural sulci, by its conic spire, more numerous spiral rows of much smaller pits and by its unicoloured shell.

Size: A 4.5-5.3 mm; D 2.9-3.5 mm.

Type locality: Borneo:

Distribution: In Thailand known from mud flats, nipa palm and mangrove forests at the coasts of the Gulf of Thailand and the Indian Ocean. Extralimarily known from Malaya and the Philippines, but definitely further distributed, as many reports of other species of *Laemodonta* may refer to this species.

Remarks: This species was placed by HUBENDICK in the synonymy of *L. punctigera*, although the constant differences are not connected by intermediate forms.

***Laemodonta monilifera* (H. & A. ADAMS, 1853).**

- 1853 *Plecotrema moniliferum* H. & A. ADAMS, Proc. zool. Soc. London, 21: 120 (no locality).
1860 *Plecotrema rapax* DOHRN, Malak. Bl., 6: 204 (Arabia).
1860 *Plecotrema mordax* DOHRN, Malak. Bl., 6: 204 (Tahiti).
1872 *Plecotrema hirsuta* GARRETT, Amer. J. Conch., 7: 219 (Viti Isles).
1873 *Plecotrema consobrina* GARRETT, Proc. Acad. nat. Sci. Philad., 25: 236 (Viti Isles).
1946 *Plecotrema clausa*, — MADGE, Mauritius Inst. Bull., 2: 211 [non H. & A. ADAMS] (Mauritius).
1956 *Plecotrema monilifera*, — HUBENDICK, Proc. malac. Soc. London, 32: 116, pl. 23 fig. 3 (From the Red Sea and Mombassa to Mangareve; Suez; Karachi; S Japan; Reunion, New Caledonia, Rapa and Mangareva).

Shape and sculpture of this species are similar to that of *L. typica*; however, there is no periomphalic keel. Aperture with the typical columellar fold and 2 parietal teeth; outer wall with 2 palatal teeth.

Size: A 4.2-6.2 mm; D 2.7-3.8 mm.

Type locality not yet designated, probably Borneo.

Distribution: From Mombassa, Suez and Reunion to Karachi, S Japan, New Caledonia, Rapa and Mangareva. From Thailand only known from Rayong Province.

Remark: The synonymy is taken from HUBENDICK (1956) as the present author is not familiar with the species now assigned to *L. monilifera*.

***Laemodonta siamensis* (MORELET, 1875).**

pl. 15 fig. 81.

- 1875 *Plecotrema siamensis* MORELET, Sér. Conch., 4: 273, pl. 13 fig. 6 (Siam).
1891 *Plecotrema siamensis*, — FISCHER, Bull. Soc. Hist. nat. Autun, 4: 40 (Siam).
1895 *Plecotrema siamensis*, — SYKES, Proc. malac. Soc. London, 1: 245 (Siam).
1956 *Plecotrema siamensis*, — HUBENDICK, Proc. malac. Soc. London, 32: 121, pl. 23 fig. 6 (Borneo, Celebes, Philippines, Korea).
1959 *Laemodonta siamensis*, — VAN BENTHEM JUTTING, Beaufortia, 7 (83): 108 (Sibolga, Tapanuli, Sumatra).

This is the largest species of the genus. It differs from *L. decussata* by its larger size and rudimentary second palatal tooth. From all other species it differs also by its decussate sculpture as the spiral ridges between the sulci are crossed by distinct axial lines. The umbilicus is narrow or only a chink. It is surrounded by a distinct keel; this keel, however, is much weaker than in *L. typica*. There are 5-8 sulci on the penultimate whorl. The brownish shell is always unicoloured. The thick internal palatal callus carries 1 large and 1 rudi-

mentary palatal tooth. Above the strong columellar fold there is an almost horizontal parietal fold with bifurcate end and a strong parietal tooth.

Size A 7.5-9 mm; D 3.9-5.3 mm.

Type locality: "Siam"

Distribution: From Thailand only known from the east coast of the Gulf of Thailand in the Provinces of Chantaburi, Rayong, Chonburi and Trad. Extralimitarily known from Borneo, Celebes, S Korea, Philippines, (? Malaya) and Sumatra.

After examination of more material this species may be united with *L. decussata*, one being a smaller form with a strong periomphalic keel, the other a larger form with weak or rudimentary keel.

Pythiinae ZILCH, 1959.

Two genera from Thailand are assigned to this rather ill-defined, probably not homogenous subfamily:

1. Shell ventro-laterally compressed, trigonal or ovate; aperture with many teeth *Pythia*.
Shell not compressed, cylindrical or pupaeform; aperture with few folds *Cylindrotis*.

Pythia RÖDING, 1798.

Shell of medium size for the family, compressed ventro-dorsally, ovate or trigonal, with a strong varix at the left side-line. Columella with one fold, parietal wall with 2 folds. Palatal wall with a serrate ridge. Tentacles round, tapering; the eyes are placed on the back-side of their bases. Plate of the rhachis deeply incised, cutting edge simple, pointed; laterals large, with simple cutting edge, marginals squarish, with a basal process.

Type species: *Pythia helicina* RÖDING = *Helix scarabaeus* LINNAEUS.

Distribution: Coastal areas of the Indian Ocean and of the western Pacific.

In Thailand two species are known which belong to separate subgenera. The key to the subgenera is therefore also the key to the species.

Key to the subgenera from Thailand:

1. Body whorl higher than broad, upper whorls with dotted spiral lines *Pythia* s. str.
2. Body whorl broader than high, shell sculptures with fine wrinkles *Trigonopythia*.

Pythia (Pythia) s. str.

Shell ovate-conoidal, with conic spire and well rounded base. Umbilicus closed or open.

There is only one species known from Thailand. The widely distributed species as *P. scarabaeus*, *pantherina* A. ADAMS and *undata* LESSON have not yet been found in Thailand. The Indonesian and Philippine species *P. reeveana* PFEIFFER, *albovaricosa* PFEIFFER, *striata* REEVE and *crassidens* ROUSSEAU probably will not survive a critical revision of the group.

Distribution like that of the genus.

Pythia (Pythia) plicata (GRAY, 1825).

pl. 15 fig. 82.

1825 *Scarabus plicatus* GRAY, Ann. Phil., 25: 415 (Bengal).

1836 *Scarabus triangularis* BENSON, J. asiat. Soc., 5: 354 (Bengal).

1844 *Scarabus plicatus*, — KÜSTER, Conch. Cab., 1 (16): 9, pl. 1 fig. 3-4 (Bengal).

1854 *Pythia inflata* PFEIFFER, Novit. Conch., 1: 7, pl. 3 fig. 3-4 (Borneo).

1875 *Scarabus plicatus*, — MORELET, Sér. Conch., 4: 270 (Petburi, Thailand).

1950 *Pythia plicata*, — SUVATTI, Fauna Thailand: 89 (Pakpun).

Shell ovate-conical, with regularly increasing, conical spire and large, ovate and inflated body whorl the base of which is distinctly compressed ventro-dorsally. The side lines of the body whorl and of the middle whorls are carinate and carry a varix on either side. The 9 whorls are almost flat and are separated by a very shallow suture. The first 4 whorls are always dark brown, the remaining whorls are either brown or yellowish or show brown spiral bands on a yellowish ground. The upper whorls are sculptured with distinct spiral lines or delicate grooves; the body whorl is somewhat furrowed and shows delicate, irregular spiral lines. The umbilical pit is triangular, the suture is compressed into a horizontal line, separating the dorsal and ventral parts of the base of the body whorl. — The aperture is semiovate, narrowed by a system of folds and teeth. The sharp peristome is regularly curved without and straight and somewhat reflected at the columellar margin. There is a strong, high fold on the columella, an even stronger fold at the lower part of the parietal wall of the aperture with a tooth on the upper part of it. Inside the aperture there is a callous fold on the palatal wall running parallel to the peristome. This fold carries 4-6 small teeth.

Size A 18-22 mm; D 13-15.5 mm; d 10.2-12 mm.

Type locality: Bengal.

Distribution Coastal areas of S and SE Asia, Java, Sumatra, Borneo.

Habitat: Mangrove and nipa palm forests, at low tide above the water.

Pythia (Trigonopythia) KOBELT, 1898.

This subgenus differs from the typical subgenus by its still more compressed shell, triangular shape and its horizontal umbilical groove.

Type species: *Scarabus trigona* TROSCHEL.

Distribution: Coastal areas of the Indian Ocean and of the western Pacific and S China Sea.

Habitat: In mangrove and nipa palm swamps.

Pythia (Trigonopythia) trigona (TROSCHEL, 1838).

pl. 15 fig. 83.

1837 *Polyodonta carinata* BECK, Ind. Moll.: 101 [nom. nud.] (Singapore).

1838 *Scarabus trigonus* TROSCHEL, Arch. Naturg., 1: 207, pl. 4 fig. 5 (Pululoz bei Bintang).

1881 *Scarabus trigonus*, — ROCHEBRUNE, Bull. Soc. philom. Paris, 7: 33 (Indo-Chine: Saigon).

1887 *Pythia trigona*, — MARTENS, J. linn. Soc. 21: 166 (Tapo, King Island; Sullivan Island, Pegu).

1889 *Scarabus trigonus*, — MORLET, J. de Conch., 37: 129 (Prek Tuk Laak, Cambodia).

This species differs from the preceding species by the characteristics already given under the subgenus.

The 10-11 whorls are almost flat; they increase regularly in size. The body whorl is large and measures about $\frac{2}{3}$ of the height of the shell; the shell is either brownish or sand-coloured, sometimes with irregular brown dots. The umbilicus is a horizontal groove formed by the suture of the two halves of the body whorl. Parallel to the umbilical groove runs a sharp keel from the carina of the left side-line to the peristome. — Aperture extremely narrow. Columella with a strong fold which reaches the peristome. A much weaker fold is placed underneath. The parietal wall carries a strong fold below its middle and an irregularly shaped tooth between the fold and the upper insertion of the peristome. On the palatal wall there is a callous ridge which carries 5-7 teeth of different size.

Size: A 15-18 mm; D 16-18 mm; d 9-10 mm.

Type locality: Pulo Loos near Bintang, Sumatra.

Distribution In Thailand known from the provinces of Trad, Prachuap Kirikan and Chumpon. Extralimitarily known from Ceylon, Burma, Malaya, Sumatra, Java, India, Borneo, Labuan and Luzon.

Cylindrotis MOELLENDORFF, 1895.

Shell cylindrical or pupaeform, olive-coloured or corneous, smooth, glossy, rather small for the family. Aperture very narrow, pointed above and well rounded below. Base of columella truncate, with one twisted fold and a stronger parietal fold above it. There are generally 3 weak palatal folds in the aperture.

Type species: *Cylindrotis quadrasi* MOELLENDORFF.

Distribution: Known from the Philippines and Thailand only.

Habitat: Mud flats and nipa palm swamps near the coastal area. The animals are found sitting at the decaying stems of leaves of nipa palms. They feed on rotting organic matter.

In addition to the monotype of the genus one new undescribed species has been collected in Thailand.

Key to the species from Thailand:

1. Aperture about $\frac{2}{3}$ of the shell *quadrasi*.
2. Aperture about $\frac{8}{9}$ of the shell *siamensis*.

Cylindrotis quadrasi MOELLENDORFF, 1895.

pl. 16 fig. 84.

1895 *Cylindrotis quadrasi* MOELLENDORFF in QUADRAS & MOELLENDORFF, Nachr. Bl. dtsh. malak. Ges., 27: 77 (Philippines: Masbate, Negros et Culion).

1959 *Cylindrotis quadrasi*, — ZILCH in WENZ, Handb. Paläozool., 6 (2, 1): 74, fig. 239 (Philippinen: Insel Negros).

Shell small, cylindrical, with somewhat tapering spire, blunt apex and long, slender body whorl. The body whorl measures $\frac{2}{3}$ - $\frac{3}{4}$ of the length of the shell. The aperture is narrow, acutely angled above and well rounded below. The columella ends in a twisted, truncate fold. There is a small (rarely 2) columellar

fold above the end and a large, horizontal parietal fold at the beginning of the lower third of the parietal wall. There are 1-3 weak palatal folds on the inner side of the outer wall of the aperture.

Size A 6.2-9.0 mm; D 2.4-3.0 mm.

Radula with narrow, triangular rhachis; base of the rhachis incised, cutting edge simple, triangular. Laterals and marginals with a large, round cusp and a small endocone.

Type locality: Philippines: Island of Negros.

Distribution Known from Thailand and the Philippines only. In Thailand not rare in nipa palm swamps in the provinces of Trad, Rayong, Chantaburi. It has not yet been found at the coast of the Indian Ocean.

Habitat The animals sit at the insertions of the palm fronds or under the bark decaying palm trees, feeding on decaying organic matter.

***Cylindrotis siamensis* n. sp.**

pl. 16 fig. 85.

Diagnosis: A species of the formerly monotypical genus *Cylindrotis* MOELLENDORFF which differs from the type species, *C. quadrasi* MOELLENDORFF, by its shorter and broader shape, very short spire and by its very delicate spiral microsculpture.

Description: Shell of typical size for the genus, cylindrical (similar to that of a *Retusa* or *Acteocina*), solid, but not thick, corneous, transparent, glossy, smooth except for the fine growth lines and very delicate, wavy spiral microsculpture. The $4\frac{1}{2}$ whorls are somewhat convex and increase rapidly in size; the spire is very short and dome shaped, the apex obtuse. The body whorl is very large and cylindrical. It measures about $\frac{16}{17}$ of the length of the shell, leaving only 0.25 mm for the height of the spire. — Aperture very high and slender, with pointed upper part and well rounded base. It measures about $\frac{15}{17}$ of the height of the shell, leaving only a free part of the last whorl of 0.25 mm height. The truncate columella ends at the base in a twisted fold. Above it is another and weaker columellar fold and a strong, almost horizontal parietal fold. The 3 weak palatal folds, typical for the type species, are apparently missing.

Size A 4.25 mm; D 2.0 mm.

No data on animal, radula and soft parts can be given, as all animals were desiccated at the time of the description.

Type locality: Klung Harbour, Chantaburi Province.

Distribution: Known from the type locality only.

Material Holotype SMRL 4334/A; paratypes 4334/2.

Note: This species is similar to *Auriculastra brachyspira* MOELLENDORFF, but differs from the latter by the different dentition of the columella.

Cassidulinae ZILCH, 1959.

This subfamily comprises only one genus in Thailand. The other representatives of this taxon are found in the coastal areas of all tropical seas except America. Also known from the Mediterranean Sea.

Cassidula FÉRUSAC, 1821.

Shell of medium size for the family; thick, solid, not translucent, covered with a thick periderm, brownish, rarely dirtyish-white, often with one or several bands. Spire rather short, conic, body whorl large, ovate or reversedly conoidal. — Aperture narrow, with a columellar fold and 1 or 2 parietal folds. Peristome not continuous, with a thick ridge running from the upper insertion to the umbilical side. This ridge shows a distinct incision below the upper insertion. With that ridge corresponds an external varix. The umbilical pit is surrounded by a thin keel. — H. & A. ADAMS show the end of the foot bipartite like that of *Nassarius* (1854: pl. 82 fig. 2). This figure is erroneous as MARTENS (1897: 141) already pointed out. Radula with many slender teeth with simple cutting edge. Marginals with an accessory inner cusp.

Type species: *Auricula felis* LAMARCK = *Bulimus aurisfelis* BRUGIÈRE.

Distribution: Coastal areas of the Indian Ocean and the western Pacific.

Habitat: The animals live in mangrove and nipa palm forests.

Key to the Thai species:

- | | |
|---|----------------------|
| 1. Columellar fold at the end with 2-4 rami | 2 |
| — Columellar fold simple | <i>mustelina.</i> |
| 2. Shell generally larger than 23 mm | <i>aurisfelis.</i> |
| — Shell smaller than 22 mm | <i>multiplicata.</i> |

Cassidula aurisfelis (BRUGIÈRE, 1789).

pl. 16 fig. 86.

- 1789 *Bulimus auris-felis* BRUGIÈRE, Encycl. méth., 1: 343, pl. 460 fig. 5 (Mers des Grandes Indes, Mers du Sud).
- 1798 *Ellobium inflammatum* BOLTEN, Mus. Bolten.: 106; ed. alt.: 74 (no locality).
- 1819 *Auricula felis* LAMARCK, Anim. s. vert., 6 (1): 2 (Sin. pers.).
- 1825 *Voluta coffeae* WOOD, Index test.: 102, pl. 19 fig. 15 [non *V. coffea* LINNAEUS].
- 1837 *Cassidula chemnitzii* BECK, Index moll.: 105 (no locality).
- 1841 *Auricula fusca* HOMBRON & JACQUINOT, Voy. Pole Sud: pl. 9 fig. 7-9 (text see ROUSSEAU 1854).
- 1875 *Cassidula auris felis*, — MORELET, Sér. Conch., 4: 272 (Cochinchine: Baria).
- 1885 *Sidula auris-felis*, — MORGAN, Bull. Soc. zool. France, 10: 394 (P. Tikous; Bukit Tamboun; Perak).
- 1950 *Cassidula felex* (sic!), — SUVATTI, Fauna Thailand: 88 (Khan nu Paknam; Tachalom).

Shell of medium size for the family, but rather large for the subfamily and genus; reversedly ovate with regular, conic spire; rather thick, solid, with brownish ground-colour, either unicoloured or with a dirtyish-white zone at the periphery. Young specimens covered with a cuticular periderm which is lost with age. Whitish (? albinistic) specimens are not rare. The closed umbilicus is surrounded by a carina. The ovate body whorl measures about $\frac{5}{6}$ of the length of the shell, the aperture $\frac{3}{4}$ of it. — Aperture narrow, ear-shaped, not expanded. Peristome with a thick, sharp ridge within and an external varix. The peristome is connected by a thin callus only; it is sharply angled above and well rounded below. The outer margin is almost straight. The internal ridge is incised below the upper insertion. There is a rather weak parietal tooth below the upper

insertion and a strong, almost horizontal parietal fold somewhat below the middle of the parietal wall. The strong, twisted columellar fold ends in two rami. The color of the peristome and folds is either dirtyish-white or flesh-coloured.

Size A 23-30 mm; D 14-19 mm.

Animal and radula typical for the genus.

Type locality The type specimens are said to have originated from the coast of Bengal.

Distribution: In Thailand common in mangrove and nipa palm swamps together with the following species and many other species of the family and with *Cerithidea*. Extralimitarily known from the same habitats along the Indian, Burmese and Ceylonese coasts, from Malaya, Sumatra, Java, Borneo, S Vietnam, the Philippines, Moluccas, Celebes, Bali and Flores.

Parasitology Several thousand specimens have been examined for cercariae and metacercariae. Thus far none have been found infected.

***Cassidula multiplicata* MARTENS, 1865.**

pl. 16 fig. 87

1865 *Cassidula multiplicata* MARTENS, Mber. Akad. Wiss. Berlin, 1865: 54 (Bangka).

1885 *Sidula nucleus*, — MORGAN, Bull. Soc. malac. France, 10: 46 [non MARTYN, 1784] (Manila, Singapore).

1886 *Cassidula bensoni*, — MARTENS, J. linn. Soc., 21: 166 (Singapore).

1889 *Cassidula nucleus*, — MORLET, J. de Conch., 37: 129 [non MARTYN, 1784] (de Kampot à Chantabun).

1897 *Cassidula multiplicata*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostindien, 4: 142 (Bangka, Singapore, Elphinstone Bay bei Mergui).

1950 *Cassidula nuclea*, — SUVATTI, Fauna Thailand: 88 [non MARTYN, 1784] (Talui Isl.).

This species differs from the type species by its smaller size, more slender shape, the quadrifold end of the columellar fold, the brownish-violet peristome and the tuberculated middle part of the peristome ridge. The shell is generally unicoloured, rarely is a dirtyish-white band shown at the angle of the body whorl.

Size A 14-22 mm; D 9-15 mm.

Type locality: Bangka, Thailand.

Distribution: Known from Thailand from the coastal area of the Indian Ocean only. Extralimitarily known from Burma, Malaya and the Philippines. As it is almost certain that the report of *C. nucleus* from the coastal area between Chantabun (= Chantaburi) and Kampot refers to this species, the southern part of the eastern coast of the Gulf of Thailand can be included in the area of distribution. *C. nucleus* MARTYN from Tahiti is not identical with those populations from other countries stored under this name in various museums. Many of these populations belong to *C. multiplicata*, others to small forms of *C. mustelina* (DESHAYES). It may even be that *nucleus* and *mustelina* are only races of the same species. In this case, the name of DESHAYES has to be replaced by that of MARTYN. *C. nucleus* of KÜSTER and PFEIFFER seems to refer to this species, *nucleus* of GASSIES is evidently *mustelina*. As this species shows a decussate cuticula and hairs when juvenile it may well be identical with *C. sowerbyana*, *bensoni* and *turgida* PFEIFFER.

Remarks: Not all reports of *C. nucleus* in the literature are included in the synonymy of this species as it was impossible to check the material on which these

reports were based. However, we may not be mistaken, if we consider most reports from other localities than the Pacific islands as referring to this species, unless the descriptions or figures leave no doubt that another species is meant. *C. turgida* PFEIFFER (1854 Malak. Bl., 1: 134) differs by its shorter spire and decussate sculpture. It is said to live in Singapore. It may be nothing but an individual form of this species. I am unable to separate *C. sowerbyana* PFEIFFER from this species.

Cassidula mustelina (DESHAYES, 1830).

pl. 16 fig. 88.

- 1830 *Auricula mustelina* DESHAYES, Encycl. méth., Vers., 2: 92 (New Zealand).
1834 *Cassidula mustelae* BECK, Index moll.: 105 (O. pf. N. Zeland).
1854 *Auricula rhodostoma* ROUSSEAU in HOMBRON & JACQUINOT, Voy. pole sud: 33, pl. 9 fig. 1-3 (New Guinea).
1885 *Sidula mustelina*, — MORGAN, Bull. Soc. zool. France, 10: 394 (Singapore, Penang, Wellesley).
1889 *Cassidula mustelina*, — MORLET, J. de Conch., 37: 129 (Entre Kampot et Bangkok).
1897 *Cassidula mustelina*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostind., 4: 144, pl. 8 fig. 15 (Java, Borneo, Sumatra, Aru Isl., New Guinea, Siam, Penang, Singapore, Cambodia, Formosa, Mauritius).
1950 *Cassidula mustelina*, — SUVATTI, Fauna Thailand: 88 (Tachin).

This species differs from the type species and *C. multiplicata* by the simple, never bifurcate columellar fold, its smaller size and shorter spire.

Shell either unicoloured or with 3 (2-4) whitish spiral bands. The internal ridges of the peristome are brownish-violet, rarely dirtyish-white. The upper parietal tooth is weak, the parietal fold moderately strong and the columellar fold simple. A distinction from small *C. aurisfelis* and large *C. multiplicata* is easy by the dark peristomal ridge and the simple columellar fold.

Size A 14-28 mm; D 9.5-15.0 mm.

Soft parts and radula typical for the genus.

Type locality DESHAYES gave New Zealand as origin of his specimens. This was an error as they came from Singapore.

Distribution: In Thailand common in mangrove and nipa palm forests near the coasts of the Gulf of Thailand and of Indian Ocean. The species lives together with the preceding species. Extralimitarily known from Mauritius through SE Asia to the Philippines, New Guinea, NE Australia, New Caledonia and Formosa.

Parasitology In several thousand specimens from various localities no cercariae or metacercariae were found.

Auriculastra MARTENS, 1880.

Shell of medium size for the family; elongately fusiform, thick-shelled when adult, but rather thin when juvenile; spire conic, surface smooth except for the growth lines. Aperture elongate, with columellar and parietal fold. Peristome thick within, but without teeth or folds.

Type species: *Auricula subula* QUOY & GAIMARD.

Distribution: From Mauritius and S and SE Asia to Indonesia, New Guinea, the Philippines and N Australia.

Habitat: Mangrove and nipa palm swamps.

Auriculastra subula (QUOY & GAIMARD, 1832).

pl. 16 fig. 89.

- 1832 *Auricula subula* QUOY & GAIMARD, Voy. Astrolabe, Zool., 2: 171, pl. 13 fig. 39-40 (Port Carteret, Nouvelle Irlande).
1880 *Marinula (Auriculastra) subula*, — MARTENS in MÖBIUS, Beitr. Meeresfauna Mauritius: 208 (Mauritius).
1897 *Auriculastra subula*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostind., 4: 158 (Bengalen, Mergui, Singapore, Siam, Celebes, Halmaheira, Ceram, Flores, Philippinen, Palaos, Key Inseln, Neu Guinea, Neu Irland, Neu Caledonien).

Shell elongately fusiform, smooth except for the growth lines, glossy, but generally somewhat eroded; corneous or straw-coloured, unicoloured; spire conic, with pointed apex; this however, is generally eroded; the suture is generally crenulated. — Aperture elongate, pointed above and well rounded below; whitish within; parietal lamella strong, horizontal, columellar fold smaller, twisted; columella truncate in juvenile specimens, straight and callous in adults. Outer margin of the peristome thick, with a swelling in the middle, but without teeth or folds within.

Size A 10.5-15.5 mm; D 4.7-5.7 mm.

Radula with relatively broad laterals with simple cutting edges, marginals with an endocone.

Rhachis triangular, with a deep incision at the base. Because of the shape of the rhachis, this genus is placed close to *Cassidula*.

Type locality: Port Carteret, New Ireland.

Distribution In Thailand not rare in mangrove swamps, nipa palm forests and mud flats with vegetation. Found in the provinces of Chonburi, Chantaburi, Trad, Rayong, Ranong, Trang and Nakhon Sritammarat. Extralimitarily known from Mauritius, India, Burma, Malaya, Sumatra, Celebes, Borneo, Moluccas, Lesser Sunda Islands, New Guinea, E Australia, New Caledonia and New Ireland.

Remarks: The present author has studied several lots of *A. dunkeri* PFEIFFER, *saccata* PFEIFFER and *semiplicata* A. ADAMS, including their types. There is hardly any doubt that the first species belongs into the synonymy of *subula*. The two latter species are closely related to the type. *A. oparica* H. & A. ADAMS, first known from the Society Islands, was also reported from Sumatra, but has not yet been found on the continent.

Auriculastra elongata (KÜSTER, 1844).

- 1844 *Auricula elongata* KÜSTER, Conch. Cab., 1, 16: 53, pl. 8 fig. 6-8 (Sandwich Inseln).
1875 *Auricula elongata*, — MORELET, Sér. Conch., 4: 93 (Maurice).
1898 *Auriculastra elongata*, — KOBELT, Conch. Cab., 1, 16: 96, pl. 15 fig. 17-18 (von Mauritius bis zu den Sandwich Inseln).

Shell more slender than that of the preceding species. Columella truncate at the base, with a horizontal fold and a small denticle above it. The end of the columella carries a distinct twisted fold and a much weaker one above it. — Aperture narrow, peristome connected by a whitish callus.

Size A 11.2-12.2 mm; D 4.4-5.6 mm.

Type locality: Sandwich Islands.

Distribution: From Mauritius to the Sandwich Islands. In Thailand found in Trad Province.

Melampodinae H. & A. ADAMS, 1854.

Most of the representatives of this subfamily have either palatal teeth or folds as in Pedipedinae. However, they differ from the species of that subfamily by having a common genital duct as Ellobiinae and Cassidulinae.

Distribution: Coastal areas of the tropical and some of the subtropical countries; New Zealand.

There is only one genus represented in Thailand:

Melampus MONTFORT, 1810.

Shell elongately ovate or ovoidal-conic, with pointed or depressed spire and flat whorls. Aperture narrow, columella with 1 or 2 folds and with 2 or more folds or teeth on the parietal wall. On the palatal wall there are 1-5 teeth or folds. In several species the posterior end of the foot is cleft. Rhachis and laterals of the radula with simple, triangular cutting edges. Marginals with few to several cusps.

Type species: *Bulimus coniformis* BRUGUIÈRE = *Voluta coffea* LINNAEUS.

Distribution: Coastal areas of the tropical seas.

Habitat: Mud flats and tidal areas of the beaches.

At the present time 5 species from Thailand are assigned to this genus. One species, an unidentified *Detracia*, is not included in this fauna as it lives at the tidal mark of the beaches.

Key to the Thai subgenera:

1. Base of columella straight; columellar fold does not attain peristome 2
- Base of columella twisted; columellar fold inserts into peristome *Micromelampus*.
2. Spire elongate; shell slender, base with fine spiral lines *Detracia*.
- Spire depressed, shape reversedly conic, umbilical area smooth *Melampus*.

Melampus (Melampus) s. str.

Shell of small or medium size for the family, rather large for the subfamily and genus, reversedly ovoidal-conic with regularly conic spire which is generally rather short, and large body whorl. Aperture narrow, columella with a strong fold which does not reach the peristome. Above it 1-5 parietal and columellar folds. Palatal wall with several folds. — Radula as in the genus.

Distribution: As in the genus.

Habitat: Mud flats.

There is only one species known from Thailand.

Melampus (Melampus) fasciatus (DESHAYES, 1830).

pl. 16 fig. 90.

1830 *Auricula fasciata* DESHAYES, Encyl. méthod., 2: 90 (no locality).

1832 *Auricula monile* QUOY & GAIMARD, Voy. Astrolabe, Zool., 2: 166, pl. 13 fig. 28-33 [non LAMARCK] (New Guinea).

1841 *Auricula soricina* HOMBRON & JACQUINOT, Voy. Pole sud, Moll.: pl. 9 fig. 23-26 (Ceram).

1875 *Melampus fasciata*, — MORELET, Sér. Conch., 4: 271 (Saigon).

Shell solid, rather large for the genus, reversedly conoidal with conic spire whose side-lines may be a little concave. Apex pointed, sharp, brown, the post-nuclear whorls either brown or sand-coloured, the last two whorls either of the same colour or with several brown bands, generally 5. Umbilical area without spiral lines but with a very feeble spiral, wavy microsculpture. The other parts of the shell are smooth except for the fine growth lines. — Aperture long and narrow, pointed above and well rounded below. Outer margin sharp, almost straight, with a whitish callous ridge which carries 9-14 teeth. Base of the columella thick, straight. The spiral columellar fold is not very strong and does not reach the peristome. Above it is a weaker columellar fold. There are 2 parietal folds, the upper one being very weak, the typical lower one is moderately strong.

Size: A 12-15 mm; D 8.0-9.5 mm.

Animal and radula typical for the genus. The foot is distinctly cleft behind. The eyes, placed on the upper part of the bases of the tentacles, are surrounded by a whitish area.

Distribution: Coastal areas of the Indian and western Pacific Ocean from the Red Sea to the Society Islands. From Thailand only known from the Island of Phuket, but probably further distributed.

Habitat: The biotop in Thailand is a muddy, lagoon-like area near the estuary of a small river which is almost devoid of any vegetation.

***Melampus (Micromelampus)* MOELLENDORFF, 1898.**

Differs mainly from *Melampus* s. str. by the twisted end of its columella, which ends in a strong fold. Shape pupaeform, surface sculptured with fine pitted spiral lines.

Type species: *Melampus (Micromelampus) nucleolus* MARTENS.

Distribution Coasts of the eastern Indian and western Pacific Oceans.

Key to the Thai species:

- | | |
|---|---------------------|
| 1. Shell 11 : 7 mm and larger, with 4-6 (4-8) palatal folds | <i>siamensis</i> . |
| — Shell 8 : 5 mm and smaller, with 10-15 palatal teeth | 2 |
| 2. Shell without or with very delicate and irregular spiral lines | <i>nucleolus</i> . |
| — Shell with distinct spiral rows of pits | <i>pulchellus</i> . |

***Melampus (Micromelampus) nucleolus* MARTENS, 1865.**

pl. 16 fig. 91.

1865 *Melampus nucleolus* MARTENS, Mber. Akad. Wiss. Berlin, 1865: 55 (Bohol).

1876 *Melampus nucleolus*, — PFEIFFER, Mon. Pneum., 4: 308 (Amboina).

1886 *Melampus nucleolus*, — TAPPARONE-CANEFRI, Ann. Mus. civ. St. nat. Genova, (2) 4: 231 (Bandan, New Guinea).

1897 *Melampus nucleolus*, — MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostind., 4: 164 (Amboina, Ceram, Bohol, New Guinea).

Ovoidal-conic or pyriform, body whorl well rounded. Young specimens with few delicate, irregular spiral lines, old specimens generally only with periomphalic spiral lines. Colour reddish brown, sometimes with 3 or 4 rows of white patches. Columellar fold strong, thick, sometimes double at the end. Parietal folds 2, rather strong, of equal length, deeply placed. Above them are 2 weak parietal teeth. Palatal ridge with 10-15 small teeth.

Size A 6.2-8.0 mm; D 4-5 mm.

Type locality: Small island off Canape on Bohol.

Distribution: New Guinea, Philippines, Ceram. In Thailand known from Palian, Province of Trang, only.

Melampus (Micromelampus) pulchellus (PETIT, 1842).

1842 *Auricula pulchella* PETIT, Proc. zool. Soc. London, 1842: 202 (Cebu).

1858 *Tralia (Tifatia) pulchella*, — H. & A. ADAMS, Gen. rec. Moll., 2: 245 (Philippines).

1880 *Melampus frayssei* GASSIES, Act. Soc. linn. Bordeaux, 34: 54, pl. 4 fig. 26 (Lifou, îles Loyalty; Nouvelle Calédonie).

1885 *Melampus pulchellus*, — MORGAN, Bull. Soc. zool. France, 10: 392 (Cebu, Singapore).

This small species differs from the preceding species by its much smaller size and its long, conic spire which makes it look similar to *Plecotrema*. Colour reddish-brown, with 4 spiral rows of white patches. The whole shell, not only the periomphalic area, is sculptured with regular spiral lines of small pits. — The dentition of the aperture consists of a strong, twisted columellar fold and a weak, short parietal fold. Above and below this appears generally a very weak tooth. The parietal fold may be connected by a callus with the lower tooth. The palatal ridge has 8-10 short folds.

Size: A 5-6 mm; D 3-4 mm.

Type locality Cebu, Philippines.

Distribution: Philippines, New Caledonia, Singapore, Bombay, Tonkin, Thailand. In Thailand only known from several localities from the Trad Province.

Habitat Like that of the preceding species.

Melampus (Micromelampus) siamensis MARTENS, 1865.

pl. 16 fig. 92.

1865 *Melampus siamensis* MARTENS, Mber. Akad. Wiss. Berlin, 1865: 54 (Petchburi, Siam).

1874 *Melampus siamensis*, — JICKELI, Act. nov. Leop., 37: 176, pl. 7 fig. 2 (Schech Said, Dahlak Ins.).

1875 *Melampus siamensis*, — MORELET, Sér. Conch., 4: 271 (Siam).

1898 *Melampus siamensis*, — KOBELT, Conch. Cab., 1 (16, 2): 197, pl. 22 fig. 18, pl. 23 fig. 25-26 (Am vorderen Indischen Ozean, von Hinterindien bis zum Rothen Meer).

This is the largest of the three Thai species of the subgenus. Its shape is more reversedly conic, more inflated and broader than that of the others; brownish, but often with 2-4 whitish spiral bands. On young specimens traces of a delicate, irregular spiral sculpture may be found. Adult specimens show this sculpture generally only around the closed umbilicus. — Columellar fold large, thick, twisted; above it is a strong, almost horizontal parietal fold, and above this 2-4 small teeth which may grow together and form a vertical ridge. The palatal folds are less in number than in the two preceding species (4-7), but they reach much deeper into the interior of the shell.

Size: A 11-14 mm; D 6-8 mm.

Type locality: Siam: Petchaburi.

Distribution Coasts of the Indian and western Pacific Ocean.

Habitat: Mud flats, mangrove forests.

This subfamily comprises the largest living species of the family. As there is only one recent genus in Thailand see below for further details.

Ellobium RÖDING, 1798.

Shell medium-sized to large, ovoidal-conic or somewhat fusiform, thick, covered with a brown periderm, upper part of the whorls decussated or granulated. Outer margin of the peristome with a thick lip; this shows a swelling but is devoid of any folds or teeth. Columella with a twisted fold, parietal wall with a large fold and often with a tooth above it. — Radula with a slender, fusiform rhachis and broad, irregularly ovate laterals with broad, simple cutting edges. Marginals triangular or conoidal. Reproductive organs with common genital duct.

Type species: *Ellobium midae* RÖDING = *Bulla aurismidae* LINNAEUS.

Distribution Coastal area of the Indo-Pacific.

Habitat: Mangrove and nipa palm forests; mud flats with vegetation.

Key to the Thai species:

1. A : D = 70 : 40 mm and larger; without parietal tooth; surface coarsely granulated
aurismidae.
2. A : D = 55 : 20 mm and smaller; with strong parietal tooth; surface delicately decussated
aurisjudae.

Ellobium aurismidae (LINNAEUS, 1758).

pl. 16 fig. 93.

1758 *Bulla auris-midae* LINNAEUS, Syst. Nat., ed. 10: 728 (no locality).

1798 *Ellobium midae* RÖDING, Mus. Bolten.: 105 (no locality).

1798 *Ellobium ceramense* and *E. tumidum* RÖDING, Mus. Bolten.: 105 (Ceram).

1801 *Auricula midae* LAMARCK, Syst. anim. s. vert.: 92 (no locality).

1889 *Auricula auris-midae*, — MORLET, J. de Conch., 37: 129 (de Hatien à Kampot, Cambodia).

1904 *Auricula auris-midae*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 413 (Cambodge, Tonkin, Bangkok, Kompong-Som).

1950 *Auricula auris-midae*, — SUVATTI, Fauna Thailand: 88 (Bandon Bight).

1966 *Ellobium (Ellobium) aurismidae*, — SOLEM, Spolia zool. Mus. haun., 24: 20 (Kao Soi Dao, Makhamb District; Chantaburi Prov.).

Shell very large for the family — it is the largest species known from this family and of all Basommatophora —, thick and solid, of white ground colour, but covered with brown periderm. Somewhat compressed dorso-ventrally, with a strong varix at the left side resulting from a growth interval. Spire short, conic, with obtuse apex, body whorl large, ovate, measuring about $\frac{6}{7}$ of the height of the shell; it is obtusely shouldered. The granulation of the surface is particularly coarse above this shoulder and stronger around the umbilical area than on the middle part. — Aperture ear-shaped (auriform, hence the name of the species). The peristome is extremely thick and porcelaneous. It is either whitish or brown. It is thickened in the middle of the outer wall of the aperture and shows a verti-

cal ridge on the parietal wall when adult. The twisted columellar fold does not reach the peristome. Above it is a stronger, almost horizontal parietal fold. Internal parietal tooth is missing. — Animal with round tentacles whose tips are distinctly swollen and of somewhat darker colour. — Radula typical for the genus.

Size A 70-85 mm; D 40-50 mm; these are the measurements of specimens from Thailand. There are specimens reported with a height of above 100 mm.

Type locality Has not yet been designated.

Distribution: In Thailand known from the coastal areas of the Indian Ocean and of the Gulf of Thailand: Grabi, Pang Nga, Kantang, Chantaburi, Trad, Rayong. Extralimitarily known from Malaya and Singapore, Java, Sumatra, Borneo, Cambodia, S Vietnam, New Guinea, N and NW Australia, Queensland, Celebes and Ceram. Not yet reported from the Philippines and Pacific islands. Its occurrence in Burma is highly probable. Reports from the Indian coasts need confirmation.

Habitat: This species lives amphibiously on mud flats with vegetation, in nipa palm and mangrove swamps and at the muddy banks of rivers near the estuary.

Ellobium aurisjudae (LINNAEUS, 1758).

pl. 16 fig. 94.

1758 *Bulla auris judae* LINNAEUS, Syst. Nat., ed. 10: 728 (no locality).

1798 *Ellobium labrosum* and *E. subtile* RÖDING, Mus. Bolten.: 105 (no locality).

1817 *Auricula reticulata* SCHUMACHER, Essai nouv. syst.: 229 (no locality).

1854 *Auricula dactylus* and *A. turrita* PFEIFFER, Nov. conch., 1: 15, pl. 5 fig. 15-16 (Borneo), pl. 4 fig. 8-9 (Philippines).

1874 *Auricula australiana* TAPPARONE-CANEFRI, Zool. viaggio Magenta, Mal.: 105, pl. 2 fig. 10 (Australia).

1889 *Auricula dactylus*, — MORLET, J. de Conch., 37: 129 (Kampot, Kep, Cambodge).

1950 *Auricula auris-judae*, — SUVATTI, Fauna Thailand: 88 (Singora, Bandan, Koh Samui, Chantaburi estuary, Tachin).

Shell somewhat smaller and much more slender than that of the type species. It is almost cylindrical. The sculpture is much weaker and consists of axial striae which are crossed by fine spiral lines causing a pattern of small granules. These are somewhat stronger on the upper half of the body whorl than on the lower half. — The dentition of the aperture differs from that of the type species by its strong parietal tooth above the parietal fold. The columellar fold is almost vertical. The internal lip of the peristome shows a weak swelling in the middle.

Size: A 30-70 mm; D 13-25 mm.

Radula similar to that of the type species. The rhachis, however, is elongately triangular, with broader base and tapering towards the cutting edge. Laterals and marginals with broad, simple cutting edges.

Type locality: Not yet designated.

Distribution: In Thailand in mangrove swamps, nipa palm forests and mud flats near the coasts of the Gulf of Thailand and of the Indian Ocean. The populations of this species are not found together with the type species which prefers the mud-banks of rivers in the estuarine area. Extralimitarily known from India, Burma, SE Asia, Indonesia, Philippines, Moluccas, New Guinea and Australia.

Remarks: MARTENS (1897: 153) reports *E. subnodosa* (METCALFE) [= *auris-malchi* O. F. MÜLLER] from Singapore. Even if we recognize this species, the report

from Singapore seems to refer to another species, as no other species but the two above described have been found recently in Singapore. *Auricula moerchi* MENKE and *A. schep-makeri* PETIT are also dubious species. The first may be a synonym of *aurismidae*, the latter of *aurisjudae*; this was reported from Sumatra. *Ellobium chinensis* (PFEIFFER), known from China and Tonkin, has never been found further south. It looks like a small *aurisjudae* with the dentition of an *aurismidae*. Other *Ellobium* species from Sumatra which are not yet known from the continent, are: *limnaeiforme* (ANNANDALE), *nevillei* (MORELET), *tornatelliforme* (PETIT) and *percha* (ANNANDALE).

Lymnaeacea GRAY, 1842.

This superfamily is here understood in the sense of BAKER (1956) who restricted it to the two families of Lymnaeidae and Lancidae. As only the first of these two families is found in Thailand — the patelloid family of Lancidae is restricted to America — the description of this superfamily is identical with that of the family.

Lymnaeidae GRAY, 1842.

Shell oval, ovoidal-conic or turreted, thin, generally dextral; with large aperture and simple peristome; the columella generally shows a twisted fold. — Head flap-like, separated from the body, without rostrum or proboscis; the tentacles are triangular; the eyes are placed at the anterior part of the bases of the tentacles. — The jaw consists of a trapezoidal plate with a curved, round process on either side. The radula consists of numerous rows of many small teeth. The rhachis has a simple, pointed cusp. The laterals generally have 3 cusps, the marginals have 4-8 cusps, the number of cusps being reduced in the outer marginals. — The hermaphrodite gland and its duct lie embedded in the digestive gland; the male and female organs are placed at the right side of the pallial cavity. The upper part of the reproductive organs are uniform in all species, the distal organs, however, show some variation which are used for taxonomic purposes. The orange coloured spermatheca is an oval or rounded sac; its duct opens into the uterus near the opening. The differently shaped prostate gland is placed near the large albumen gland. The vas deferens starts at its distal end. The penial complex consists of a narrow tubular part and a large muscular distal part. The first part is the penial sheath which contains the small, pointed verge, the latter is the preputial part. There is no flagellum.

Distribution: Cosmopolitan.

Habitat: Restricted to freshwater only. In lakes, ponds, rivers and creeks. Also found in artificial water courses, canals, ditches and irrigation trenches.

The many genera and subgenera which were introduced to divide the large genus *Lymnaea* have not yet been generally accepted. There is only one genus represented in Thailand, *Radix* MONTFORT, although the 3 species known from this country were formerly assigned to three different genera or subgenera, *Radix*, *Cerasina* and *Galba*. For the convenience of parasitologists, *Radix* is here treated as a subgenus of *Lymnaea*.

Parasitology: The family of Lymnaeidae is of great parasitological importance as it includes several intermediate hosts of trematodes which infect man and mammals.

Lymnaea LAMARCK, 1799.

Shell dextral, with short, often minute, conic spire and large, inflated body whorl.

Distribution: Cosmopolitan.

Lymnaea (Radix) MONTFORT, 1810.

Shell ovate or ovoidal-conic, thin, with short, conic spire; translucent, corneous, without sculpture. Aperture large, ovate, peristome thin, sharp. Columella with more or less distinct fold.

Type species *Radix auriculatus* MONTFORT = *Helix auricularia* LINNAEUS.

Distribution: Europe, Africa, Asia. Imported into North America.

Habitat Like that of the family.

Key to the Thai species:

- | | | |
|--|-----|---------------------|
| 1. Shell larger than 14 mm; outer margin of columella twisted | ... | 2 |
| — Shell smaller than 14 mm; outer margin of columella regularly curved | | <i>viridis.</i> |
| 2. Prostate gland unfolded; side-lines concave | | <i>auricularia.</i> |
| — Prostate gland multifolded; side-lines straight or convex | | <i>luteola.</i> |

Lymnaea (Radix) auricularia (LINNAEUS, 1758).

This well-known species of *Lymnaea* is distributed over Europe, parts of N-Africa and over almost all Asian country except for N-Siberia. It is introduced into U. S. A. and found in several Indo-Pacific islands.

Two geographic races are known from Thailand, *L. a. rubiginosa* (MICHELIN) and *L. a. swinhoei* (H. ADAMS) but at several localities, particularly in the north, populations were found which may well be assigned to the type race. In the south of Thailand forms were found which resemble the slender form from Kashmir, known as *L. lagotis defilippi* ISSEL. All these forms are connected by intermediate forms.

It is difficult to give a key to these forms as they are very variable. *L. a. swinhoei* is larger than *L. a. rubiginosa* and has a broader and longer spire, but a narrower aperture. The peristome is angled beside the upper insertion, that of *a. rubiginosa* is generally rounded.

Lymnaea (Radix) a. rubiginosa (MICHELIN, 1831).

pl. 16 fig. 95.

1831 *Limnaeus rubiginosus* MICHELIN, Mag. Zool., 1 (1): Moll. no 22, pl. 22 (Indes Orientales).

1834 *Lymnaea succinea* DESHAYES in BELANGER, Voy. Ind. Orient.: 418, pl. 2 fig. 13-14 (Ind. orient.).

1848 *Limnaeus longulus* MOUSSON, Mitth. naturf. Ges. Zürich, 1: 267 (Java).

1862 *Limnaeus auricula* KÜSTER, Conch. Cab., 1 (17b): 30, pl. 5 fig. 20-21 (Ostindien).

1862 *Limnaeus megaspida* KÜSTER, Conch. Cab., 1 (17b): 34, pl. 6 fig. 13 ("Brasilien", wohl eine ostindische Art).

- 1862 *Limnaeus singaporinus* KÜSTER, Conch. Cab., 1 (17b): 35, pl. 6 fig. 17 (in Ost-indien bei Singapore).
- 1862 *Limnaea spadicea* MORELET, Proc. zool. Soc. London, 1862 (30): 438 (Bangkok, Saigon).
- 1866 *Limnaea crosseana* MABILLE & LE MESLE, J. de Conch., 14: 130, pl. 7 fig. 5 (Cambodia, Cochinchina).
- 1870 *Limnaea siamensis* SOWERBY, Conch. Icon., 18: fig. 63 (Siam).
- 1875 *Limnaea spadicea*, — MORELET, Sér. Conch., 4: pl. 13 fig. 10 (Bangkok, Saigon).
- 1891 *Limnaea spadicea*, — MORLET, J. de Conch., 39: 233 (Maenam Pinh, Xieng Moi).
- 1928 *Limnaea luteola* f. *siamensis*, — RAO, Rec. Ind. Mus., 30: 456 (Lower Burma, N and S Shan States).
- 1929 *Limnaea klossi* GHOSH, J. fed. Mal. St. Mus., 14: 395 (Malaya).
- 1950 *Limnaea (Gulnaria) siamensis*, L. (*Radix*) *spadicea* and *Limnaea* spec., — SUVATTI, Fauna Thailand: 89 (Nontaburi, Klong Borapet, Bangkok, Chieng Mai, Chieng Rai, Surat).
- 1951 *Lymnaea auricularia rubiginosa*, — HUBENDICK, Handl. kungl. svensk. Vet. Akad., (4) 3 (1): 50, 52, 56, figs. 180-185, 188-190, 193, 194, 201, 204, 207 (Thailand, Malaya, Java, Sumatra, Sumba, Cambodia, Laos, Vietnam).
- 1962 *Lymnaea (Ceracina) luteola*, — HABE, Nature & Life SE Asia, 3: 57, pl. 2 fig. 13 [non LAMARCK] (Bangkok).

This race from SE Asia differs from the European race by its smaller size and less inflated body whorl. Shell thin, translucent, corneous, with small, short, pointed spire and large, oval body whorl. The uppermost of the 5½ whorls are almost flat, the penultimate whorl is somewhat convex and the last whorl is large and inflated. The side lines of the spire appear concave because of the inflated body whorl. This may be moderately shouldered below the suture. — Aperture large but not extended, moderately expanded or not, connected by a thin, sinuous callus; the outer margin of this callus is S-shaped, its columellar part shows a slightly twisted fold.

Size: A 12-32 mm; D 17-20 mm; A of aperture 8-24 mm.

The male reproductive organs show a prostate gland with unfolded lobe, otherwise typical for the family.

Type locality: "Indes Orientales" The original specimens are said to come from Bogor in Java.

Distribution In Thailand this race is found everywhere except for the northernmost provinces. Extralimarily known from Laos, Cambodia, Vietnam, Malaysia and Indonesia. Several reports of *Radix luteola* from Burma seem to refer to this species.

Habitat: This race is found in all kinds of bodies of water, lakes, ponds, brooks, canals, ditches, rivers and even mountain creeks, but it seems to prefer still water.

This race has often been confused with *L. luteola* LAMARCK.

Parasitology *L. a. rubiginosa* is an important intermediate host of several trematode species in Thailand and other parts of SE Asia. It is known to harbour the larval stages of *Schistosoma incognitum*, a blood-fluke which does not develop in man but may cause cercarial dermatitis. It is also the first intermediate host of *Fasciola hepatica* in Thailand, of *Fasciola gigantica*, *Orientobilharzia harinasutai* and several avian species of blood-flukes which cause cercarial dermatitis. For this reason the species is known in Thailand under the vernacular name "hoy kunn" ("itchy snail"). It has also been found to serve as second intermediate host for several species of Echinostomatidae.

Lymnaea (Radix) a. swinhoei (H. ADAMS, 1866).

pl. 16 fig. 96.

- 1866 *Limnaea swinhoei* H. ADAMS, Proc. zool. Soc. London, 1866: 319, pl. 33 fig. 13 (Takow, Formosa).
1867 *Limnaeus chinensis* MARTENS, Malak. Bl., 14: 221 (China, auf den Tsushan Inseln).
1877 *Limnaea yunnanensis* NEVILL, J. asiat. Soc. Bengal, 46: 27 (Yunnan).
1886 *Limnaea annamitica* WATTEBLED, J. de Conch., 34: 57 (Hue).
1886 *Limnaea chefouensis* CLESSIN, Conch. Cab., 1, 17: 391 (Che-Fou, China).
1887 *Limnaea discreta* MABILLE, Bull. Soc. malac. France, 4: 133 (Tonkin).
1887 *Limnaea hagenmulleri* MABILLE, Bull. Soc. malac. France, 4: 134, pl. 3 fig. 6 (Tonkin).
1889 *Limnaea balansai* and *L. unica* MABILLE, Contr. Faune malac. Tonkin: 12, 13 (Tonkin, Chobo).
1918 *Limnaea shanensis* ANNANDALE, Rec. Ind. Mus., 14: 107, pl. 10 fig. 5-8, pl. 11 fig. 2-3 (He-Ho, Inle-Lake, S Shan States).
1939 *Radix swinhoei*, — YEN, Abh. senckenb. naturf. Ges., 444: 66, pl. 5 fig. 43 (Hainan; Swatow, Kwangtung).

The shell is very similar to that of the preceding race, but generally much larger, more elongate, with more cylindrical and distinctly shouldered body whorl.

Size A 24-34 mm; D 16-20 mm.

VAN BENTHEM JUTTING (1956: 457) gives 34 20 mm as largest dimensions for *L. a. rubiginosa* from Java. This team has never found specimens of that race which attained the above given maximal size, although more than 50000 specimens were collected in Thailand, Malaysia and Indonesia.

Type locality: Takao (= Kaohsiung), Formosa.

Distribution In Thailand found in the northernmost parts of the provinces of Mae Hongson, Chiang Mai, Nan and Chiang Rai. Extralimarily known from China, Tonkin, N Burma, N Laos and Japan. Probably *L. quadrasi* MOELLENDORFF is also synonymous with this subspecies and if this is the case its distribution also extends to the Philippines.

Parasitology: This subspecies replaces the preceding race in its area of distribution. It serves as intermediate host for the same trematode species as its southern counterpart.

Lymnaea (Radix) viridis QUOY & GAIMARD, 1832.

pl. 16 fig. 97.

- 1832 *Lymnaea viridis* QUOY & GAIMARD, Voy. Astrolabe, Zool., 2: 204 (Guam).
1859 *Limnaea ollula* GOULD, Proc. Boston Soc. nat. Hist., 7: 40 (Hongkong).
1867 *Limnaeus pervius* MARTENS, Malak. Bl., 14: 221 (Tshi fu).
1877 *Limnaea goodwinii* SMITH, Q. J. of Conch., 1: 125 (Yokohama).
1877 *Limnaea andersoniana* NEVILL, J. asiat. Soc. Bengal, 46 (2): 26 (Nantin, Yunnan).
1886 *Limnaeus philippinensis*, — CLESSIN, Conch. Cab., 1, 17: 282 [non MOUSSON] (Polili, the Philippines).
1905 *Limnaea blaisei* DAUTZENBERG & FISCHER, J. de Conch., 53: 116, pl. 5 fig. 1-2 (Van Ien; Song Luc-Nam, Tonkin).
1909 *Limnaea bowelli* PRESTON, Rec. Ind. Mus., 3: 115 (Te-ring Gompa; Mang-tsa; High Hill, Gompa; Gyantse Valley; all between 13500 and 14500 feet).
1925 *Limnaea laticallosa* ANNANDALE & RAO, Rec. Ind. Mus., 27: 105 (Kalaw, west of He-Ho plain, Burma).

- 1937 *Galba laticollosiformis* YEN, Publ. Mus. Hoanghos Paio, 34: 18 (Ma-chia-pu, Shansi, China).
 1951 *Lymnaea viridis*, — HUBENDICK, Handl. kungl. svensk. Vet. Akad., (4) 3 (1): 162, figs. 48-50, 232-236, 246-251, 277, 298, 551 (India, Burma, Tonkin, S-China, Japan, Hongkong, Celebes, Philippines, Japan).

This species is generally much smaller than *L. auricularia*. The whorls are well rounded, the spire is regularly conic, never concave at the side-lines, the aperture is regularly oval, without angles. The left margin of the parietal and columellar callus is regularly rounded. It does not form an obtuse angle as in *L. auricularia*.

Size: A 8.0-14.0 mm; D 5.0-11.0 mm; mountain forms from small creeks with fast current are much smaller; sometimes they may attain height of less than 5 mm.

This species was formerly placed into the subgenus (genus) *Galba* because of its short penial complex. Because of the fewer number of chromosomes (16), however, a systematic position in the subgenus *Austropeplea* COTTON was suggested by INABA (1969: 162).

Type locality: Guam.

Distribution: In Thailand known from the provinces of Thonburi, Bangkok, Mae Hongson, Chiang Mai and Nan only. This species is much rarer than the preceding species. Mae Hongson Mae Hongson, 12 km S of the town; Huai Mae Han near Mae Sarieng; Maenam Yuam, N of Mae Sarieng; 40 km N of Mae Sarieng. Nan Huai Mae Samien; 20 km NW of Nan; 9 km S of Lae; Tawan Pha. Thonburi Pak Klong San. Extralimitarily known from N-India, Burma (*bowelli*); Malaya (leg. author); Java (leg. author); Sumatra (leg. author); Celebes (*viridis*); Philippines (*philippinensis*); China (*ollula*, *pervius*, *andersoniana*); Japan; Hawaii; Taiwan.

Parasitology Like that of *L. auricularia*.

***Lymnaea (Radix) luteola* LAMARCK, 1822.**

pl. 16 fig. 98.

- 1822 *Lymnaea luteola* LAMARCK, Hist. nat. Anim. s. Vert., 6 (2): 160 (India).
 1834 *Lymnaea succinea* DESHAYES, Voy. Belanger, Zool.: 418, pl. 2 fig. 13-14 (Malabar).
 1837 *Limnaeus impurus*, *L. cerasus*, *L. nucleolus* and *L. prunus* TROSCHEL, Arch. Naturgesch., 3: 172 (Bengal).
 1858 *Limnaea tigrina* and *L. pinguis* DOHRN, Proc. zool. Soc. London, 1858: 134 (Ceylon).
 1862 *Limnaea ovalis* GRAY in SOWERBY, Gen. Shells, 7: *Limnaea* fig. 4 (Calcutta).
 1873 *Limnaea hians* SOWERBY, Conch. Icon., 18: pl. 28 fig. 57 (Malabar).
 1886 *Limnaea labiosa* CLESSIN, Conch. Cab., 1, 17: 397, pl. 16 fig. 43 (India).
 1919 *Limnaea acuminata* var. *nana* ANNANDALE & PRASHAD, Rec. Ind. Mus., 16: 141, pl. 4 fig. 1, pl. 5 fig. 2 (Assam).
 1925 *Limnaea physcus* ANNANDALE & RAO, Rec. Ind. Mus., 27: 104, 174, fig. IV, 8 (Shan States).
 1951 *Lymnaea luteola*, — HUBENDICK, Handl. kungl. svensk. Vet. Akad., 3 (1): 161, figs. 31, 32-35, 38-40, 173, 179, 349, 350 (India, Burma, S-China, Siam).

As the synonymy shows, this species is quite variable and the above named synonymic species are based on its many forms. It is not easy to distinguish this species from certain forms of *L. auricularia rubiginosa* by shell characters alone. In the Thai specimens collected by members of the School of Tropical Medicine

in Bangkok, the spire is very short and almost blunt. The typical form from India, however, has a spire which measures about $\frac{1}{3}$ of the length of the shell. The aperture is regularly ovoidal, the body whorl is never shouldered below the suture. The columellar fold is much shorter and less twisted than in *a. rubiginosa*.

Size A 17-29 mm; D 9-17 mm. From India, specimens with a length of 44 mm have been reported.

In doubtful cases the anatomical differences may aid in the identification, but the differences between the reproductive organs of the three Thai species are not very great. *L. a. rubiginosa* has a very narrow uterus, the distal part of which is much narrower than in *luteola*. The inner part of the uterus of *luteola* is almost as broad as the accessory gland. The prostate gland of *luteola* is generally longer than that of *a. rubiginosa* and it is more folded.

Type locality India.

Distribution: From Thailand only one certain population is known: a small pond at Ban Kung Khayan at Thung Yai District, Province of Nakhon Sritammarat. It has often been reported from Thailand but all reports seem to refer to *L. rubiginosa*. Extralimitarily known from India, Ceylon, Burma and S-China.

Ancylacea BROWN, 1844.

This superfamily is understood in the sense of BONDESEN (1950) and BAKER (1956). It comprises now 4 families: Planorbidae, Bulinidae, Physidae and Ancyliidae. Representatives of Physidae are not yet known from Thailand.

Shell sinistral or ultradextral (pseudodextral), discoidal, planispiral, ovate or cap-shaped. Male and female genital pores separated. Renal organ with ureter. Eyes at the bases of the tentacles. These are only contractile and not inversible as in Onchidiacea. Radula with many rows of 39 or more teeth. Rhachis with 2-4 cusps, laterals with 3 cusps, marginals with several cusps.

Distribution Cosmopolitan.

Habitat: With rare exceptions the species of this superfamily are inhabitants of freshwater.

Key to the Thai families:

- | | | |
|---|-------|--------------|
| 1. Shell coiled | ..... | 2 |
| — Shell cap-shaped | ..... | Ancyliidae. |
| 2. Pseudobranch either multifolded or with several ridges | ..... | Bulinidae. |
| Pseudobranch not folded, smooth or with one ridge | | Planorbidae. |

Bulinidae BAKER, 1945.

Shell sinistral or ultradextral, generally ovate and shaped like *Physa*, rarely planispiral like Planorbidae. Rhachis of the radula with 2 cusps, laterals with few cusps, marginals with several cusps. Pseudobranch folded, with deep ridges. Blood cells with red hemoglobin.

Distribution S-Europe, Africa, S-, SE- and E-Asia, Indonesia, New Guinea, Australia and several islands of the W-Pacific.

Indoplanorbis ANNANDALE & PRASHAD, 1920.

LARAMBERGUE (1939) has proved that the type species of this genus shows all characteristics of a true Bulinidae in spite of the planorbid shape of the shell. Only one species is known of this genus as all other described taxa proved to be synonymous with the type species. For the description of the generic characters see below under the species.

Type species: *Planorbis exustus* DESHAYES.

Distribution and habitat see below.

Indoplanorbis exustus (DESHAYES, 1834).

pl. 16 fig. 99.

- 1834 *Planorbis exustus* DESHAYES in BELANGER, Voy. Indes-Orient., Zool.: 417, pl. 1 fig. 11-13 (Lieux marécageux de la côte de Malabar).
1836 *Planorbis indicus* BENSON, J. asiat. Soc. Bengal, 5: 743 (Bengal).
1838 *Planorbis orientalis* DESHAYES, Hist. anim. s. vert., (2) 8: 385 (Indes-Orientales).
1855 *Planorbis modicus* H. & A. ADAMS, Gen. rec. Moll., 2: 261 (India).
1855 *Planorbis brunneus* H. & A. ADAMS, Gen. rec. Moll., 2: 261 (Bombay).
1856 *Planorbis coromandelicus* DUNKER, Conch. Cab., 1, 17: 43, pl. 6 fig. 14-16 (Trankebar und Coromandel).
1856 *Planorbis zebrinus* DUNKER, Conch. Cab., 1, 17: 57, pl. 6 fig. 11-13 (Pondichery an der Küste von Coromandel).
1860 *Planorbis coromandelicus* var. *minor* MARTENS, Proc. zool. Soc. London, 1860: 12 (Siam).
1862 *Planorbis circumspissus* MORELET, Rev. Mag. Zool., 14: 477 (Saigon).
1866 *Planorbis circumspissus*, — MABILLE & LEMESLE, J. de Conch., 14: 130 (Moth-Kasa, Cambodge; marécage de Rulao-Tag = Kulo Tag, Cchinchine).
1876 *Planorbis merguiensis* HANLEY & THEOBALD, Conch. Ind., 8: 60, pl. 151 fig. 5-6 (Mergui, Burma).
1886 *Planorbis zonatus* CLESSIN, Conch. Cab., 1, 17 (2): 117, pl. 17 fig. 1 (Ceylon).
1886 *Planorbis hindu* CLESSIN, Conch. Cab., 1, 17 (2): 224, pl. 33 fig. 9 (Indien).
1878 *Planorbis eburneus* SOWERBY, Conch. Icon., 20: pl. 5 fig. 38 (Ceylon).
1889 *Planorbis exustus*, — MORLET, J. de Conch., 37: 130 (Pnom Penh; Sudon rivière, Cambodge; Vatana et la rivière Strang, Siam).
1891 *Planorbis exustus*, — MORLET, J. de Conch., 39: 233 (Ménam-Pinh et les ruisseaux qui se jettent dans cette rivière. Les ruisseaux du plateau de Xieng-Moi).
1903 *Planorbis exustus*, — BLANFORD, Proc. malac. Soc. London, 5: 280 (Lampun).
1950 *Indoplanorbis exustus*, — SUVATTI, Fauna Thailand: 89 (Chieng Rai: Mekok River; Chieng Mai; Klóng Borapet; Bangkok; Lam Nong Hang Sai).
1964 *Indoplanorbis exustus*, — HABE, Nature & Life SE-Asia, 3: 60 (Bangkok).

Shell discoidal, upper and lower side somewhat concave, brownish, yellowish or olive-coloured, rarely blackish; sculptured with fine, regular, axial riblets; the 4 rounded whorls increase rapidly in size; they may be very obtusely angled around the upper concavity. — Aperture expanded, peristome sharp, without lip. The delicate spiral microsculpture is well visible in young specimens only.

Size A 19-25 mm; D 9-13 mm; dwarfish local forms may not exceed a size of 4 12 mm.

$$\text{Radula formula: } \frac{C}{2} + \frac{10L}{4-5} + \frac{16M}{6-9} + \frac{8oM}{5-0}.$$

Pseudobranch multifolded, with deep ridges. The male reproductive organs show a short, plump preputium and long, much thinner, hose-like vergic sac; the verge is only a short, cylindrical process of the vergic sac within the preputium. The vas deferens is about as thick as the verge. Prostate gland compact and fan-shaped. The female reproductive organs show a thin and small vagina with a small spermatheca, the duct of which is short and narrow. Nidamental glands attached to uterus and oviduct. Albumen gland heart-shaped, the seminal vesicles arranged in several rows on the ovisperm duct. The ovotestes show a comparatively small number of acini.

Distribution Common in the low-lands of Thailand, probably in all provinces. Extralimitarily known from Indo-China, Malaysia, Burma, India, Ceylon, Sumatra. Introduced into Java, Japan, Celebes and Hawaii.

Parasitology: This species harbours, beside other trematode larvae, larval stages of *Schistosoma spindale*, *S. indicum* and *S. nasale*. Though these species do not develop in man, they may cause cercarial dermatitis. The snail is therefore called by the local rural population, as also *Lymnaea auricularia rubiginosa*, "hoy kunn", "itchy snail". The causality between populations of these two gastropod species and dermatitis seems to be longer known to the local population in Thailand than to parasitologists.

Planorbidae GRAY, 1840.

Shell sinistral or ultradextral, generally discoidal or planispiral, rarely ovoidal as in *Physa* and *Bulinus* or even elongately scalarid. Some species have internal lamellae, others teeth or folds in the aperture.

The animal is generally greyish with black pigmentation of varying pattern. The two tentacles are long and round (contrast Lymnaeacea and Ancyliidae), filiform and mobile. The eyes are placed at the upper sides of their bases. The foot is rounded in front and tapering to the end. The head is formed by a velum-shaped flap whose rounded front part is cleft in the middle for the mouth opening. — The radula consists of many rows with 21-85 teeth in one row. Rhachis always with 2 cusps, laterals generally with 3 cusps, rarely with more, marginals with several cusps. The semicircular or moon-shaped jaw consists of several segments. — Pseudobranch not folded, with one ridge only. — The simple, lobated ovotestis is embedded in the digestive gland. The short ovisperm-duct leads to a more bulbous part into which the seminal vesicles insert, then carries on until it bifurcates into the oviduct and spermduct. The oviduct leads into the uterus and this into the short vagina. The spermatheca is generally large with a short duct. The polylobate prostata inserts into the sperm-duct. These two ducts form the vas deferens which enters the penis sheath and opens into the preputium. Here it ends in a papilla which may carry a conchiolinous stylet.

The Planorbidae are here understood as outlined by BAKER (1945), but include *Camptoceras* and *Amerianna*. Former authors united Bulinidae and Planorbidae as subfamilies in one larger family and subdivided the Planorbinae into tribus. These tribus are here ranked as subfamilies.

Parasitology: Most members of this family are intermediate hosts for medically important trematodes. For further details see below under the lower taxa.

Key to the Thai subfamilies:

- | | |
|--|------------------|
| 1. Shell discoidal or planispiral; verge without appendage | 2 |
| — Shell ovate or elongate, verge with appendage | 3 |
| 2. Shell without periderm, very glossy; vergic sac with flagella | Segmentininae. |
| — Shell with periderm, not glossy; vergic sac without flagella | Planorbinae. |
| 3. Mantle cavity without pseudobranch | Camptoceratinae. |
| — Mantle cavity with pseudobranch | Amerianninae. |

Camptoceratinae n. subfam.

Shell ovoidal or elongately scalarid (contrast Planorbinae), sinistral, with delicate spiral sculpture. Animal planorbid, but without pseudobranch in the mantle cavity (contrast Amerianninae). This is substituted by a flap-like process at the left side of the animal.

Type genus: *Camptoceras* BENSON, 1843, the only recent genus of the subfamily.

Distribution India, Burma, Thailand, Siberia and Japan; probably also in China.

Camptoceras BENSON, 1843.

Characters of the genus like those of the subfamily. There are two subgenera acknowledged. The type subgenus has not yet been found in Thailand. It consists of the terebraeform or scalarid species.

Type species *Camptoceras terebra* BENSON.

Distribution: Like that of the subfamily.

Habitat: Freshwater, but also in the zone of the tidal influence.

Camptoceras (Culmenella) CLENCH, 1927.

The species of this subgenus differ from those of *Camptoceras* s. str. by their ovate, *Bulinus*- or *Physa*-like shape. HUBENDICK (1959) pointed out some anatomical differences between the two subgenera. The base of the verge in *Camptoceras* s. str. is swollen and the marginals of the radula are separated into a lateral and a caudal group. In this subgenus the base of the verge is not swollen and the marginals are all arranged in one group along the caudal edge.

Type species: *Bulinus hirasei* CLENCH, non WALKER, 1919, = *Camptoceras prashadi* CLENCH, 1931.

Distribution Bengal, Kashmir, Japan, SE-Siberia, Thailand and Japan.

Camptoceras (Culmenella) jiraponi HUBENDICK, 1967.

pl. 16 fig. 1.

1967 *Camptoceras jiraponi* HUBENDICK, Ark. Zool., (3) 20: 169, fig. 9-15 (Wat Gaeo, Thonburi).

Shell ovate with very large body whorl and small spire. The 2½ whorls are very convex and increase rapidly in size; they are moderately angulate above. — The aperture is ovoidal with the upper part narrower than the lower;

it is somewhat expanded. Peristome continuous somewhat reflected, appressed to the penultimate whorl. The sculpture consists of about 15 spiral lines which carry minute chaetae.

Size: A 5.0-5.6 mm; D 2.7-3.1 mm.

The animal is grey with sparse black pigmentation. This is more concentrated at the margin of the foot. A conspicuous characteristic feature are the well-developed post-tentacular flaps which are supposed to have sensory functions. At the mantle opening is a large, cutaneous flap which replaces the missing pseudobranches. The penial complex shows a bulbous appendicula ("accessory preputial organ"), a feature which makes a distinction from *Physa* and *Bulinus* easy. — Radula with the formula 3M-13L-C1-13L-3M. Rhachis with 2 large cusps and a small accessory cusp on either side. Laterals with 4 or 5 cusps, marginals with 6.

Type locality Trench along the way to Wat Gaeo in Thonburi Province.

Distribution: Known from the type locality and from a small pond at Ban Nong Koi, Tung Song District, Nakon Sritammarat Province, only.

Amerianninae HUBENDICK, 1955.

This subfamily — established by HUBENDICK as a tribe — differs from the preceding subfamily mainly by its anatomy. The sinistral shell is ovate and similar to those of *Physa* or *Bulinus*. The pseudogills are present and are much more folded than those of Planorbinae and therefore similar to those of Bulininae. The rhachis has 2 symmetrical cusps, the laterals have 3-5 cusps, the marginals are rake-shaped.

Type species: *Ameria carinata* H. ADAMS.

Distribution: Australia, New Guinea, New Caledonia, SE-Siberia, Japan. Introduced into Thailand and Java.

There is only one genus with one species represented in Thailand.

Amerianna STRAND, 1928.

Amerianna carinata (H. ADAMS, 1861).

pl. 16 fig. 2.

1861 *Physa* [*Ameria*] *carinata* H. ADAMS, Proc. zool. Soc. London, 1861: 143 (Boyne River, Australia).

Shell ovate with small, low spire and large, inflated body whorl; straw-coloured or olive, somewhat translucent, very fragile, dull, sculptured with numerous fine growth lines which are crossed by delicate spiral lines. The $3\frac{1}{2}$ whorls increase rapidly in size. They are generally sharply shouldered, forming a horizontal plain between shoulder and suture. — Aperture large, obliquely pear- or almond-shaped, not expanded. Peristome sharp, not continuous, connected by a very thin parietal callus. Columella somewhat twisted with an oblique fold.

Size: A 9.0-13 mm; D 5.0-6.7 mm.

Animal slate-coloured, with numerous sand-coloured pigment spots dusted rather regularly over head, foot and back, but particularly densely placed along the sides of the foot, the mantle edge and the gill-flap. — Radula typical for the subfamily. — Verge with appendage.

Type locality Boyne River, Australia.

Distribution Queensland, New South Wales, N-Australia; New Guinea; Key Islands; Miscol Islands; introduced into the Botanical Garden of Bogor (Java) and the klong around the Turf Club and along Rama V Road in Bangkok-Dusit, Thailand.

Planorbinae GRAY, 1840.

Here this subfamily is understood as outlined by PILSBRY (1934) and BAKER (1945).

Shell spiral, ultradextral (pseudodextral), either flattened on both sides or with one or both sides concave, upper side rarely somewhat convex.

The greyish or sand-coloured animals are generally pigmented with black dots or patches. The tentacles are long and filiform. The rhachis of the radula has generally 2 large cusps on the cutting edge. There are occasionally 1 or 2 accessory cusps on either side of them. Laterals with 3-7 cusps, marginals either claw-shaped or with serrated cutting edges. The jaw consists either of 3 pieces or is fragmented into several plates. The prostatic gland consists of a single row of sac-like diverticula placed in a single row along the long prostatic duct. The diverticula of the ovotestis are generally placed in a double row. Some groups have a stylet at the tip of the verge.

Distribution: Cosmopolitan.

Only one genus of Planorbinae is represented in Thailand and SE-Asia.

Gyraulus CHARPENTIER, 1837.

Shell rather small, rarely higher than 3 mm and broader than 11 mm, with few (3-5) horizontally coiled whorls which are either regularly rounded or somewhat compressed and carinated at the periphery. All whorls can be seen from both sides. Either both sides are somewhat concave, or one side is plane, rarely is the upper side somewhat convex. Surface with or without spiral lines. — Rhachis of the radula with 2 cusps; laterals with few cusps, marginals with serrated cutting edges. The jaw consists of numerous plates.

The male reproductive organs show a hose-shaped penial complex, with a strong retractor inserting at the transition between the preputium and the vergic sac. The verge tapers to the end and carries a stylet at its tip. The seminal vesicle consists of a few large glands which are much thicker than the ovisperm duct. The prostatic gland consists of more than 20 lobes placed in one row along the prostatic duct. The short duct of the prostatic gland joins a sperm duct of about equal diameter. The ovotestis consists of a double row of pyriform diverticula. On each side of the seminal vesicles runs a branch of the ovisperm duct. Spermatheca elongate-ovate or pyriform, spermatheca duct short and narrow. Free oviduct short and narrow, uterus much wider than vagina. The nidamental gland consists of many lobes. The albumen gland is composed of a few large gland cells.

Type species: *Planorbis albus* O. F. MÜLLER, 1776.

Distribution: Europe, Asia, Africa and N-America.

Some of the species of this genus are rare and endemic in Thailand, others are plentiful and found in almost all parts of the country.

Parasitology: Several species of *Gyraulus* serve as first intermediate hosts for several trematode species of the family of Echinostomatidae and few other groups.

History: The first SE Asian species of this genus was described by CROSSE & FISCHER (1863: 362) from Saigon and named *Planorbis saigonensis*. A careful study of the type in Paris convinced the author that this species is identical with the earlier described Indian species *P. convexiusculus* HUTTON. In 1867 MARTENS described a *P. compressus* var. *siamensis* which was later redescribed by ROCHEBRUNE as *confusus*. *P. convexiusculus* and *siamensis* were often confused by later authors hence the name of ROCHEBRUNE. It is surprising that nobody before HABE (1964: 58) ever cited MARTENS' name and that no author (ANNANDALE 1918, BLANFORD 1903, SUVATTI 1950) before ITO & al. ever reported such a common species as *convexiusculus* from Thailand.

Key to the Thai species:

- | | |
|--|-------------------------|
| 1. D of shell larger than 4 mm and height more than 1.5 mm | 2 |
| — D 3.5 mm and smaller, height 1.2 mm and less | 3 |
| 2. Whorls compressed and carinated; sculptured with spiral lines | <i>siamensis</i> . |
| — Whorls rounded, not carinated; without spiral lines | <i>convexiusculus</i> . |
| 3. Sculptured with delicate spiral lines | <i>rotula</i> . |
| Sculptured with growth lines only | 4 |
| 4. Last whorl not greatly broadened | 5 |
| — Distal part of body whorl greatly broadened | . . . <i>bakeri</i> . |
| 5. A 0.9-1.0 mm | <i>hubendicki</i> . |
| — A 0.5-0.7 mm | <i>prasongi</i> . |

Gyraulus convexiusculus (HUTTON, 1849).

pl. 17 fig. 3.

- 1849 *Planorbis convexiusculus* HUTTON, J. asiat. Soc. Bengal, (2) 18: 657 (India).
1858 *Planorbis stelzneri* DOHRN, Proc. zool. Soc. London, 1858: 134 (Ceylon).
1863 *Planorbis saigonensis* CROSSE & FISCHER, J. de Conch., 11: 362, pl. 13 fig. 7 (Saigon).
1867 *Planorbis compressus*, — MARTENS, Malak. Bl., 14: 213 [non HUTTON 1849] (Java).
1876 *Planorbis convexiusculus*, — HANLEY & THEOBALD, Conch. Ind.: 40, pl. 99 fig. 8-10 (India).
1885 *Planorbis demissus* WESTERLUND, Ur Vega Exped. vet. Jaktt., 6: 204, pl. 4 fig. 16 (Ceylon: Point de Galle).
1885 *Planorbis associatus* WESTERLUND, Ur Vega Exped. vet. Jaktt., 6: 205, pl. 4 fig. 17 (Ceylon: Point de Galle).
1897 *Planorbis proclivis* MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostindien, 4: 12, pl. 1 fig. 11-16 (Sumatra).
1897 *Planorbis compressus*, — MARTENS in WEBER, Zool. Ergebn. Reisen Niederl.-Ostindien, 4: 13 [partim] (Java, Celebes).
1962 *Gyraulus convexiusculus*, — ITO & al., Jap. J. med. Sci. Biol., 15: 250, fig. 13 (Bangkok).
1964 *Gyraulus chinensis convexiusculus*, — HABE, Nat. & Life SE-Asia, 3: 58, pl. 2 fig. 4-6 [partim] (Bangkok).

Shell planispiral, rather large for the genus, almost flat below and somewhat concave above, rarely convex above and concave below. The $4\frac{1}{2}$ whorls increase rapidly in size; they coil in a horizontal plane. In very old specimens the end part of the body whorl may descend somewhat. The whorls are either completely rounded or rarely somewhat compressed and with a very obtuse angle at the periphery. The sculpture consists of fine growth lines; rudimental spiral lines are a rare exception. The ground colour is whitish or yellowish-brown, but the shell is covered with a thin periderm of darker colour which is generally covered by a layer of blackish mineral deposit. Cleaned specimens are almost glossy (those of *siamensis* have a silky lustre). — Aperture moon-shaped, not expanded; peristome sharp, connected by a thin, callous film, not thickened within.

Size: A 1.8-2.8 mm; D 6.5-8.3 mm. Indian and Chinese specimens are reported to attain a larger diameter.

Animal flesh-coloured, dusted with densely placed small black pigment dots; sole with less pigmentation, each tentacle with one row of black spots. Mantle edge with large black patches. Digestive gland reddish. Reproductive organs typical for the genus. Tip of the verge with a stylet.

Type locality: "India" No exact type locality has been designated.

Distribution Common everywhere in Thailand.

Parasitology First intermediate host of *Echinostoma ilocanum* and other species of *Echinostoma*. Furthermore cercariae of *Paramphistoma* sp. were found in *G. convexiusculus*.

***Gyraulus siamensis* (MARTENS, 1867).**

pl. 17 fig. 4.

1867 *Planorbis compressus* var. *siamensis* MARTENS, Malak. Bl., 14: 213 (Bangkok).

1875 *Planorbis compressus*, — MORELET, Sér. Conch., 4: 276 [non MICHAUD nec HUTTON] (Bangkok).

1881 *Planorbis confusus* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 32 (Bangkok).

1904 *Planorbis confusus*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 414 [partim] (Bangkok; Long-Xuyen, Cochinchine).

1964 *Gyraulus chinensis convexiusculus*, — HABE, Nat. & Life SE-Asia, 3: 58 [partim].

This species is generally of the same size as the preceding species with which it has often been confused. The shell is more compressed than that of *convexiusculus*. It is sculptured with delicate spiral lines which are rarely missing. The peripheral keel is sharp and often cutaneous, the aperture is hatchet-shaped.

Size: The specimens from Thailand rarely exceed a height of 2 mm and a diameter of 7 mm. *G. compressus* (HUTTON) which is considered very closely related to this species measures 10.5 : 3 mm.

The animal of this species is of brighter colour than that of *convexiusculus*. The black pigment dots on the animal are less numerous but there are more pigment patches on the mantle lobe; these, however, are always smaller than the patches on the mantle of *convexiusculus*. No stylet has been found at the tip of the verge.

Type locality: Bangkok.

Distribution: This species is only known from Indo-China, Thailand and Malaya. If we include *compressus* (HUTTON) and several other flat, keeled species from India and Indonesia in this Rassenkreis, the distribution extends from India to New Guinea and China. MARTENS (1897: 13) reported this species from the Philippines.

Parasitology: This species is not accepted by miracidia of *Echinostoma ilocanum*.

***Gyraulus prasongi* n. sp.**

pl. 17 fig. 5.

Diagnosis: A species of *Gyraulus* CHARPENTIER which differs from all other species of the genus by its extremely small size. Compared with small specimens of other species it is always narrower and has more whorls.

Description: Shell small, planispiral, ultradextral, thin, translucent, very fragile, corneous-yellow, smooth except for the delicate growth lines, somewhat glossy. The 3-3½ whorls increase rapidly in size; they never show any trace of a carina. Lower side almost plane, upper side somewhat concave. From both sides all whorls can be easily seen. Each whorl is about 1½ times as broad as the preceding whorl. Last whorl modestly expanded at the aperture. — Aperture moon-shaped, rather large; peristome sharp, with a very delicate callus within but not lipped.

Size: A 0.5-0.7 mm (penultimate whorl 0.4 mm); D 1.7-2.1 mm.

Animal bright grey with very dense black pigmentation. The round, moderately long tentacles end in a blunt tip. There is one delicate line of black pigmentation inside the tentacles. Back dusted with extremely fine pigment dots. Mantle without pigmentation. A stylet at the tip was not detected.

Type locality: Trench 2 km N of Satun, S-Thailand.

Distribution: Known from the type locality and a neighbouring paddy field only.

Habitat: The trench has almost completely freshwater during the rainy season but is slightly brackish in the dry season and during high tide. The species is found together with species of *Assimineae*.

Material Holotype SMRL 4201/A; paratypes 4201/10 and 10 each in the collections of USNM, ZMH and SMF.

***Gyraulus hubendicki* n. sp.**

pl. 17 fig. 6.

Diagnosis: A species of *Gyraulus* CHARPENTIER which differs from *G. convexiusculus* (HUTTON) by its much smaller size, from *G. rotula* (BENSON) by lacking a spiral sculpture and from *G. prasongi* by being 1½ times as large.

Description: Shell small for the genus, planispiral, ultradextral, thin, translucent, corneous, lower side almost plane, upper side somewhat concave, rarely convex or plane. Both sides show all whorls distinctly. The 3½ whorls are round, the end part of the body whorl is often moderately angled below the periphery. They increase rapidly in size and are separated by a deep suture. Each succeeding whorl is about 1½ times larger than the preceding. — Aperture crescent-shaped and oblique; peristome sharp, connected by a thin parietal callus.

Size: A 0.9-1.0 mm; D 2.5-3.3 mm.

Animal greyish, dusted with black pigment dots which form large patches on the mantle lobe. Tentacles long, round, filiform; the eyes are placed at their bases on the inner side. Head truncate in front, with a notch in the middle at the mouth opening. Foot long and slender when extended; it tapers to the pointed end. — Radula with bicuspid rhachis, tricupid laterals; intermediate teeth with 4 cusps, marginals with 5-6. — Penial complex with a cylindrical atrium and a fusiform verge with a short, flexible stylet. The uterus is short and carries a rather large, round spermatheca whose duct is rather long and thick. The fan-shaped ovotestes are embedded in the digestive gland. The seminal vesicles on the ovisperm duct are much smaller than those of the type species and of other species. The prostate gland consists of about 20 finger-shaped lobes.

Type locality: Trench along the road about 2 km N of Satun, S-Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 4193/A; paratypes 4193/40.

Habitat: This species lives together with *G. prasongi* n. in slightly brackish water.

Gyraulus rotula (BENSON, 1850).

pl. 17 fig. 7.

1850 *Planorbis rotula* BENSON, Ann. Mag. nat. Hist., (2) 5: 351 (Moradabad).

1876 *Planorbis (Gyraulus) rotula*, — HANLEY & THEOBALD, Conch. Ind.: pl. 99 fig. 2-3 (Moradabad).

1885 *Planorbis (Gyraulus) liratus* WESTERLUND, Ur Vega Exped. vet. Jaktt., 6: 204, pl. 4 fig. 18 (Point de Galle, Ceylon).

Shell below medium size for the genus, smaller than *G. hubendicki* but of the same height. The 3½ whorls are regularly rounded. The species is easily to distinguish by its distinct spiral lines. These are not only restricted to the very delicate periderm.

Size: A 0.8-1.0 mm; D 1.8-2.6 mm.

Animal and radula typical for the genus. No stylet has been found at the tip of the verge.

Type locality: Moradabad, India.

Distribution: In spite of the rather wide distribution, the species seems to be extremely rare. It has been found at Moradabad (India), Point de Galle (Ceylon) and at Aranyapratet in Thailand. A trench near the air-strip is the only locality known in Thailand.

Gyraulus bakeri n. sp.

pl. 17 fig. 8.

Diagnosis: A species of *Gyraulus* CHARPENTIER which differs from its closest relative, *G. labiatus* (BENSON), by its smaller size, less inflated end part of the last whorl and the lack of the internal lip. It differs from *G. sumatranus* (MARTENS) by its smaller size and lack of the peripheral carina.

Description: Shell small for the genus, but for the comparatively small size rather high, thin, fragile; when cleaned from mineral deposits it appears greyish- or yellowish-corneous, translucent, somewhat glossy, with strong,

oblique growth lines but without any traces of spiral sculpture. The $3\frac{1}{2}$ whorls are well rounded (contrast *G. sumatranus*) and increase rapidly in size; the end part of the body whorl is almost double as broad as the penultimate whorl; it descends somewhat. Upper side of the shell flattened with concave spire; lower side either flat or somewhat concave. — Aperture very oblique, crescent-shaped, angled above and well rounded below. Peristome sharp without and not lipped within (contrast *G. labiatus*); it is not continuous, but connected by a very thin parietal callus.

Size: A 0.9-1.3 mm; D 2.8-3.5 mm.

Animal greyish with large black pigment spots of different sizes and pattern. Verge without stylet.

Type locality: Huai Kam Mi, about 46 km N of Prae.

Distribution: In several mountain streams in N-Thailand.

Material Holotype SMRL 4203/A; paratypes 4203/12. — SMRL 4204/5—a tributary to the Huai Ka Mi; 4205/10—a stream between Ban Kok Chumpa and Ban Kok Cham Prae, Loei Province; 4186/3—Maenam Pong at Ban Pa Nok Kao, Loei; 804/20—Ban Talhum, Nan Province.

Relationship This species belongs to the small group of Asian species of *Gyraulus* which is distinguished by the broad distal part of the body whorl.

Etiology: The species is dedicated to FRANK COLLINS BAKER, American malacologist who died in 1945 after having contributed so much to our knowledge of Planorbidae.

Segmentininae BAKER, 1945.

Shell small, translucent, glossy, upper side always convex with concave spire, lower side either flat or somewhat convex. Umbilicus open or closed. Whorls often with laminae within.

The size rarely exceeds 2.3 : 8.0 mm.

Animal generally much less pigmented than that of Planorbinae. Prostate gland similar to that of the preceding subfamily, verge with 1 or 2 flagella at the end of the vergic sac. Several genera with penial gland in the preputium. Kidney without a ridge. Rhachis with 2 long cusps; laterals with 1-6 long cusps and several additional small; the number of the large cusps decreases from the center to the margin. Marginals with irregularly serrated cutting edge.

Type genus: *Segmentina* FLEMING.

Distribution America, Europe, N-Afrika and Asia with many islands in the western Pacific.

Key to the Thai genera:

- | | |
|------------------------------------|---------------------|
| 1. Shell with internal lamellae | <i>Segmentina</i> . |
| 2. Shell without internal lamellae | <i>Hippentis</i> . |

Hippentis CHARPENTIER, 1837.

Shell always with open umbilicus and without internal lamellae.

Type species: *Helix fontana* LIGHTFOOT, 1767 = *Helix complanata* LINNAEUS, 1758.

Hippeutis (Helicorbis) BENSON, 1850.

This subgenus is barely different from the type subgenus. *H. complanatus* has 9 laterals and 7 marginals, *H. umbilicalis* BENSON shows 12 laterals and 14 marginals. The slight differences of the reproductive organs will be described in another paper.

Type species: *Planorbis umbilicalis* BENSON.

Distribution S-, E- and SE-Asia and on many islands in the western Pacific.

Hippeutis (Helicorbis) umbilicalis (BENSON, 1836).

pl. 17 fig. 9.

- 1836 *Planorbis umbilicalis* BENSON, J. asiat. Soc. Bengal, 5: 741 (Sylhet).
1850 *Planorbis caenosus* BENSON, Ann. Mag. nat. Hist., (2) 5: 349 (Moradabad).
1884 *Planorbis dorrianus* WATTEBLED, J. de Conch., 32: 126, pl. 15 fig. 6 (L'arroyo de Long-Xuyen).
1884 *Planorbis (Segmentina) gruneri* CLESSIN, Conch. Cab., 1, 17: 148, pl. 21 fig. 9 (Singapore).
1885 *Planorbis versicolor* WESTERLUND, Ur Vega Exped. vet. Jakt., 4: 206, pl. 4 fig. 19 (Point de Galle, Ceylon).
1918 *Planorbis calathus*, — ANNANDALE, Rec. Ind. Mus., 14: 113 [non BENSON 1836] (Inlé Lake).
1921 *Hippeutis* (?) *umbilicalis*, — ANNANDALE & PRASHAD, Rec. Ind. Mus., 22: 584, fig. 163 (radula) (Manipur).
1962 *Helicorbis umbilicalis*, — ITO & al., Jap. J. med. Sci. Biol., 14: 259, fig. 14 (Bangkok).
1964 *Helicorbis umbilicalis*, — HABE, Nat. & Life SE-Asia, 3: 59, pl. 2 fig. 7-9 (Bangkok).

Shell glossy, brownish-corneous, translucent, very depressed, convex above with sunken spire and almost flat below with open umbilicus in which the spire can be seen. There are no internal lamellae contrary to BENSON's original description.

Size: A 1.8-2.3 mm; D 4.8-8.0 mm.

Radula: Rhachis with 2 long cusps. Laterals with 3-4 cusps, the outer cusp being cleft. Under strong magnification some accessory cusps may be seen on either side of the main cusps. The inner marginals have 3 cusps, the outer marginal 1 only or only a serrated cutting edge. There are 11-12 laterals and 12-14 marginals. The radula seems to differ considerably from the picture given by ANNANDALE & PRASHAD.

Reproductive organs: Vergic sac with two club-shaped flagella, similar to those of *H. complanatus*.

Type locality: Sylhet, Assam.

Distribution: India, Ceylon, Burma, Thailand, Laos, Cambodia, S-Vietnam, Malaya, Japan, S-China, Philippines, Sumatra, Java, Sumba, Borneo, Celebes, New Guinea.

The distribution in Thailand is not continuous, but it has been found in most of its provinces and is definitely distributed over the whole country.

Biology: *H. umbilicalis* lives in still, clear water with rich vegetation. It is found in the flats and valleys of large rivers but has never been found in mountainous areas. This species is known to serve as first intermediate host of several species of Echinostomatidae and of *Fasciolopsis buski*.

Segmentina FLEMING, 1818.

This genus differs from *Hippentis* by showing internal lamellae in the shell.

Type species *Planorbis nitidus* O. F. MÜLLER.

Distribution: Europe, N-Africa, Asia and many islands in the western Pacific.

The typical subgenus is not represented in Thailand. The two below subgenera differ anatomically from the type subgenus. *Segmentina* s. str. has a penial gland which is missing in *Trochorbis* and *Polypylis*; *Segmentina* has short flagella, those of the two Asian subgenera are long.

Key to the Thai subgenera:

- | | |
|---------------------|---------------------|
| 1. Umbilicus open | <i>Polypylis</i> . |
| 2. Umbilicus closed | <i>Trochorbis</i> . |

Segmentina (Polypylis) PILSBRY, 1906.

Shell higher than that of *Hippentis*, upper side convex, lower side flat or nearly so. Apex sunken, umbilicus open. There are several radial lamellae within the shell. The embryonic whorls are sculptured with minute, shallow pits.

Animal greyish, with rather long and thin tentacles. The 40 laterals and marginals of the radula with 7 cusps. These cusps become rudimentary on the outer marginals. Pseudobranch obsolete. Penis sheath longer than preputium; with 1 or 2 flagella. Tip of verge cuticularized. Penial gland missing.

Type species: *Planorbis largillierti* "DUNKER" MARTENS = *Planorbis hemisphaerula* BENSON.

Distribution: S-, SE- and E-Asia. Several of the western Pacific islands.

Key to the Thai species:

- | | |
|---|------------------------|
| 1. Umbilicus wide; verge with one swollen flagellum | <i>hemisphaerula</i> . |
| 2. Umbilicus narrow; verge with 2 thin flagella | <i>calathus</i> . |

Segmentina (Polypylis) calathus (BENSON, 1850).

pl. 17 fig. 10.

1850 *Planorbis calathus* BENSON, Ann. Mag. nat. Hist., (2) 5: 349 (Moradabad).

1885 *Segmentina spirodelus* WESTERLUND, Ur Vege Exped. vet. Jagtt., 4: 209, pl. 5 fig. 21 (Point de Galle, Ceylon).

Shell small, convex above with sunken apex and flat below with narrow umbilicus.

Size: A 1.8-2.1 mm; D 4.6-4.9 mm.

Penial complex with 2 rather thin flagella. — Radula typical for the subgenus.

Type locality Swamp near Moradabad in India.

Distribution India, Ceylon, Burma, Thailand. — The species seems to be rare in Thailand. It is only known from the northernmost provinces of Chieng Mai, Chieng Rai and Nan. The report from Sumatra and Java refers to *Helicorbis umbilicalis*.

Segmentina (Polypylis) hemisphaerula (BENSON, 1842).

pl. 17 fig. 11.

- 1842 *Planorbis hemisphaerula* BENSON, Ann. Mag. nat. Hist., 9: 487 (Dshoushan, Chekiang, China).
1865 *Helix dicaela* MORELET, J. de Conch., 13: 226 (Siam).
1867 *Planorbis calathus*, — MARTENS, Malak. Bl., 14: 217 [non BENSON = *nitidellus* MARTENS 1877] (Yokohama).
1867 *Planorbis largillierti* "DUNKER" MARTENS, Malak. Bl., 14: 217 (Hongkong; Amoy).
1875 *Planorbis dicaelus*, — MORELET, Sér. Conch., 4: 276, pl. 12 fig. 8 (Ajuthia).
1877 *Planorbis nitidellus* MARTENS, S. B. Ges. naturf. Fr. Berlin, 1877: 112 (Yokohama).
1910 *Planorbis (Segmentina) demangei* BAVAY & DAUTZENBERG, J. de Conch., 58: 20, pl. 1 fig. 15-17 (Hanoi).

Very similar to the preceding species, but with very obtuse keel and more open umbilicus.

Size: A 2.1-2.3 mm; D 7.2-8.0 mm.

Radula typical for the subgenus. Penis sheath with 1 thick flagellum.

Type locality: Dshou-shan, Chekiang, China.

Distribution: S-China, Ryu Kyu Islands, Taiwan, Laos, Cambodia, Thailand. In Thailand it is found sporadically over the whole country. There are not very many localities known, but where it is found, it is found in abundance.

Parasitology: This species is a proven intermediate host of *Fasciolopsis buski* in Thailand and other countries.

Segmentina (Trochorbis) BENSON, 1855.

Since all species which may be assigned to this subgenus seem to be con-specific, *Trochorbis* is a monotypical subgenus. For further description see below under the only species of the subgenus.

Segmentina (Trochorbis) trochoideus (BENSON, 1836).

pl. 17 fig. 12.

- 1836 *Planorbis trochoideus* BENSON, J. asiat. Soc. Bengal, 5: 742 (Barrackpore, India).
1876 *Planorbis trochoideus*, — HANLEY & THEOBALD, Conch. Ind.: XVIII, 18, pl. 39 fig. 4-6 (Barrackpore).
1906 *Segmentina kennardi* BULLEN, Proc. malac. Soc. London, 7: 130 (Buitenzorg, Java).
1918 *Planorbis caenosus*, — ANNANDALE, Rec. Ind. Mus., 14: 113 [non BENSON, 1850] (Inle Lake, Burma).
1918 *Planorbis trochoideus*, — ANNANDALE, Rec. Ind. Mus., 14: 113 (Inle Lake, Burma).
1925 *Segmentina taia* ANNANDALE & RAO, Rec. Ind. Mus., 27: 110, fig. 2 (Inle Lake; the canal at Yaunglwe, S Shan States).

Note: The reports of *Segmentina calathus* by MARTENS (1897: 15), LESCHKE (1914: 250), VAN BENTHEM JUTTING (1929: 83; 1931: 8) and BUTOT (1952: 18; 1953: 30) refer also to this species.

I am in full agreement with RENSCH (1934: 215) and VAN BENTHEM JUTTING (1956: 469) that *S. kennardi* and *S. taia* are identical, but a careful study of material of *trochoideus* from India proved that all three species belong to one species only.

The shell of this species is smaller than that of the preceding species, more dome-shaped with sharper, subbasal keel. Its colour is greyish-vitreous, rarely corneous. The umbilicus is either completely closed or a minute pin-point opening.

Size: A 1.3-1.7 mm; D 2.5-3.3 mm.

Radula typical for the genus. Penis sheath with 2 finger-shaped flagella. There is no penial gland.

Type locality: Barrackpore, India.

Distribution India, Burma, Thailand, Laos, Java, Sumatra, Sumba. Not yet found in Malaysia and Cambodia.

Habitat: Like that of the preceding species.

Parasitology: This species is an intermediate host of *Fasciolopsis buski*.

Ancylidae BROWN, 1844.

Shell small, cap- or shield-shaped, with oval or rounded-trapezoidal outline; apex conical, in the mid-line behind the centre of the shell, generally somewhat asymmetrical. Aperture large, open, sometimes partially closed by a septum.

Animal with short, broad head, plumb rostrum and short tentacles. The eyes are placed at the inner side of the bases of the tentacles. The foot tapers towards the rounded end. — The pulmonary cavity is reduced; respiration takes place through secondary gills and the skin. The gill (pseudobranch) is placed between mantle edge and foot.

Distribution Cosmopolitan.

As full agreement has not yet been reached among the authorities on freshwater limpets with regard to taxa between family and genera, we shall here omit the subfamilies established by other authors.

Key to the Thai genera:

1. Apex of shell with radiating striae; rhachis symmetrical; verge with club-shaped flagellum ... *Ferrissia* (*Pettancylus*).
2. Apex of shell puckered or with tiny impressions, never striate; rhachis asymmetrical; verge with long, coiled flagellum *Gundlachia*.

Ferrissia WALKER, 1903.

All freshwater limpets with radially striate apex, symmetrical rhachis and rather short, swollen or slender flagellum are united in this genus. The typical subgenus is restricted to the New World. It is distinguished from the Old World species by a very thick, swollen penial flagellum which opens into the middle part of the penis sheath. Rhachis with 2 large central cusps and 1 additional small cusp on either side. This dentition is symmetrical.

Type species *Ancylus rivularis* SAY.

Distribution: N- and C-America, S-Europe, Africa, Asia, Oceania and Australia.

All Thai species belong to one subgenus.

Ferrissia (Pettancyllus) IREDALE, 1943.

Shell small, thin, whitish or yellowish-corneous, translucent, oval or rounded rhomboidal in outline, rather flattened, with eccentric mediane or lateral apex which is radially striate and curves somewhat backward and to the right side.

Size: The length of the shell rarely exceeds 5 mm.

Animal with short, broad head and short, obtuse tentacles. It is either devoid of pigmentation or shows very delicate dark pigment spots dusted over the head and front part of the back. — Radula typical for the genus. Laterals with 4-8 cusps, marginals with 7-11 irregularly shaped cusps. — The penial complex is externally not divided into preputium and penis sheath. The thick, almost cylindrical to moderately club-shaped flagellum inserts in the upper part of the penis sheath beside the insertion of the vas deferens. For detailed anatomy see HUBENDICK (1964: 47, 28, figs. 163-174).

Type species: *Ancylus tasmanicus* TENISON-WOODS.

Distribution Europe, Africa, Asia, Australia, Tasmania and many Indo-pacific islands.

Key to the Thai species:

- | | |
|---|-------------------|
| 1. Shell without radial riblets | 2 |
| — Shell with delicate radial riblets | <i>siamensis.</i> |
| 2. Shell higher than 1 mm | 3 |
| — Shell 1 mm high or less | <i>javana.</i> |
| 3. Shell regularly oval, L : D = 3 : 1 | <i>baconi.</i> |
| — Shell irregularly ovate, L : D almost 2 : 1 | <i>verruca.</i> |

Ferrissia (Pettancyllus) javana (MARTENS, 1897).

1897 *Ancylus javanus* MARTENS in WEBER, *Ergebn. Reise Niederl.-Ostind.*, 4: 15, pl. 1 fig. 34-35 (Java: Buitenzorg).

1897 *Ancylus celebensis* MARTENS in WEBER, *Ergebn. Reise Niederl.-Ostind.*, 4: 16, pl. 1 fig. 38-39 (Pare-Pare und in einem Flüßchen bei Loka).

1916 *Ancylus* sp., — ANNANDALE, *J. nat. Hist. Soc. Siam*, 2 (2): 92 (Patalung River).

1950 *Ancylus* spec., — SUVATTI, *Fauna Thailand*: 89 (Patalung River).

1956 *Ferrissia javana*, — VAN BENTHEM JUTTING, *Treubia*, 23: 476, fig. 118-119, 123-124 (Sumatra, Java, Celebes).

Shell small, elongately oval, thin, cap-like, depressed, regularly rounded in front; it tapers somewhat towards the end. Apex obtuse, situated somewhat behind the middle of the shell, slightly turned to the right. The shell is vitreous, dull without and glossy within, covered with a very thin yellowish periderm. The sculpture consists of very delicate concentric growth lines and very feeble radial lines which originate from the apex and are much stronger in the protoconch than in the other part of the shell. The muscle scars within are rounded and of about equal size.

Size A 0.8-1.0 mm; L 3.0-3.3 mm; D 2.2-2.4 mm.

Animal slate-grey without black pigmentation. Foot oval, tentacles short, blunt, of more than double the length of the rostrum. — Rhachis with 2 large cusps and 1 small cusp on either side of them. Laterals with 3-4 cusps, marginals with 5-7.

Type locality Buitenzorg (Bogor), Java.

Distribution: Java, Sumatra, Celebes, Malaya, S-Thailand. From Thailand known from the provinces of Nakhon Sritammarat (Chandee) and Patalung (Patalung River).

Ferrissia (Pettancylus) baconi (BOURGUIGNAT, 1853).

pl. 17 fig. 13.

1853 *Ancylus baconii* BOURGUIGNAT, Proc. zool. Soc. London, 21: 89, pl. 25 fig. 18-25 (Bengal).

1921 *Ancylus (Ferrissia) baconi*, — ANNANDALE & RAO, Rec. Ind. Mus., 22: 592 (Orissa; Philippines, Japan).

1925 *Ferrissia baconi*, — ANNANDALE & RAO, Rec. Ind. Mus., 27: 112 (Hi-Ho gorge, Inle watershed).

Shell small, depressed, thin, translucent, with fine concentric striae. The delicate radial striae are confined to the protoconch. The apex is placed behind the center of the mid-line and is somewhat inclined to the right side. The outline of the aperture is more or less regularly ovate. The shell is glossy within. The three small muscle scars are barely visible.

Size A 1.1-1.3 mm; L 3.3-3.8 mm; D 2.2-2.5 mm.

Animal without pigmentation. — Rhachis of the radula with 2 large cusps and a small cusp on each side of the large. Laterals with 4-5 cusps, marginals with 5-6.

Type locality: Bengal.

Distribution: Bengal, Burma, N-Thailand. In Thailand found in the provinces of Mae Hongson, Chiang Mai and Nan.

Habitat: Mountain creeks with clear, fast running water. The animals sit attached to stones, dead leaves or twigs.

Ferrissia (Pettancylus) verruca (BENSON, 1855).

pl. 17 fig. 14.

1855 *Ancylus verruca* BENSON, Ann. Mag. nat. Hist., (2) 15: 12 (India).

1912 *Ancylus brenieri* BAVAY & DAUTZENBERG, J. de Conch., 60: 32, pl. 5 fig. 15-16 (Chiné, Hoa Bin, Tonkin).

1915 *Ancylus verruca*, — PRESTON, Fauna Brit. Ind., Moll.: 105 (Bhimtal; Kemaon Lake; marshes near Moradabad; near Budaon Rohilla; Orissa; Ceylon etc.).

1921 *Ancylus (Ferrissia) verruca*, — ANNANDALE & al., Rec. Ind. Mus., 22: 589 (Imphal, Manipur).

1928 *Ferrissia verruca*, — RAO, Rec. Ind. Mus., 30: 459, fig. 18B (Mongyin, Northern Shan States).

This species differs from the preceding by its asymmetrical outline, larger size and bluish nacre within. The shape is more elongately ovate, the greatest width is at the middle of the shell. The shell is of yellowish-corneous colour, but most species are covered with a layer of black mineral deposit.

Size A 1.1-1.3 mm; L 3.5-4.0 mm; D 2.0-2.2 mm.

Animal and anatomy typical for the genus. Laterals with 4 cusps, marginals with 5.

Type locality: India.

Distribution India, Ceylon, Burma, N-Thailand and Tonkin. Probably also in N-Laos. In Thailand this species has been found in the provinces of Mae Hongson, Chiang Mai and Nan.

Habitat: It lives in the same habitats as the preceding species but they are rarely found together.

***Ferrissia (Pettancyllus) siamensis* n. sp.**

pl. 17 fig. 15.

Diagnosis: A species of *Ferrissia (Pettancyllus)* IREDALE which differs from *F. ceylanica* (BENSON) by its smaller size, weaker radial sculpture and pearly nacre within. It differs from all Thai species of this genus by its distinct radial sculpture.

Description: Shell of medium size for the genus, thin, translucent, of white ground colour but covered with a thin, yellowish periderm. Adult shells are mostly covered with a thick layer of blackish mineral deposit. When cleaned of the deposit and the periderm removed, the diaphanous shell shows the typical radial striae of the protoconch. The apex is placed somewhat to the right of the mid-line at the beginning of the third-fourth of the shell. The apex is obtuse and inclined somewhat to the right side. The whole shell is sculptured with distantly placed delicate radial lines. The outline of the aperture is elongate-oval. The side-lines are almost parallel or taper somewhat to the end of the shell. The shell is distinctly convex in front of the apex and somewhat concave behind it. The interior is of opaque colour, very glossy and covered with a thin pearly nacre. Muscle scars weak.

Size A 1.2-1.5 mm; L 3.5-4.0 mm; D 2.7-3.2 mm.

The animal is dirtyish-white with very delicate darker pigmentation dusted over the front part of the body and head. The rostrum is thick, plump and rounded in front. The eyes are placed at the inner sides of the tentacles. These are short and obtuse. The foot tapers towards the rounded posterior part. — The jaw consists of more than 40 minute plates. The radula shows an elongate rhachis with 2 regular and symmetrical cusps at the cutting edge. There is a small accessory cusp on either side of the large cusps. The laterals have 6-8 cusps, the marginals 8-9. Only the outermost marginals have less cusps as they are not fully developed. The formula of the radula is about 10-7-1-7-10 in each row, but it is very variable even within one specimen. — The gonad is formed of 4 large glandular follicles. The hermaphroditic duct is very short and carries a small vesica seminalis. The prostate gland is formed by few twisted lobes. The male copulatory organs consist of large, pyriform preputium into which a very small penis sheath with a rudimentary verge is invaginated. A rather short, thickened flagellum inserts in the top of the preputium beside the insertion of the vas deferens. The vas deferens is long and thin but in situ it is not coiled. The spermatheca is round, its duct short and rather thick.

Type locality: A creek N of Ban Kham, 18 km NW of Nan, about 19° 52' — 100° 39'

Distribution: Known from the type locality only.

Material Holotype SMRL 1013/A; paratypes 1013/11.

Relationship: This species seems to stand between *F. ceylanica* and *F. petterdi* (JOHNSTON). The sculpture is stronger than that of *petterdi* but weaker than that of *ceylanica*. *F. ceylanica* has been reported from Burma (ANNANDALE 1921: 591) and Manipur. Sometimes, however, very delicate radial striae have been discovered in species normally sculptured with concentric growth lines only. *F. viola* ANNANDALE is higher in relation to its length and its apex is placed more medianly. *F. viola* is said to have delicate radial striae on the internal surface. These have never been observed in *F. siamensis*.

Gundlachia PFEIFFER, 1849.

Shell similar in shape to that of *Ferrissia*, but generally more broadly oval, although slender species are known. The sculpture of the protoconch does not show any radial striae; it is either pitted or completely smooth.

The dentition of the rhachis is always asymmetrical. There are 2 main cusps of different size and normally 2 small accessory cusps, one on either side. Preputium large, copulatory organ without genuine verge, but with long coiled flagellum.

In his studies on Ancyliidae HUBENDICK (1964: 62) gave a list of generic names recognized in this family. From SE-Asia he only reported *Ferrissia* and restricted the distribution of *Gundlachia* to the American continent. There is no doubt that the following species belongs to *Gundlachia*. Septate forms of species of *Ferrissia* had been reported as *Gundlachia* by other authors from Asia, but anatomical studies proved their correct assignment to be with *Ferrissia*. The following species is therefore the first true *Gundlachia* known from SE-Asia and probably from all Asia.

Gundlachia hubendicki n. sp.

pl. 17 fig. 16.

Diagnosis: A species of *Gundlachia* PFEIFFER which differs from *G. radiata* (GUILDING) from S-America by its generally much smaller size, although *G. radiata* is known to vary considerably with regard to its dimensions.

Description: Shell small, thin, whitish, diaphanous, with thin, yellowish periderm, but generally covered with a black layer of mineral deposit. The apex is bluntly rounded and declined very far to the back and right side. The protoconch is sculptured with delicate, shallow pits. Sometimes it attains the right side-line or even reaches beyond it. Its tip is placed in the last $\frac{1}{4}$ or even last $\frac{1}{8}$ of the shell. The outline of the aperture varies considerably like those of *G. radiata* and *G. moricandi* (ORBIGNY). It may be regularly oval and comparatively broad or elongately ovate with well rounded side-lines, or these side-lines may be almost parallel and the shape elongately trapezoidal. The sculpture consists of fine but sharp growth lines and very delicate radial striae which may often be completely obsolete as in *G. radiata*. The shell is only moderately glossy within; the inner layer is whitish or somewhat opaque but not pearly. The muscle scars are very shallow and indistinct.

Size: A 0.8-1.0 mm; L 2.6-3.1 mm; D 1.5-2.0 mm. (*G. radiata* attains a length of 10 mm, *G. moricandi* of more than 11 mm.)

Animal of opaque colour without any traces of pigmentation. Head broad, tentacles moderately long and pointed. The eyes are placed at the inner side of the bases of the tentacles. The rostrum is round and large. The foot is rather small for the size of the animal. The visceral sac is small and placed in the apical cavity. There are two very small, folded pseudobranches. — The jaw consists of a large dorsal plate and many small lateral plates. The radula shows an elongate, trapezoidal rhachis with asymmetrical cusps as typical for the genus. There is a small accessory cusp on either side of the 2 larger middle cusps. The laterals have 4-5 cusps, the marginals up to 9. — The gonad consists of several large, sac-like acini. The vesica seminalis is formed by an irregular mass of diverticula. The prostate gland consists of several lobes. The copulatory organ shows a simple preputium into which a rudimentary verge is invaginated. This is formed by a pointed, muscular cone at the common opening of the vas deferens and flagellum. The flagellum is long and coiled at the end.

Type locality: Klong Premprachakon in Bangkok, along Rama V Road, opposite the Turf Club.

Distribution Known from three provinces in Thailand only, Bangkok, Thonburi and Nan.

Material: Holotype SMRL 881/A; paratypes 881/20. — SMRL 883/20-Wat Gaeo at Ban Khum Sri, Thonburi; 888/10-Creek N of Ban Kham, 16.5 km N of Nan.

Etiology This species is dedicated to Dr. BENGT HUBENDICK, whose publications on Ancyliidae contributed so much to our knowledge of freshwater limpets.

Bivalvia LINNAEUS, 1758.

The distinctive feature of this class is the subdivision of the shell into two calcified valves which are connected by a dorsal ligament of uncalcified conchiolin. This ligament is rarely missing (Anomiacea, Pholadacea). Below the ligament is the hinge plate which generally bears several teeth which are of importance for the classification of bivalves.

Animal bilaterally symmetrical, with a rudimentary head that lacks tentacles, eyes, jaws and radula, and with a tongue- or hachet-shaped foot (reduced in many forms, particularly those with a functional byssus: Etheriidae, Anomiidae). Ciliary feeders with labial palps near the mouth; large ctenidia are also present. Two mantle lobes line the inside of the valves and enclose the compressed body. Animal with 3 siphonal openings (branchial, anal, supraanal) or continuously open posteriorly, not divided into separate apertures. The two ctenidia are comprised of four demibranchs, two in each side of the visceral mass. Only in Septibranchia the ctenidia are lacking completely. Marsupia in the gill tubes, either in both pairs or in one pair only.

Fertilization is generally external in marine species, but internal in most brackish and in all freshwater species. An internal fertilization is not preceded by a copulation. Most species with long larval stages, some (Pisidiidae, Sphaeriidae) are ovoviviparous. The larval stages may be glochidia with long parasitic life (Unionidae, Margaritiferidae), lasidia (Mutelidae, not present in Thailand) or free-swimming veliger larvae (Corbiculidae, Mytilidae and most brackish water species).

Distribution Cosmopolitan.

Habitat: Marine, brackish and fresh water.

As no full agreement has yet been reached on the subdivision of this class into subclasses and orders, it is still at the discretion of each author which system to use in a faunistic report. The system used in this paper is mainly that of COX (1960), NEWELL (1965) and VOKES (1967), but well established names have been retained instead of new ones introduced by above authors. These authors recognized 6 subclasses (Palaeotaxodonta KOROBKOV, Cryptodonta NEUMAYR, Pteriomorphia BEURLEN, Palaeoheterodonta NEWELL, Heterodonta NEUMAYR, Anomalodesmata DALL) instead of the three classical subclasses Protobranchia, Lamellibranchia and Septibranchia. Only the third, fourth and fifth of the above named subclasses are represented in fresh and brackish water in Thailand. Palaeoheterodonta NEWELL, 1965 has been replaced by Schizodontida STEINMANN, 1888, a well introduced name. The shell characteristics of these subclasses, mainly based on anatomical findings, are so heteromorphic that common characteristics for all orders or subfamilies included in these subclasses cannot be given. The characteristics given below in the identification key refer to Thai representatives only. Neither can they be used generally nor are these taxa based on them.

Key to the Thai subclasses:

1. Hinge teeth (when present) not modified into cardinals and laterals; mantle edges ventrally open Pteriomorphia.
- Hinge teeth (when present) modified into laterals and cardinals; mantle edge ventrally united 2
2. Hinge "schizodont", no true cardinals; anterior laterals transformed into pseudo-cardinals Schizodontida.
- Hinge "heterodont", teeth (when present) with true cardinals Heterodonta.

Pteriomorphia BEURLEN, 1944.

Shell and hinge teeth do not offer any common characteristics for identification of this subclass.

Filament of ctenidia united to two interrupted, folded lobes, elongate and reflected, thus forming two-sided lamellae, the arms of which are usually united by interlamellar junctions. With three pairs of ganglia.

Distribution: Cosmopolitan.

Habitat Marine, brackish and fresh water.

Key to the orders of the subclasses:

1. Shells with symmetrical valves 2
- Shells with asymmetrical valves Ptericoncha.
2. Hinge with many equally shaped teeth; animal with anterior adductor Arcoida.
- Without hinge teeth; animal without anterior adductor Mytiloida.

Arcoida STOLICZKA, 1871.

This order is represented by one recent superfamily only. Formerly it was a superfamily of the order Taxodonta.

Arcacea LAMARCK, 1809.

Shell elongate, with almost straight hinge plate which carries numerous equally shaped short teeth. The outermost teeth run parallel to the dorsal margin. Inner surface not nacreous. — Animals with completely open mantle edges; gills filibranch, filaments attached by filary junctions.

Distribution: Cosmopolitan.

Habitat: Marine, brackish and freshwater. Many species of this superfamily are found in estuarine water in Thailand but only one genus is represented in fresh water.

Arcidae LAMARCK, 1809.

Shell elongate, with very long, straight dorsal margin and long, straight hinge plate. This carries numerous teeth of equal size. The shell is generally gaping for the byssus opening.

Distribution and habitat like those of the superfamily. There is only one genus naturally occurring in fresh water. Dead shells of *Arca* sp., locally imported for food, may be found everywhere in Thailand.

Scaphula BENSON, 1834.

Shell elongate, boat-shaped, generally with radial ribs or striae and with a distinct ridge or keel. The linear hinge is edentate in the middle part. This distinguishes this genus from all other small genera of Arcidae. There are about 4 anterior teeth of equal shape and 4-6 posterior. Adductor scars deep, the inferior of the posterior scars is squarish. Pallial line deep, shallow, sinuated.

Type species: *Scaphula celox* BENSON.

Distribution India, Burma, Thailand.

Habitat: Fresh- and slightly brackish water. The animals live attached by their byssus to stones, wood etc.

Scaphula pinna BENSON, 1856.

pl. 18 fig. 17.

1856 *Scaphula pinna* BENSON, Ann. Mag. nat. Hist., (2) 17: 128 (Tenasserim River).

1868 *Scaphula pinna*, — BENSON, J. asiat. Soc. Bengal, 36: 72, pl. 14 fig. 11-13 (Tenasserim River).

Shell elongately subtrapezoidal, dorsal and ventral margins almost parallel. The shell is divided into two parts by a strong, sharp posterior carina which runs from the umbones to the podium. The periderm is brownish, the sculpture consists of fine radial sulci. The hinge plate is narrow; there are 5 converging anterior teeth and 6 very obliquely placed posterior. The middle part of the hinge is edentate.

Size: L 9.5-13 mm; A 3.5-5.5 mm; D 4.5-6.0 mm.

Byssus of the animal with one single root only. Ventricle simple, placed underneath the intestine. There are two functional kidneys present.

Type locality: Tenasserim River in Burma.

Distribution In Burma known from the type locality only. In Thailand found in the reservoir of Uthong, in the Klong Rapipat in Ayuthiya Province, and in the Palace Garden of Bang Pa-In.

Note: The type species of this genus, *S. celox* BENSON, is known only from the Cane River near Banda in the Ganges drainage. Another species of this genus, *S. deltae* BENSON, is distinguished by its strong ribs parallel to the posterior keel. It is known from several Indian and Burmese localities, but has not yet been found in Thailand.

Mytiloida FÉRUSSAC, 1822.

Of the two superfamilies assigned to this order, only the Mytilacea have representatives in brackish and fresh water. For further description see below under the superfamily.

Distribution: Cosmopolitan.

Habitat: Predominantly marine and estuarine, few species live only in fresh water.

Mytilacea RAFINESQUE, 1815.

Shell equivalve, umbones placed near the pointed anterior end, posterior end more or less rounded. Shape more or less triangular, rarely oval, sometimes ventro-dorsally compressed. Ligament behind the umbones, hinge plate without teeth.

Distribution and habitat like those of the order.

The superfamily consists of one family only.

Mytilidae RAFINESQUE, 1815.

For shell characters, distribution and habitat see above the superfamily.

Key to the Thai genera:

- | | |
|---|----------------------|
| 1. Shell with radial sculpture. Ligament with tubercles | <i>Brachidontes.</i> |
| 2. Shell without radial sculpture. Ligament without tubercles | <i>Limnoperna.</i> |

Limnoperna ROCHEBRUNE, 1882.

Shell rather small for the family, elongately triangular, with obtuse umbonal ridge; umbones at the anterior end of the shell. Hinge plate without teeth, ligament visible from outside but placed between the hinge plates. Nacre milky-blue without a true layer of mother-of-pearl. Internal septum imperfect. — Animal with an anterior adductor. The gonads do not reach the mantle. Foot finger-shaped, with byssus.

Type species *Dreissena siamensis* MORELET.

Distribution: S- and SE-Asia, Indonesia.

Habitat: Fresh and brackish water.

Key to the Thai species:

- | | |
|--|-------------------|
| 1. Length of adult shell more than 15 mm | <i>siamensis.</i> |
| 2. Length of adult shell less than 8 mm | <i>supoti.</i> |

Limnoperna siamensis (MORELET, 1875).

pl. 18 fig. 18-19.

- 1875 *Dreissena siamensis* MORELET, Sér. Conch., 4: 365, pl. 17 fig. 3 (Lac Tonli Sap, Cambodge).
1882 *Limnoperna lemeslei* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 102 (Mekong; Gran Lac de Rham-Pemh).
? 1888 *Modiola cambodiensis* CLESSIN, Conch. Cab., 3, 8: 135, pl. 36 fig. 1 (Kambodscha).

Shell small, elongate, with pointed anterior end and well-rounded posterior; ventral margin straight or even somewhat concave; thin, reddish-brownviolet, with olive-green periderm. The umbonal carina is very weak, the sculpture consists of coarse growth lines only. With a thin, milky-blue nacre within. — Hinge and muscle scars typical for the genus.

Size L 18-23 mm; A 6-9 mm; D 7-9 mm.

Type locality: Tonle Sap Lake in Cambodia.

Distribution Mekong S of Nakon Panom; Maenam Mun River; Lam Chi River; Chao Phraya and Pasak River. In many klongs and tributaries to the Chao Phraya and in the Maeklong River. In the S the distribution reaches to the Tapi River and Tale Luang near Pattalung. Extralimitarily known from Laos, Cambodia and Vietnam.

Habitat: Freshwater but does not avoid the tidal zone. Never found in brackish water and in the estuarine area of rivers. The species occurs in colonies fastened by the byssus to rocks, poles and larger species of molluscs.

The variability of this species is restricted to size and shape. High specimens with small diameter are found in the same population together with specimens with inflated umbones and therefore broad diameter but small height.

Limnoperna supoti n. sp.

pl. 18 fig. 20.

Diagnosis: A species of *Limnoperna* ROCHEBRUNE which differs from the type species by its small size and by its habitat. It is only found in the eroded tips of the shells of *Brotia* species.

Description: Shell very small, elongate, depressed, with straight or even concave ventral margin, well-rounded upper margin, obtusely pointed anterior and somewhat angled posterior end. From the pointed and narrowly placed umbones runs an obtuse but inflated carina to the posterior end of the shell. Ground colour of the shell dark violet, olive or straw coloured with dark violet zones above and below the umbonal carina, covered with an almost blackish periderm. The growth lines are coarse; there is no radial sculpture. In the ventral margin is an oval opening for the byssus; this is sometimes only a narrow chink. Interior with a very thin nacreous layer. — Hinge plate very narrow, without any teeth but with a very delicate ridge parallel to the margin. The narrow ligament is not completely external but placed between the hinge plates. It is well visible from outside as the hinge plates do not close complete above the ligament. Below the umbones the shell appears constricted and forms inside of the umbones a small umbonal pit.

Size L 3.5-4.5 mm; A 2.4-3.1 mm; D 2.5-3.2 mm.

Anterior adductor present but weak, posterior adductor well developed. The animals are ovoviviparous. The animals incubate eggs, larval stages and embryonic shells until the shell reaches a size of at least 0.8 mm.

Type locality Kaek River in Sopa Falls, 80 km E of Pitsanuloke.

Distribution At present known from the Kaek River, Huai San, and Huai Kao Man in the Province Loei only.

Habitat The shells sit attached by their byssus in the decollated apices of *Brotia* species. They were found in *B. binodosa* (BLANFORD), *pseudosulcospira* and *pseudoasperata* BRANDT. The Maenam Kaek is a small river and the other two localities are mountain creeks with rather fast current.

Material Holotype SMRL 6535/A; paratypes 6535/20. — SMRL 6531/10-Huai San at Tad San Falls, Loei Province; 6532/2-Huai Kao Man, 65 km W of Loei; 6533/15-Kaek River at Tung Salaeng Garden; 6534/20-Kaek River at Gaeng Song Rapids.

The type was found in the apex of *B. binodosa*. Other *Brotia* species, *pagodula* (GOULD) from the Moei River and *costula* (RAFINESQUE) from various localities, were carefully examined for this species but did not reveal any new localities. An examination of the shells of other gastropods and clams resulted in the finding of a new species of *Sinomytilus*, which lives in the fractured apices of *Modellnaia siamensis* n. sp.

The shell varies somewhat in size and coloration. Population 6531 is straw-coloured without any violet zones.

Etymology: The species is dedicated to my technician Mr. SUPOT UNHAVAITHANA, who found it for the first time at the Tad San Falls.

***Brachidontes* SWAINSON, 1840.**

The shell is of the same size as *Limnoperna* or somewhat larger. It differs from the preceding genus by showing a radial sculpture on the whole surface of the shell. The ligament is short; there are generally some tubercles on either side of it. It is placed internally.

Type species: *Modiola sulcata* LAMARCK.

Distribution Cosmopolitan.

Habitat Generally marine, but few species are found in fresh and brackish water.

***Brachidontes arcuatulus* (HANLEY, 1844).**

pl. 18 fig. 21.

1844 *Modiola arcuatula* HANLEY, Proc. zool. Soc. London, 1844: 16 (Singapore).

1857 *Modiola arcuatula*, — REEVE, Conch. Icon., 10: pl. 6 fig. 27 (Singapore and Philippine Islands).

1889 *Modiola arcuatula*, — MORLET, J. de Conch., 37: 161 (Embouchure de la rivière de Compong-Son).

1916 *Modiola evansi*, — ANNANDALE, J. nat. Hist. Siam Soc., 2 (2): 93 [non E. A. SMITH] (Tale Sap at Koh Sih-Ha).

1950 *Modiola evansi*, — SUVATTI, Fauna Thailand: 102 [non E. A. SMITH] (Tale Sap at Koh Sih-Ha).

Shell very similar to a compressed *L. siamensis*, but with weak, however, distinct radial sculpture. The colour of the periderm is brownish in the middle of the shell and greenish at its margins. The bluish-white nacre is thin, but much stronger than that of *L. siamensis*. Therefore the muscle scars are more distinct. The hinge plate is irregularly excavated and much broader than that of *Limno-*

perna. It is completely covered by a strong, but short internal ligament. The tubercles on either side of the ligament are obsolete.

Size: L 22-24 mm; A 9-11 mm; D 7-8 mm.

Type locality: Singapore.

Distribution In Thailand known from the Tapi River, Tale Luang and Chantaburi River. Extralimitarily known from Japan, Indonesia, Philippines and Malaya. Probably also in Burma.

Habitat: Fresh and brackish water, in estuaries of rivers and in large lakes but also found in one population about 120 km away from the sea. The animals live attached by their byssus to stones, poles and larger molluscs.

***Septifer* RECLUZ, 1848.**

Umbones at the anterior end of the shell. There is a small internal septum in the umbonal cavities at which the anterior adductor inserts. Shell with axial sculpture.

A complete shell of *S. bilocularis* (LINNAEUS), the type species of *Septifer*, which is widely distributed from Reunion to China and E-Australia, was found in the mud-flats of Satun in S-Thailand. Although generally considered to be a marine species it seems to be that *S. bilocularis* does not avoid brackish water. As only one dead shell is available, it is here only mentioned in the text.

Pteronconcha Cox, 1960.

Shell with inequal valves, often with byssus or fastened with one valve to rocks, roots, other shells etc. This order and Mytilacea were formerly united in the order Taxodonta.

Distribution: Cosmopolitan.

Habitat: Predominantly marine, but few genera live in mud-flats, mangrove forests and estuarine areas.

Key to the Thai suborders:

1. All brackish water species with byssus Pteriina.
2. All species without byssus Ostreina.

Pteriina NEWELL, 1965.

Foot of the brackish water species always with byssus. There are two superfamilies with each one family and genus represented in estuarine and brackish water in Thailand:

1. Shell with ligament, valves only moderately inequal Pteriacea.
2. Shell without ligament, valves greatly inequal Anomiacea.

Pteriacea BRODERIP, 1839.

Shell only moderately inequivalve; ligament present. Foot with byssus. There is only one family with one genus represented in brackish water in Thailand.

Isognomonidae WOODRING, 1925.

For characteristics and distribution see below under the genus.

Pedalion HUDESFORD, 1770.

Shell moderately inequivalve; surface generally scaly. Hinge elongate, straight, without teeth. Ligament with numerous conchiolinous tubercles. There is only one species known from the mangrove and nipa palm forests near the Thai coast: *P. vitrea* (REEVE).

Distribution: Circumtropical.

Type species *P. ephippium* (LINNAEUS).

Anomiacea RAFINESQUE, 1815.

Anomiidae RAFINESQUE, 1815.

Shell irregularly rounded, valves greatly unequal, one valve generally with a large byssus opening. Shell without ligament.

Distribution: Circumtropical.

Habitat: Marine and brackish water.

Anomia O. F. MÜLLER, 1776.

Shell rounded, with greatly unequal valves, one valve with large byssus opening; shell iridescent within, with two byssus muscles.

Distribution: From the Persian gulf to the South Chinese sea.

Habitat: There is only one species represented in Thailand: *A. aenigmatica* (LAMARCK). It lives attached to the stems of the nipa palm fronds. It is found at all Thai coast where there are nipa palm forests.

Ostreina FÉRUSAC, 1822.

Ostreacea RAFINESQUE, 1815.

For characteristics and distribution of the suborder and superfamily see below under the family.

Ostreidae RAFINESQUE, 1815.

Shell greatly inequivalve, fastened with one valve to rocks, poles, roots or other shells of larger size. Ligament with a triangular cartilage pit. Hinge without teeth. — Foot rudimentary, without byssus.

Distribution: Cosmopolitan.

Habitat: Predominantly marine. Some species live in the estuarine areas of rivers or even in mangrove forests, attached to the roots of the trees.

Four species have been identified in brackish and estuarine water in Thailand: *Lopha cucullata* (BORN) which lives attached to rocks in the estuarine area of several rivers, and *L. folium* (LINNAEUS), *L. mytiloides* (LAMARCK) and *L.*

echinata (QUOY & GAIMARD) which live in mangrove forests attached to the roots of the trees. Although they are not true inland species they are mentioned here as they were found together with *Assimineae*, *Cerithidea* and *Ellobiidae*, groups which have been included in this faunistic report.

Schizodontida STEINMANN, 1888.

This probably artificial subclass comprises two fossil and one recent order. True cardinals are missing. The anterior laterals are transformed into pseudocardinals. The pseudocardinals, the laterals or all hinge teeth may be obsolete.

Distribution Cosmopolitan.

Habitat Freshwater.

Unionoida STOLICZKA, 1871.

As there is only one recent superfamily, see for description below.

Unionacea FLEMING, 1828.

Shell from medium to large size, valves generally symmetrical; the schizodont dentition is sometimes reduced or completely obsolete. — Foot shaped like a hatchet. Pallial margins either completely free or united at the posterior end. The filaments of the demibranchs are united behind the foot. The outer pair of demibranchs is often united also with the mantle and the inner pair with the digestive sac. Most species are dioecious. The eggs develop either only in two or in all four demibranchs (marsupia).

Distribution: Cosmopolitan.

Habitat Freshwater.

The classical subdivision of this superfamily into two fossil and four recent families (Margaritiferidae, Unionidae, Etheriidae and Mutelidae) is still generally accepted, although attempts have been made to modify this old systematic arrangement (MODELL 1942, 1948, 1964; MORRISON 1955, 1966, 1967; McMICHAEL & HISCOCK 1958; HEARD & GUCKERT 1971). Only two of these families are represented in Thailand, unless new studies are going to prove that the new subfamily, *Modellnaininae*, belongs to Mutelidae and not into Amblemidae into which the present author had placed it. The only recent family are the Amblemidae; Margaritiferidae have been found only fossil in Thailand, although they were originally reported recent in Laos.

Key to the Thai and Laotian families:

1. Inner surface of the shell with many small muscle scars; animal with incomplete gill diaphragm, gills without water tubes Margaritiferidae.
2. Inner surface of the shell with anterior, posterior and umbonal muscle scars only; animal with complete gill diaphragm; gills with water tubes Amblemidae.

Margaritiferidae HENDERSON, 1929.

The reniform shell is of strong texture and carries a well developed hinge. Left valve with two more or less complete pseudocardinals, right valve with one.

The species have the inclination of reducing the laterals. Interior surface of the shell with numerous small muscle scars. — Mantle edge posteriorly open, thus there are no special anal, supraanal and branchial openings. Animals dioecious; glochidia semicircular, without hooks, but with a row of delicate teeth.

Distribution: Northern Hemisphere.

Habitat Freshwater; in creeks and small rivers.

MODELL (1942) included Pseudodontinae and some other non-Thai subfamilies in the Margaritiferidae. A careful anatomical examination showed that the species of *Pseudodon* are much more closely related to *Pilsbryconcha* and certain species of Rectidentinae than to Margaritiferinae. We therefore restrict this family to those genera which were originally united within MODELL's subfamily Margaritiferinae.

***Margaritanopsis* HAAS, 1913.**

There is only one species represented in SE-Asia. This taxon is generally treated as a subgenus of *Margaritifera* SCHUMACHER, 1816 (= *Margaritana* SCHUMACHER, 1817).

Mono-Type species *Unio laosensis* LEA.

Distribution Burma, N-Thailand, Laos. Not known from Cambodia as cited in the original description.

***Margaritanopsis laosensis* (LEA, 1863).**

1863 *Unio laosensis* LEA, Proc. Acad. nat. Sci. Philad., 7: 190 (Laos mountains, Cambodia, Siam).

1866 *Unio laosensis*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 63, pl. 21 fig. 61 (Laos mountains, Cambodia, Siam).

1900 *Unio sula* THEOBALD, — Simpson, Synops. Naiad.: 678 [non nud.].

1919 *Margaritana woodthorpi* GODWIN-AUSTEN, Rec. Ind. Mus., 16: 203, pl. 15.

1922 *Margaritanopsis laosensis*, — PRASHAD, Rec. Ind. Mus., 24: 93, pl. 2 fig. 1-4 (Karin Hills, Burma).

1969 *Margaritifera (Margaritanopsis) laosensis*, — HAAS, Tierreich, 87: 13 (Hinter-Indien bis zum Bergland von Laos).

Shell smooth, arcuate, compressed, rounded anteriorly and posteriorly; valves rather thick, umbones only slightly prominent, eroded, thus no sculpture could be detected. — Ligament long, brown; periderm dark brown, obscurely rayed behind. Anterior slope only slightly raised, posterior slope long and narrow, slightly carinate, with a single dark ray running from the beaks to the podium. Cardinal teeth small, striate or somewhat lobed; laterals long, roughened and almost straight. — Anterior muscle scars distinct, large and well impressed; dorsal scars placed above the center of the cavities of the beaks; ventral scars small and dotted over the middle of the disc. Nacre white and iridescent.

Size: L 70-97 mm; A 28-39 mm; D 24-28 mm.

Type locality "Laos mountains, Cambodia, Siam"

Distribution: N-Burma, N-Thailand, Laos. Not known from Cambodia. As LEA had only 2 specimens for description, his quotation does not mean that this species lives in Laos and Cambodia and Thailand, but he placed the "Laotian mountains" into Thailand as well as into Cambodia. In Thailand our team found this species only in subfossil conditions in the valley of the Pai River in Mae Hongson Province.

Amblemidae RAFINESQUE, 1820.

Shell of medium to large size, dentition with pseudocardinals and posterior laterals. Pseudocardinals either tooth-shaped or lamelliform, sometimes reduced or completely obsolete. All hinge teeth may be rudimentary. — Animal with two adductors, an anterior and a posterior. Their insertions are seen as muscle scars in the anterior and posterior part of the inner shell. Above the scar of the posterior adductor is the scar of the posterior retractor pedis. The anterior retractor pedis has its scar beside the anterior adductor. Below it is the scar of the protractor pedis. There may be several additional umbonal muscle scars in the umbonal cavities and some below the pallial line. These are visible only in thick-shelled species. Animal with complete gill diaphragm. Marsupia in all four demibranchs or rarely in the outer 2 only. Gills with water tubes. Glochidia semioval (contrast Unionidae which have triangular glochidia). Glochidia with relatively long parasitical life.

Distribution and habitat like those of the superfamily.

Key to the Thai subfamilies:

- | | |
|--|-----------------|
| 1. Hinge with lateral teeth . . | 2 |
| — Hinge without lateral teeth | 3 |
| 2. Pseudocardinals lamelliform . . | Rectidentinae. |
| — Pseudocardinals dentiform or obsolete | 4 |
| 3. Shell hook-shaped | Modellnaiinae. |
| — Shell not hook-shaped | Pseudodontinae. |
| 4. Shell generally winged, longer than 100 mm | Hyriopsinae. |
| — Shell generally not winged, shorter than 80 mm | Parreysiinae. |

Pseudodontinae FRIERSON, 1927.

Shell elongately linguiform or broadly oval, often with short wing. Hinge teeth either completely missing or reduced to a knob-like pseudocardinal in each valve. Mantle with supraanal aperture; marsupia in all four demibranchs.

Key to the Thai genera:

- | | |
|--|-------------------------|
| 1. Hinge with one knob-like pseudocardinal in each valve | . . <i>Pseudodon</i> . |
| 2. Hinge without any teeth | <i>Pilsbryoconcha</i> . |

Pilsbryoconcha SIMPSON, 1900.

Shell elongately linguiform, thin; anteriorly rounded, posteriorly angulate; compressed; umbones not prominent, with weak, concentric furrows. Periderm olive-green when young, brownish or blackish-brown in adult specimens. Hinge without teeth.

Type species *Anodonta exilis* LEA.

Distribution: SE-Asia, Indonesia (Sumatra, Java, Borneo).

Key to the Thai species and subspecies:

- | | |
|------------------------------|-------------------------------|
| 1. L : A about 2 : 1 | 2 |
| — L : A about 3 : 1 (-1.2) | <i>lemeslei</i> . |
| 2. Posterior wing very low | 3 |
| — Posterior wing rather high | <i>exilis linguaeformis</i> . |

3. Posterior end (podium) pointed in the middle; ventral margin arched *exilis exilis*.
— Posterior end rounded or pointed at the base; ventral margin straight *exilis compressa*.

Pilsbryoconcha lemeslei (MORELET, 1875).

pl. 18 fig. 22.

1875 *Anodonta lemeslei* MORELET, Sér. Conch., 4: 328, pl. 14 fig. 1 (Cambodge).

1876 *Anodonta lemeslei*, — CROSSE & FISCHER, J. de Conch., 24: 333 (Cambodge: Battambang).

1950 *Pilsbryoconcha lemsleyi* [sic!], — SUVATTI, Fauna Thailand: 109 (Bangkok, in klong).

Shell elongate, thin, compressed, covered with a greenish-brown periderm which turns dark brown or even blackish with age; it is generally much corroded in adult specimens. Young specimens have a pointed podium, that of old specimens is either rounded or somewhat produced at the base. The umbones of all collected specimens, even young ones, were too much corroded for studying an umbonal sculpture. The nacre of the inner surface is bluish in young specimens and salmon-coloured in older specimens. The hinge is very narrow and generally void of any dentition. However, the trace of a rudimentary pseudocardinal may appear as a very tiny tubercle. — The muscle scars are large and for the thin shell they are comparatively deep. The pallial line is very shallow.

Size: L 82-105 mm; A 30-41 mm; D 18-22 mm.

Type locality Cambodge (Battambang).

Distribution Cambodia, Thailand.

Biology: The species lives in still water buried in the mud.

The species is rare and known from few places in Thailand only: Bang Pae (Prov. Ratburi); Aranyaprathet (Prov. Prachinburi); Nang Rong (Prov. Buriram). The report from Bangkok (SUVATTI) needs confirmation, as klongs are not the biotope of this species. Slender forms of the following species may have been confused with this one.

The Rassenkreis of *Pilsbryoconcha exilis* (LEA).

With exception of the preceding species all species from SE-Asia which were assigned to this genus may be united in one rassenkreis. The two races are represented in Thailand, each originally described as a separate species. The type race is found in still, rather clear water, another race is that of small rivers with sandy bottom and the third is restricted to the Mekong and some of its tributaries. This species has the most extended habitat of all Unionids in Thailand. It is found in klongs, ponds, lakes, small rivers and large water courses. It may even be found in the area of tidal influence but avoids mountain creeks with too fast current. — For the key to the races see below the genus.

Pilsbryoconcha exilis exilis (LEA, 1839).

pl. 18 fig. 23.

1839 *Anodonta exilis* LEA, Trans. Amer. philos. Soc., 6: 81, pl. 22 fig. 68 (no locality).

1848 *Anodonta polita* MOUSSON, Land & Süßw. Moll. Java: 98, pl. 19 fig. 2-3 (Java).

- 1863 *Monocondylaea compressa* LEA, Proc. Acad. nat. Sci. Philad., 7: 190 [non *Spatha compressa* MARTENS] (Siam).
 1866 *Monocondylaea compressa*, — LEA, J. Acad. nat. Sci. Philad., 6: 30, pl. 11 fig. 29 (Siam).
 1867 *Anodon politus* SOWERBY, Conch. Icon., 17: pl. 12 fig. 36 (Siam).
 1867 *Anodon gracilis* SOWERBY, Conch. Icon., 17: pl. 14 fig. 45 (Philippines: Panay Island).
 1867 *Anodon kelletti* SOWERBY, Conch. Icon., 17: pl. 19 fig. 71 (Siam).
 1876 *Anodonta sempervivens* DESHAYES, Nouv. Arch. Mus. Paris, 10: 120, pl. 5 fig. 5 (Cambodge).
 1881 *Anodonta laminata* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 40 (Siam, Rivière Sutrang).
 1950 *Pilsbryoconcha exilis*, — SUVATTI, Fauna Thailand: 109 (Klong Takong; Pak Jong; Mekong Basin).
 1952 *Pilsbryoconcha exilis*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 22 (Me Ping; Klong Klung near Wat Pratart Farm; Kwan Don, Setul Prov.).

Shell elongately linguiform but less narrow than the preceding species; with strong concentric growth lines, smooth and shining, olive green, with rounded anterior end and pointed podium. Ventral margin only slightly arched, in very large specimens almost straight in the middle. Umbones not prominent, eroded; very young specimens show an umbonal sculpture which consists of 3-5 short and straight furrows only. Hinge small, without any dentition or with a very feeble, rudimentary pseudocardinal in each valve. Pallial line shallow; anterior muscle scars moderately deep, posterior very shallow. Nacre within bluish-white.

Size L 80-120 mm; A 44-58 mm; D 17-26 mm.

A detailed description of the anatomy of this species will be given in a separate paper to show the close relationship between *Pseudodon* and *Pilsbryoconcha*.

Type locality Unknown. In a later paper LEA assumed that the original material came from Java. Javanese and Thai specimens are so completely alike that a provenance can not be deduced from shell characters.

Distribution Thailand, Laos, Cambodia, S-Vietnam, Malaysia, Sumatra, Java, Borneo. In Thailand this species is found in the plains of almost all provinces.

Biology: It lives in still water in klongs, ponds, lakes and ditches. Although it is also found in muddy water, it prefers clear water with rich vegetation. It is neither known from the drainage system of the Salween River nor from the northernmost provinces of Thailand: Chieng Mai, Mae Hongson, Chieng Rai and Nan.

Parasitology This species is everywhere used as food for pigs and ducks, but in certain areas it is also eaten by the local population. As the species was found to be infected with metacercariae of several species of Echinostomatidae, it may serve as second intermediate host if not properly cooked.

***Pilsbryoconcha exilis compressa* (MARTENS, 1860).**

pl. 18 fig. 24.

- 1860 *Spatha compressa* MARTENS, Proc. zool. Soc. London, 28: 16 (Kao-kho, NE of Pakprianu in Siam).
 1863 *Anodonta (Lamproscapha) schomburgki* MARTENS, Proc. zool. Soc. London, 31: 15 (Siam).

This ecological race is found in streams and small rivers with clear water and sandy bottom. It differs from the type race by its smaller size, more corroded umbones, blackish-green colour and rounded posterior end. In adults the podium may be truncate and pointed at the base. Nacre bluish or salmon-coloured.

Size L 60-90 mm; A 32-46 mm; D 16-26 mm.

Type locality "Kao-Kho, NE of Pakpriau in Siam", probably Kao Kaeo NE of Pak Phli.

Distribution In small rivers and streams, particularly in NE- and E-Thailand, but also in other provinces as Ratburi, Buriram, Petburi, Nakhon Nayok and Nakhon Sritammarat.

Pilsbryconcha exilis linguaeformis (MORELET) has not yet been found in Thailand, but is abundant in the neighbouring Khmer Province of Battambang.

Pseudodon GOULD, 1844.

Hinge plate with tooth-like apophysis in each valve representing the reduced pseudocardinals, fitting into corresponding indentation in the opposite valve. These teeth are not fractured but smooth, that in the right valve closing in front of that in the left. Laterals obsolete.

Mantle with supraanal aperture, marsupia in all four demibranchs. Glochidia semioval, without hooks.

Type species *Anodonta inoscularis* GOULD.

Distribution S-, SE- and E-Asia, Japan and larger Sunda Islands.

Habitat All kinds of freshwater.

A careful study of the shell, soft parts and embryology of the species of *Pseudodon* represented in Thailand leads to the conclusion that none of the subgenera established by various authors have more than specific value and sometimes not even that. All subgeneric names which refer to Thai species are therefore placed into the synonymy of the genus. It can be assumed that the same applies to taxa established for species from other countries.

Key to the Thai species:

- | | |
|--|----------------------------|
| 1. A $\frac{2}{3}$ of L or more | 2 |
| A less than $\frac{2}{3}$ of L | 4 |
| 2. Shell oval, thick, no posterior wing | 3 |
| — Shell rounded-trigonal, with posterior wing | <i>cambodiensis.</i> |
| 3. Shell not raised posteriorly and only moderately inflated | ... <i>inoscularis.</i> |
| — Shell high posteriorly and greatly inflated | <i>vondemb. tumida.</i> |
| 4. Shell ovate, ventral margin rounded, shell moderately thick | <i>vondemb. elliptica.</i> |
| — Shell reniform, ventral margin straight or concave, shell comparatively thin | <i>mouhoti.</i> |

Pseudodon mouhoti (LEA, 1863).

pl. 19 fig. 25.

1863 *Monocondylaea mouhotii* LEA, Proc. Acad. nat. Sci. Philad., 7: 190 (Laos Mountains, Cambodia, Siam).

1866 *Monocondylaea mouhotiana*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 65, pl. 21 fig. 62 (Laos Mountains, Cambodia, Siam).

- 1866 *Monocondylus exilis* MORELET, J. de Conch., 14: 63 (in torrentibus montanis Cambodiae).
- 1882 *Pseudodon anodontinum* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 41 (Shiglomi-Breithon).
- 1882 *Pseudodon pierrei* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 41 (Shiglomi-Breithon).
- 1882 *Pseudodon mabillei* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 41 (Mékong près Sombor-Sombor).
- 1889 *Pseudodon pierrei*, — MORLET, J. de Conch., 37: 166 (. entre Pnom Penh et Campot; Rivière de Srakéo, Siam).
- 1950 *Pseudodon (Bineurus) mouhoti*, — SUVATTI, Fauna Thailand: 109 (Siam).

Shell very inequilateral, elongately kidney-shaped, with slightly curved dorsal margin and nearly straight or even concave ventral margin; regularly rounded anteriorly and somewhat angulate posteriorly. The shell is generally rather thin and covered with a thick brown periderm. The umbones are not prominent; they are generally eroded. The sculpture consists of rather rough growth lines and obsolete diagonal short lines below the dorsal margin behind the umbones. Nacre bluish, muscle scars comparatively deep for the thin shell. Mantle line distinct. Hinge line very narrow; in each valve there is a small, tubercle-like pseudocardinal. — Anatomy typical for the genus.

Size L 85-105 mm; A 40-55 mm; D 15-22 mm.

Type locality "Laos mountains, Cambodia, Siam"

Distribution: N-, NE-, E- and SE-Thailand. Not found in Central, W- and S-Thailand. Extralimitarily known from Laos, Cambodia, Vietnam. Probably also found in N-Burma and Yunnan.

Habitat: Mountain streams and rivers with sandy ground.

H. MODELL suggested that *P. mouhoti* is only a small race of *P. vondembuschianus* (LEA). This species is neither a race of *vondembuschianus* nor of *inoscularis* (GOULD) as it is found together with the first named species in the Mekong and Mun River. There are no intermediate forms between either of these three species, or, if we accept *cambodjensis* PETIT as a separate species, among the four recognized species of this genus.

The Rassenkreis of *Pseudodon inoscularis* (GOULD).

There are three former species of *Pseudodon* which are here assigned to this rassenkreis, *inoscularis* (GOULD), *callifer* (MARTENS) and *cumingi* (LEA). More material may prove that *cambodjensis* PETIT also belongs to this species. The typical race, *i. inoscularis*, is found in the drainage of the Salween River in Burma and the Burmese border area of Thailand, *i. callifer* is the race of Central Thailand and *i. cumingi* is an ecological race of mountain stream, found particularly in Malaysia and S-Thailand. MODELL (personal communication) suggested that *mouhoti* and *cambodjensis* should also be included in this Rassenkreis. These two species, however, were found by the present author together at several localities and as only one of them can therefore belong to *inoscularis*, both were still treated as separate species.

Distribution: Burma, Thailand, Malaysia, Laos, Cambodia, S-Vietnam. Not known from Indonesia.

Key to the Thai subspecies:

- | | |
|---|---------------------|
| 1. Shell thick, inflated; L : A more than 75 : 45 mm | 2 |
| — Shell not very thick and not inflated; L : A less than 75 45 mm | 3 |
| 2. Shell elongately rhomboidal | <i>inoscularis.</i> |
| — Shell regularly ovate | <i>callifera.</i> |
| 3. Shell thin, oval, podium short | <i>harmandi.</i> |
| — Shell moderately thick, elongate rhomboidal, podium extended | <i>cumingi.</i> |

Pseudodon inoscularis inoscularis (GOULD, 1844).

- 1844 *Anodon inoscularis* GOULD, Proc. Boston Soc. nat. Hist., 1: 160 (Salween River, Burma).
 1844 *Anodon salweenianus* GOULD, Proc. Boston Soc. nat. Hist., 1: 160 (Salween River, Burma).
 1865 *Monocondylaea crebristriata* ANTHONY, Amer. J. Conch., 1: 205, pl. 18 fig. 1 (Pegu).
 1865 *Monocondylaea* [sic!] *peguensis* ANTHONY, Amer. J. Conch., 1: 351, pl. 18 fig. 2 (Pegu, British Burma).
 1868 *Unio vondembuschi*, — SOWERBY, Conch. Icon., 16: pl. 95 fig. 518 [non LEA, 1840] (Birma, Java).
 1912 *Pseudodon crebristriatus* var. *curvata* PRESTON, Rec. Ind. Mus., 7: 295 (Pegu).

Shell very inequilateral, rhombic-ovate, rather thick, rounded anteriorly and biangular or truncate posteriorly. The dorsal margin is regularly curved, the ventral sometimes straight or even somewhat concave („*curvata*“ PRESTON). The periderm is of greenish, brownish or blackish colour, depending on the age of the shell. Sometimes there are some greenish rays on the posterior slope of the shell. On the posterior slope the strong, crenulate growth lines are crossed by two prominent folds. Sometimes there are groups of short, radial grooves on parts of the surface. — The pseudocardinal tubercles are strong and prominent. Muscle scars and pallial line rather deep; nacre bluish or salmon-coloured.

Size: L 110-140 mm; A 45-60 mm; D 25-32 mm.

Type locality Salween River in Burma.

Distribution: Salween River and many of its tributaries. In Thailand known from the Salween River W of Mae Sarieng and from the Moei River. Not yet found in the Yuam River and Pai River. Extralimitarily known from the Pegu River and Tenasserim River. Not yet reported from the Irawaddy River.

Pseudodon inoscularis callifer (MARTENS, 1860).

pl. 19 fig. 26.

- 1860 *Anodonta callifer* MARTENS, Proc. zool. Soc. London, 28 (1860): 15 (Siam).
 1950 *Pseudodon* (*Pseudodon*) *inoscularis*, — SUVATTI, Fauna Thailand: 109 [non GOULD] (Maeklong, Ratburi).

This race differs from the type subspecies by its more regularly ovate shape, lack of ridges on the posterior slope and by its much stronger pseudocardinal tubercles. Generally the shell is also more solid than that of the type subspecies.

The nacre is whitish. Young specimens have a greenish periderm, older specimens are brown or even blackish.

Size L 60-95 mm; A 40-63 mm; D 22-37 mm.

Type locality "Siam"

Distribution N-, C- and W-Thailand. Extralimitarily reported from Cambodia and S-Vietnam. Populations in SE-Thailand approach *i. cumingi* in size and shape.

The typical form of this race is only found in the drainage of the Maeklong River. In the drainage system of the Chao Praya River it is substituted by *cambodjensis* (PETIT), probably also only a race of *inoscularis*. But as both are widely distributed in Cambodia, it would appear more suitable to treat *inoscularis* and *cambodjensis*, at least for the time being, as separate species. South of the distribution of *i. callifer* we find the Malayan race *i. cumingi* (LEA) the shells of which are generally smaller than this race but may also attain the size of *callifer*. In this case *callifer* and *cumingi* are almost identical. Southeast of the distribution of *callifer* we find another race which may be considered the ecological race of small mountain streams or small sandy rivers.

Pseudodon inoscularis harmandi CROSSE & FISCHER, 1876.

1876 *Pseudodon harmandi* CROSSE & FISCHER, J. de Conch., 24: 331, pl. 10 fig. 2 (Cambodge).

1889 *Pseudodon cumingii*, — MORLET, J. de Conch., 37: 165 [non LEA] (rivière de Strang, Siam; entre Pnom Penh and Kampot, Cambodge).

1889 *Pseudodon harmandi*, — MORLET, J. de Conch., 37: 165 (entre Pnom Penh et Kampot, Cambodge).

This is a small race inhabiting streams and small rivers in SE-Thailand and in Cambodia. Small shells of populations of *i. cumingi* from mountain streams in Malaysia look very like those of this race and these forms suggest that a division into river, stream and pond races is just as justified as the present subdivision of the species in geographical races from Burma, Thailand, Indochina and Malaysia.

The shell is smaller than that of the preceding races, covered with a brownish periderm, somewhat inflated, solid, with coarse growth lines. It is therefore less glossy than *callifer*, and the posterior part of the dorsal margin is higher.

Size Rarely exceeding L 65 mm, A 47 mm; D 27 mm.

Type locality "Cambodia"

Distribution: Known from Cambodia and SE-Thailand. In Thailand this race was found in small rivers and streams in the provinces of Chonburi, Rayong, Chantaburi, Nakon Nayok and Prachinburi.

Pseudodon inoscularis cumingi (LEA, 1850).

pl. 19 fig. 27.

1850 *Anodonta cumingii* LEA, Proc. zool. Soc. London, 18: 199 (Malacca).

1860 *Monocondylaea cumingii*, — LEA, J. Acad. nat. Sci. Philad., 4: 235, pl. 33 fig. 14 (Malacca).

1885 *Pseudodon cumingii*, — MORGAN, Bull. Soc. zool. France, 10: 422 (Batam River, Perak).

1969 *Pseudodon cumingi*, — HAAS, Superf. Union.: 128 (Malakka, Perak, Thailand, Kambodscha).

This race is generally smaller than the specimens of *callifer*, but rather large specimens are not rare. It is generally thinner and less inflated than the type race and *callifer*. Its shape is more variable; partly oval like *callifer*, partly reniform like *mouhoti*.

Size Not exceeding L 75 mm; A 48 mm; D 25 mm.

Type locality Malacca.

Distribution Malaysia (Perak, Malacca, Pahang, Kedah, Kelantan), Thailand, not in Cambodia. In Thailand this subspecies is found in almost all small rivers in peninsular Thailand S of Petburi. Similar forms are found in the SE provinces of Nakhon Nayok, Chonburi, Rayong and Chantaburi. The reports from Java refer to *P. vondembuschiana chaperi* (MORGAN).

Habitat Restricted to streams and rivers only, never found in lakes, ponds and ditches. The large shells of populations from larger rivers in Malaysia are very similar to *callifer* or the type race.

***Pseudodon cambodjensis* (PETIT).**

This species, known only from Thailand and Cambodia, is represented in Thailand by two races, the typical race and a smaller, thin, compressed geographic race.

Key to the Thai subspecies:

- | | |
|--|-----------------------|
| 1. Shell length larger than 100 mm, shell inflated | <i>cambodjensis</i> . |
| 2. Shell length less than 80 mm, shell compressed | <i>tenerimus</i> . |

***Pseudodon cambodjensis cambodjensis* (PETIT, 1865).**

pl. 19 fig. 28.

- 1865 *Monocondylaea cambodjensis* PETIT, J. de Conch., 13: 16, pl. 4 fig. 4 (Battambang, Cambodge).
1876 *Monocondylus subtrigonus* SOWERBY, Conch. Icon., 16: pl. 58 fig. 292 [non DESHAYES] (Siam).
1866 *Monocondylus orbicularis* MORELET, Ann. Zool., 1866: 167 (Battambang).
1875 *Monocondylus orbicularis*, — MORELET, Sér. Conch., 4: 338, pl. 16 fig. 5 (Battambang).
1889 *Monocondylea cambodjensis*, — MORELET, J. de Conch., 37: 165 (Rivière du haut Pursac, Cambodge).
1891 *Unio vagulus* FISCHER, Bull. Soc. nat. Hist. Autun, 4: 139 [n. nom.] (Siam).
1950 *Pseudodon cambodjensis*, — SUVATTI, Fauna Thailand: 109 (Singburi, Klong Maela).

This species is easily distinguished by its high posterior wing which gives the shell a rounded triangular shape. The texture of the shell is thinner than that of the preceding and following species. It is generally less inflated and the colour of old specimens remains greenish and never turns blackish. The pseudo-cardinals are weak, the muscle scars are shallow. The nacre is salmon-coloured or whitish.

Size Not exceeding L 105 mm; A 73 mm; D 33 mm.

Type locality Rivière de haut Pursac, Cambodge.

Distribution: In Thailand known from the Singburi River, Lopburi River and several tributaries of the Mekong; Ta Chin River at Supanburi and Ang Tong Province. In Cambodia reported from W- and S-Cambodia.

***Pseudodon cambodjensis tenerrimus* n. subsp.**

pl. 20 fig. 29.

Diagnosis: A subspecies of *P. cambodjensis* (PETIT) which differs from the type subspecies by its smaller size, thinner texture and compressed shell.

Description: Shell rounded subtrigonal when the wing is complete but oval when the wing is corroded. The shell is covered with a dark olive-green periderm. The small umbones are always corroded. The pseudocardinals are weak; that in the right valve being a little stronger than that in the left. Muscle scars shallow, pallial line hardly noticeable. Nacre bluish-white and iridescent.

Size Not exceeding L 75 mm; A 63 mm; D 21 mm.

Type locality Songkram River at Sri Songkram.

Distribution: Lam Choen and Lam Chi River, Mun River, Songkram River; all tributaries to the Mekong.

Material Holotype SMRL 5937/A. — SMRL 2421-River Lam Chi, W of Kon Kaen; 2423-River Lam Choen, W of Kon Kaen; 2396/3-Mun River at Rasi Salai; 2638/9 Songkram River at Wannonivet; 2677/2-Songkram River at Tha Uthen; 2950/3-Pong River N of Kon Kaen.

***Pseudodon vondembuschianus* (LEA, 1840).**

Two *Pseudodon* taxa from SE-Asia, *ellipticus* CONRAD and *chaperi* (MORCAN) are assigned to this Indonesian species as subspecies. The first species synonymizes with *P. ovalis* MORLET and with *P. ponderosa* PRESTON. The first is the race of C- and E-Thailand and of Cambodia, the latter the race from peninsular Thailand and Malaysia.

***Pseudodon vondembuschianus ellipticus* CONRAD, 1865.**

pl. 20 fig. 30.

1865 *Pseudodon ellipticum* CONRAD, Amer. J. Conch., 1: 25, fig. 1 (Cambodia).

1889 *Pseudodon ovalis* MORLET, J. de Conch., 37: 197, pl. 7 fig. 3 (Rivière de Srakeo, Siam).

1909 *Pseudodon ponderosa* PRESTON, Proc. malac. Soc. London, 8: 202, pl. 8 fig. 1 (Nan-Ko, Siam).

1950 *Pseudodon (Trigonodon) crebristriatus*, — SUVATTI, Fauna Thailand: 109 [non ANTHONY] (Tachang; near Pak Jong; Lam Tong Lang).

Shell elongately elliptical, rounded anteriorly, tapering and somewhat pointed posteriorly. Moderately thick to very thick, young specimens with greenish periderm, old specimens with brownish or blackish. There are two ecological forms of this geographic race, a large, thick and somewhat inflated form from rivers draining into the Mekong and a smaller, thinner, more compressed form from still water and small, sandy streams in C- and E-Thailand. The large form is often nearly as thick as optimal forms of *P. inoscularis callifer*, the pseudocardinals are strongly developed and the muscle scars are deep. The thinner form is more similar to *P. cambodjensis* but differs from this species by its lacking the posterior wing. The nacre is bluish with cream- coloured umbonal cavities.

Size L 80 (klong form), 105 (river form) mm; A 50-60 mm; D 25-35 mm. Largest specimen 123 : 76 mm.

Type locality: Cambodia.

Distribution C- and E-Thailand, Cambodia, S-Vietnam. In Thailand found in the drainage systems of the Maeklong, Chao Praya, Bang Prakon and Mekong, also in still water.

Pseudodon vondembuschianus chaperi (MORGAN, 1885).

pl. 20 fig. 31.

1885 *Pseudodus chaperi* MORGAN, Bull. Soc. zool. France, 10: 423, pl. 9 fig. 1-2 (Rivière Kinta) [on pl. 9 as *Pseudodon*].

This race stands in the same relationship to *vondembuschianus* as *cumingi* LEA to *inoscularis*.

It is generally smaller than *ovalis*, thinner and with two distinct areal folds slanting downwards on the posterior slope. On occasion some parallel oblique grooves are found on different parts of the shell. Podium pointing downwards. Large specimens are generally thin, adults of small populations are much thicker. The populations of small streams are much smaller than those from larger rivers.

Size L not exceeding 84 mm; A 48 mm; D 34 mm.

Type locality Kinta River in Perak, Malaysia.

Distribution Malaysia, peninsular Thailand. Some populations from streams in SE-Thailand may also be attributed to this subspecies.

Pseudodon vondembuschianus tumidus (MORELET, 1866).

1866 *Monocondylus tumidus* MORELET, J. de Conch., 14: 62 (in torrentibus montanis Cambodiae).

1876 *Monocondylaea tumida*, — DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 117, pl. 5 fig. 1-3 (Mekong; Lac à Preac Bac, Cambodge).

1876 *Pseudodon moreleti* CROSSE & FISCHER, J. de Conch., 24: 330 (Les marecages qui avoisinent les rives du Mekong; dans un lac, à Preai-Bac; arroyo de Peam-Chelang; cours d'eau de la province de Compong-Soai).

1889 *Pseudodon tumidus*, — MORLET, J. de Conch., 37: 167 (Dans tous les cours d'eau et etangs du Cambodge).

This race differs from the preceding race by its much thicker texture and more inflated shell. Otherwise not different.

Type locality Cambodia.

Distribution: Mekong and tributaries in Cambodia and S-Laos; in Thailand this subspecies is known only from the Mekong at Bandan.

Hyriopsinae MODELL, 1942.

This subfamily contains the largest species of Unionacea. These are not only easily distinguished by their large size but also by their large, fractured pseudocardinals. Laterals lamelliferous, 1 in the right valve, 2 in the left. Only the species of *Cristaria* differ from the other species by their obsolete pseudocardinals, but because of their large size, they will not be confused with other species from Thailand. All species have a more or less strongly developed posterior wing and a much smaller anterior one.

Distribution: E- and SE-Asia.

Habitat Rivers and lakes.

Key to the Thai genera:

- | | |
|---|-----------------------|
| 1. Hinge with pseudocardinals .. | 2 |
| — Hinge without pseudocardinals | <i>Cristaria.</i> |
| 2. Shell elongate, never higher than 120 mm; with anterior wing | <i>Hyriopsis.</i> |
| — Shell, when adult, higher than 130 mm; suborbicular, with posterior wing only ... | <i>Chamberlainia.</i> |

Hyriopsis CONRAD, 1853.

Shell elongately ovate or lanciform, with large posterior wing and small anterior. Pseudocardinals fractured or crenulate. Laterals lamelliform, granulated at the margins. Muscle impressions deep, not confluent.

Type species *Unio delphinus* GRUNER = *H. bialatus* SIMPSON.

Distribution like that of the subfamily.

Key to the Thai subgenera:

- | | | |
|---|-------|---------------------|
| 1. Pseudocardinals incised | ..... | <i>Limnoscapha.</i> |
| 2. Pseudocardinals crenulate, not incised | | <i>Hyriopsis.</i> |

Hyriopsis (Hyriopsis) s. str.

Shell very slenderly elongate, lanciform, with long posterior wing and much shorter anterior; moderately thick. Pseudocardinals not deeply incised, transversely furrowed or crenulate.

Distribution: Thailand, Laos, Cambodia, S-Vietnam, Malaysia, ? Sumatra.

Key to the Thai species:

- | | |
|---|--------------------|
| 1. Height less than half the length of the shell (without wing) | <i>bialatus.</i> |
| 2. Height more than half the length of the shell (without wing) | <i>delaportei.</i> |

Hyriopsis (Hyriopsis) bialatus SIMPSON, 1900.

pl. 21 fig. 36.

- 1841 *Unio delphinus* GRUNER, Arch. Naturg., 1: 276, pl. 9 fig. 1a-c [non SPENGLER, 1793] (Sungi flumine, Malaccae).
- 1864 *Unio megapterus* MORELET, J. de Conch., 12: 159 [non CHENU, 1862] (Cochinchine).
- 1866 *Unio delphinus*, — MABILLE & LE MESLE, J. de Conch., 14: 121 (Le Grand Lac, Battambang, Cambodge; Mytho, Cochinchine).
- 1876 *Unio delphinus*, — CROSSE & FISCHER, J. de Conch., 24: 325 (Cambodge, Battambang; Thouden-Moth, Cochinchine; Malacca).
- 1889 *Metaptera delphinus*, — MORLET, J. de Conch., 37: 165 (Grand Lac et ses affluents, dans les étangs qui avoisinent Pnom-Penh, rare dans le grand fleuve).
- 1900 *Hyriopsis bialatus* SIMPSON, Proc. U. S. nation. Mus., 22: 579 [n. nom. for *U. delphinus* GRUNER].
- 1905 *Unio delphinopterus* DAUTZENBERG & FISCHER, J. de Conch., 53: 456 [n. nom. for *H. bialatus* SIMPSON non *Dipsas bialata* DESHAYES, 1839].
- 1910 *Hyriopsis gracilis* HAAS, Nachr. Bl. dtsh. malak. Ges., 42: 101 (Bienho-See, Kambodscha).

- 1950 *Hyriopsis bialatus*, — SUVATTI, Fauna Thailand: 107 (Sen River, Cambodia).
1964 *Hyriopsis bialatus*, — HABE, Nature & Life SE-Asia, 3: 61, pl. 1 fig. 11 (Boraphet Swamp, C-Thailand).

Shell of medium size for the family but rather small for the genus; elongate, lanciform, tapering to the pointed podium and with a short rostration at the anterior end; in the middle of the dorsal margin there is a high, triangular posterior wing with a sharp, pointed tip; somewhat inflated with low umbones; there are 1-2 obtuse ridges running from the umbones to the posterior end. Periderm greenish but turning to blackish with age. — Interior bluish-white; muscle scars and pallial line well impressed. Hinge narrow; pseudocardinals compressed; C1 and C2 lamelliform; C3 and C4 large, crenulated; C5 and C6 obsolete. There is one strong lamelliform lateral in the right valve and two thinner laterals in the left valve. Specimens from river populations are generally thicker than those from still water, and the wing of old specimens is more often eroded. The anterior adductor scar is round and deep and not confluent with the additional scars. The posterior scar is very shallow.

Size L 95-145 mm; A 30-75 mm (body without wing); 50-95 mm (with wing); D 20-35 mm.

Distribution: Malaysia, Thailand, Cambodia, S-Vietnam, Tonkin (HAAS 1922: 168). It is found at the following Thai localities: Mekong with Mun River, Chi River, Choen River, Songkram River. Klong in the Palace Garden of Bang Pa-In; Bung Boraphet; Ban La Po, Pitsanulok Province; Pong River, Kon Kaen Province.

Hyriopsis (Hyriopsis) delaportei (CROSSE & FISCHER, 1876).

pl. 21 fig. 37.

- 1876 *Unio (Arconaia) delaportei* CROSSE & FISCHER, J. de Conch., 24: 327, pl. 10 fig. 1, pl. 11 fig. 5 (Compong Soai, Cambodge).
1889 *Arconaia delaportei*, — MORLET, J. de Conch., 37: 165 (Grand Lac, Cambodge; rivière de Srakéo, Siam).
1914 *Hyriopsis delaportei*, — HAAS, Conch. Cab., 9 (2, II): 57, pl. 8 fig. 1 (Cambodscha).
1969 *Hyriopsis delaportei*, — HAAS, Tierreich, 87: 148 (Thailand, Cambodja).

The shell of this species differs from the type species by being somewhat higher, thicker and generally larger. The anterior wing never points upwards as it often does in *bialatus*, but in the direction of the axis. The hinge teeth are similar to those of the type species; the furrows in the pseudocardinals are less numerous and broader, the distal end of the pseudocardinals is not prominent and tubercle-like and they are not concave in the middle part. The anterior muscle scars are deep, the posterior shallow.

Size: L 90-150mm; A 70-85 mm (without wing), 90-110 with wing; D 35-40 mm.

Type locality: Kompong Soai, Cambodia.

Distribution: Mekong in Laos, Thailand and Cambodia and in several of its tributaries. In Thailand first reported from the Srakéo River (Klong Satung) by MORLET (1889: 165). There is only one other locality outside the Mekong drainage of this species, the Kaek River in the Province of Pitsanulok.

HAAS (1969: 148) places *Unio sutrangensis* MORLET, 1889, in the synonymy of this species. The dentition leaves no doubt that that species synonymizes with *H. myersiana* (LEA).

Note The Klong Satung ("Srakéo River", Prachinburi River, Pekim River, Patrang River, Bang Prakon River) is not identical with the Stung Sutrang. This is the upper part of the Stung Sisiphon or Maho River which unites with the Stung Sang Ké or Battambang River.

***Hyriopsis (Limnoscapha)* LINDHOLM, 1932.**

Shell much higher and somewhat thicker than that of the type subgenus; pseudocardinals deeply incised. The right pseudocardinal is split into two high ridges, the lower of which is the highest and longest. The left pseudocardinal consists of a high ridge and a short, irregularly furrowed tubercle separated from the ridge by a deep groove.

Type species: *L. sulcata* LINDHOLM.

Distribution Japan, China, SE-Asia.

Key to the Thai species:

1. Shell length not more than 120 mm; inflated; pseudocardinals narrow *desowitzi*.
2. Shell of adults longer than 140 mm; not much inflated; pseudocardinals broad *myersiana*.

***Hyriopsis (Limnoscapha) desowitzi* n. sp.**

pl. 22 fig. 43.

Diagnosis: A species of *H. (Limnoscapha)* LINDHOLM which differs from *H. (L.) myersiana* (LEA), its compatriot, by its smaller size, thinner texture, more inflated shell and by its compressed pseudocardinals.

Description: Shell ovate, inflated, with high posterior and small anterior wing which points upwards. Texture of the shell moderately thick but thinner than that of the type species. The thick periderm is greenish when young, but turns brownish or even blackish with age. The dorsal line is straight and slants from the tip of the wing to the tip of the gonium. The posterior margin slopes to the angled podium where it turns into the ventral margin which is regularly arched to the gonium. This is produced into a short, beaklike anterior wing. The umbones are placed in the anterior third of the shell. They are not prominent and always eroded. Young specimens show some concentric furrows on the umbones; there are 1 or 2 more or less sharp areal folds running from the umbones to the podium. — Hinge plate rather broad but the teeth are narrower than in the preceding species. The lamelliform lateral teeth are comparatively short and somewhat curved. The pseudocardinals in the right valve consist of two narrow, parallel ridges, the lower ridge being higher and more roughened than the upper one. The pseudocardinals in the left valve are placed behind each other; the first is thicker but less sharply ridged than the second. The nacre is whitish. The pallial line is not interrupted. The anterior muscle scars are deep and not confluent, the posterior are shallow.

Size L 90-115 mm; A 68-80 mm; D 33-40 mm.

Soft parts: The edges of the mantle lobes are fused posteriorly and leave open the inhalant and exhalant siphonal apertures. Both apertures are distinctly

separated by a fusion of the mantle edges and ctenidia. Dorsal to these apertures is a supraexhalant opening. The foot is thick and fleshy. There is a strong anterior adductor; placed posteriorly and slightly below it is a smaller anterior retractor pedis. The posterior adductor is almost twice as thick as the anterior; the posterior retractor pedis is distinct. There is a set of several small umbonal muscles and the pallial line muscles are fused to a thick band. The animals are monosexual. The left and right ctenidia are fused and form branchial chambers. The outer demibranchs are larger than the inner, and they have also larger water-tubes. Marsupia seem to be only in the outer chambers.

Type locality Klong Rapipat at Ban Ta Luang, in Ayutthia Province, W of Saraburi.

Distribution Known from the Klong Rapipat, Pasak and Lopburi Rivers only.

Material: Holotype SMRL 2561/A; paratypes 2561/25. — SMRL 2562/3-Maenam Pasak at Ban Ta Luang; 2563/3-Maenam Lopburi at Lopburi town; 3564/1-Maenam Pasak at Saraburi; 2565/2-Maenam Pasak at Gaeng Koi.

Etiology: This species is dedicated to Dr. ROBERT DESOWITZ, formerly parasitologist at the SMRL.

***Hyriopsis (Limnoscapha) myersiana* (LEA, 1856).**

pl. 22 fig. 44.

- 1856 *Unio myersianus* LEA, Proc. Acad. nat. Sci. Philad., 8: 92 (Siam).
1856 *Unio housei* LEA, Proc. Acad. nat. Sci. Philad., 8: 92 (Siam).
1857 *Unio myersianus*, — LEA, J. Acad. nat. Sci. Philad., 3: 290, pl. 22 fig. 2 (Siam).
1857 *Unio housei*, — LEA, J. Acad. nat. Sci. Philad., 3: 291, pl. 23 fig. 3 (Siam).
1875 *Unio myersianus*, — MORELET, Sér. Conch., 4: 344 (Mênam, Siam).
1889 *Unio sutrangensis* MORLET, J. de Conch., 37: 195, pl. 9 fig. 3 (Rivière de Sutrang).
1889 *Metaptera myersianus*, — MORLET, J. de Conch., 37: 165 (Grand Lac, Cambodge; Rivière de Stung-Sutrang et sur la rive, Siam).
1903 *Unio housei*, — BLANFORD, Proc. malac. Soc. London, 5: 283 (Siam).
1904 *Unio patrangensis* MORLET, Miss. Pavie, 3: 382 (Rivière de Patrang, Siam).
1904 *Unio stungtrangensis* FISCHER & DAUTZENBERG, Miss. Pavie, 3: 440 [n. nom.] (Stungtrang).
1950 *Hyriopsis myersianus*, — SUVATTI, Fauna Thailand: 107 (Meklong River; Rajaburi; Pasak River; Meping River at Raheng).
1952 *Hyriopsis myersianus*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 22 (Me Ping at Wang Pratart Farm).

Shell large, body ovate, with the dorsal wing rhomboidal, of thick texture, very little inflated, young specimens with greenish periderm which turns brownish or blackish with age. Umbones placed at the first sixth of the anterior end, not inflated, corroded; umbonal sculpture of juvenile specimens consists of one row of tubercles only; there are 1-3 obtuse areal folds or ridges. The anterior part of the dorsal margin slants in a straight line from the tip of the posterior wing to the tiny anterior wing, then descends vertically to the dorsal margin forming a regular quarter of a circle. The ventral margin is only slightly arched; the podium is obtusely pointed. — Hinge plate rather broad. Laterals (1 in the right valve and 2 in the left) strong, rather long and slightly curved. The pseudocardinals in the right valve consist of one proximal tooth, compressed and with sharp ridge and one big distal tooth which is transversely incised and deeply fractured. The outer pseudocardinal of the left valve is

reduced to a sharp ridge on the lower part of the inner tooth. This one is also transversely striate and deeply fractured. The nacre is bluish white or salmon-coloured. The three anterior muscle scars are very deep, the posterior are very shallow.

Size L rarely exceeding 170 mm; A (with wing) 120 mm; D 40 mm.

Type locality Siam. Probably the Maenam Chao Praya.

Distribution In Thailand found in the Meklong River and its tributaries Maenam Kwae Noi and Maenam Kwae Yai. Upper reaches of the Chao Praya River and its tributaries Pasak River, Ping River and Nan River, Kaek River and Kwae Noi River in Pitsanulok Province. Prachinburi River (Patrang River, Srakeo River); in S-Thailand only known from the Klong San in Pattalung Province. In the Mekong and its tributaries this collecting team has only found *H. delaportei*. The reports of *myersiana* from the Tonle Sap and Mekong need confirmation.

Chamberlainia SIMPSON, 1900.

Shell very thick and large; this genus comprises the largest Thai species of Unionacea; ovate or suborbicular; hinge plate very broad, with 2 pseudocardinals in each valve; 1 very strong lateral in the right valve and 2 smaller in the left. Anterior muscle scars very deep, posterior shallow but distinct.

Type species *Unio hainesianus* LEA.

Distribution As the monotype.

Chamberlainia hainesiana (LEA, 1856).

pl. 23 fig. 45.

- 1856 *Unio hainesianus* LEA, Proc. Acad. nat. Sci. Philad., 8: 92 (Siam).
1857 *Unio hainesianus*, — LEA, J. Acad. nat. Sci. Philad., 3: 289, pl. 21 fig. 1 (Siam).
1862 *Unio imperialis* MORELET, Rev. Mag. Zool., 14: 480 (Ménam, Siam).
1875 *Unio hainesianus*, — MORELET, Sér. Conch., 4: 342 (Siam, fleuve Ménam).
1881 *Dysnomia pavonina* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 44 (Battambang).
1882 *Unio duclerci* ROCHEBRUNE, Bull. Soc. philom. Paris, 7: 27, pl. 1 fig. 2 (Mékong).
1891 *Unio paviei* MORLET, J. de Conch., 39: 241, pl. 7 fig. 3 (Rivière de Ménam-Pinh).
1904 *Chamberlainia pavonina* and *Simpsonia duclerci*, — ROCHEBRUNE, Bull. Mus. Hist. nat. Paris, 10: 463, 465 (Battambang; Prov. de Salaburi; Mekong).
1904 *Simpsonia demangei* ROCHEBRUNE, Bull. Mus. Hist. nat. Paris, 10: 466 (Rivière Claire entre Vietri et Tuyen-Quas, Tonkin).
1914 *Chamberlainia pavici* [err. typ. for *paviei*], — ROCHEBRUNE, Bull. Mus. Hist. nat. Paris, 20: 563.
1935 *Unio hainesianus*, — GARRET, J. nat. Hist. Bull. Siam Soc., Suppl. 10: 61 (Nan River).
1950 *Unio hainesianus* and *Chamberlainia hainesiana*, — SUVATTI, Fauna Thailand: 107 (Nan River, Meklong River; Ratburi).
1952 *Chamberlainia hainesiana*, — HAAS, J. nat. Hist. Bull. Siam Soc., 15: 21 (Me Ping at Wang Pratart Farm).
1964 *Chamberlainia hainesiana*, — WOODWARD, Vid. Medd. dansk naturh. Foren., 126: 337, pl. 31, 32, 33 (Maenam Kwae Noi, Thailand).

Shell very large, very thick, particularly the anterior part; almost equilateral when young, but less so when adult, suborbicular or ovate; posterior wing very high when young but eroded when adult. The periderm of young specimens has

a greenish colour, old specimens are brownish. The umbones are somewhat prominent; due to the erosion on even young specimens no traces of umbonal sculpture could be seen. The wing has 10-13 transverse, parallel grooves, several other may be irregularly dispersed over the shell. — Hinge plate curved; laterals lamelliform, L2 in the right valve short but extremely high, L1 and L3 in the left valve are anteriorly grown together. Pseudocardinals short and stumpy. The pseudocardinals in the right valve consist of one large, triangular, pointed tooth and a small, tubercle-like one below it. The slopes of the large tooth are roughened. The two pseudocardinals in the left valve are separated by a deep incision. The lower one is higher, apophysis-like and smooth, the upper one is lower, broader and roughened by several transverse grooves. The umbonal cavities are rather deep; there is a row of about 6 (average) muscle scars in the cavity. The scar of the anterior adductor is large and deep. There are two muscle scars of the retractor pedis, the upper one of which is confluent with the scar of the adductor and the middle retractor pedis. The posterior adductor scar is large and shallow. The inner surface is cream coloured in the anterior part and bronzy or mother-of-pearl-like in the posterior part.

Size A 120-170 mm; D 65-85 mm; L 180-260 mm.

Animal: A detailed description of the anatomy is given by WOODWARD (1964: 339). Mantle edge with 3 siphonal openings, inhalant, exhalant and supraexhalant. Marsupia only in the outer demibranchs. This is a Unionid characteristic. Glochidia semioval, without hooks. All examined animals were monosexual.

Type locality Siam.

Distribution In Thailand found in the Chao Praya River and its tributaries, Ping River, Nan River, Kwae Noi and Kaek River in Pitsanulok. MaeKlong River between Ratburi and Kanchanaburi and its tributaries, Maenam Kwae Noi and Kwae Yai. It is reported as *Simpsonia demangei* by ROCHEBRUNE from the Songkoi River in Tonkin and as *Dysnomia pavonina* from Battambang. Of the two valves in Paris considered as ROCHEBRUNE's holotype only the left valve belongs to this species. The right valve is identified by HAAS (1969: 154) as the Centralamerican *Megaloniaias nickliana digitata* (MORELET). The present author has never found any *hainesiana* in Cambodia, neither in the Mekong nor in the Tonle Sap. The report by MORELET from swamps near Meinam in Indochina refers without doubt to the Maenam Chao Praya.

Biology The species lives in rivers only and has never been found in still water.

Parasitology The animal is eaten by locals living near the Maenam Kwae Noi. No metacercariae have been found in the animals, as had to be expected as the first intermediate hosts of Echinostomatidae do not live in rivers with fast current.

Economy: Nuclei made from the shell substance of this species have been successfully tested for culture pearls in Japan. As the amount of shells needed in Japan is going to ruin the two only larger populations in the Nan River and in the Kwae Noi River the present author did not encourage any local agencies or firms to comply with the request from Japan firms to export shells of *Chamberlainia* in a larger amount.

The suspicion expressed by HAAS (1952: 21, 1969: 153) that *Unio paviei* MORLET is only the juvenile form of *hainesiana* is proved justified by a chain of intermediate forms of all sizes. Juvenile specimens are generally suborbicular, old specimens ovate. The report of *Unio duclerci* ROCHEBRUNE from the Mekong refers to this species. As

Maeklong and Mekong have often been confused it is well possible that ROCHEBRUNE's type originates from the Maeklong as already numerous specimens of this species had been sent to European and American museums from Ratburi Province.

***Cristaria* SCHUMACHER, 1815.**

Shell large, thin or moderately thick, oval, with high posterior wing. Hinge plate with strong, lamelliform laterals but without pseudocardinals (contrast all other genera of the subfamily).

Type species: *Cristaria tuberculata* SCHUMACHER = *Dipsas plicatus* LEACH.

Distribution E- and SE-Asia.

There is only one species known from Thailand.

***Cristaria plicata* (LEACH, 1815).**

pl. 23 fig. 46.

- 1815 *Dipsas plicatus* LEACH, Zool. Misc., 1: 120, pl. 53 (no locality).
1817 *Cristaria tuberculata* SCHUMACHER, Essai nouv. Syst. Vers Test.: 107, pl. 20 fig. 2 (no locality).
1830 *Symphynota bialata* LEA, Trans. amer. phil. Soc., 3: 445, pl. 15 fig. 25 (Canton, China).
1848 *Anodonta herculea* MIDDENDORFF, Bull. phys. math. Acad. St. Petersb., 6: 303 (Onon, Ostsibirien).
1866 *Anodonta bellus* MORELET, Rev. Mag. Zool. Paris, 18: 167 (Lac Tonle-Sap, Cambodge).
1866 *Symphynota magnifica*, — MABILLE & LE MESLE, J. de Conch., 14: 123 [non LEA] (Battambang, Cambodge).
1885 *Dipsas occidentalis* HEUDE, Conch. Fluv. Prov. Nanking, (9): pl. 66 fig. 129.
1886 *Dipsas bialatus* and *D. plicatus*, — MORLET, J. de Conch., 34: 266 (Etangs des environs d'Hanoi).
1889 *Dipsas plicatus*, — MORLET, J. de Conch., 37: 168 (Haut Pursac, Cambodge).
1901 *Dipsas herculeus* var., — HEUDE, J. de Conch., 49: 35 (. bassin de Ménam jusqu'à celui de Sanghalien).
1969 *Cristaria (Cristaria) plicata*, — HAAS, Tierreich, 88: 387 (Ost-Asien, von der Mandshurei bis Süd-China; Südost Sibirien, Kambodja).

Shell large to very large, elliptical-rhomboidal, thin to moderately thick, moderately inflated, forms of still water more so than river forms; rather variable in shape, with long anterior and high posterior end, with a distinct wing. The periderm is of greenish colour, generally with some darker rays. There are 1 or 2 weak posterior ridges. The umbonal sculpture consists of concentric lines arranged in two loops. Hinge plate strong, ligament of medium size, brown, somewhat protruding. Laterals lamelliform, pseudocardinals either missing or represented by a delicate knob-like protuberance only. Nacre whitish, moderately iridescent.

Size L 160-260 (? -300) mm; A 90-180 mm; D 50-90 mm. The Thai specimens never show such large dimensions, their length rarely exceeds 160 mm.

Type locality Unknown, probably China.

Distribution: From SE-Siberia through eastern China, Tonkin, Laos, Thailand to Cambodia. In Thailand this species is known in two ecological races, a thin-shelled, inflated race from still water pools in the Province of Kon Kaen and a compressed, thicker-shelled race from the Mekong.

Note As this species has semi-oval glochidia without hooks it cannot be placed among Anodontinae as HAAS (1969), VOKES (1967: 213) a. o. suggested. In spite of the reduced pseudocardinals the hinge teeth suggest a close affinity to *Hyriopsis* and *Chamberlainia*, as MODELL (1942: 188, 1964: 112) suggested. This genus is also not related to *Pletholophus* SIMPSON and its close relative *Crassitesta* SIMPSON. There is only one true Anodontinae known from SE-Asia, *Sinanodonta woodiana* (LEA), on whose various forms innumerable "species" are based. *Anodonta laosensis* FISCHER (= *Anodonta rostrata* SOWERBY non KOKEIL) is said to be synonymous with *A. ore-gcnensis* LEA from N-America. *S. woodiana* LEA has never been found in Thailand, but is known from several Malaysian localities to which it has been imported by Chinese fish-breeders.

Parreysiinae HENDERSON, 1935.

Shell of medium or small size for the family, oval, cuneiform or rhomboidal, mostly inflated, umbones sculptured with V- or W-lines which may cover the whole shell. Pseudocardinals short and stumpy, laterals long and lamelliform. Marsupia in all four demibranchs; glochidia semioval without hooks.

Distribution S-, E- and SE-Asia.

Key to the Thai genera:

- | | |
|--|-------------------|
| 1. Shell very inflated, oval or cuneiform | 2 |
| — Shell not greatly inflated, rhomboidal | 3 |
| 2. Shell elongately oval or cuneiform | 4 |
| — Shell short, oval-semicircular | <i>Unionetta.</i> |
| 3. Shell rounded rhomboidal, more or less inflated | <i>Parreysia.</i> |
| — Shell elongately rhomboidal, compressed | <i>Harmandia.</i> |
| 4. Pseudocardinals compressed | <i>Indonaia.</i> |
| — Pseudocardinals tooth-shaped | <i>Scabies.</i> |

Parreysia CONRAD, 1853.

Shell solid, inflated, rounded rhomboidal or suborbicular; with V- or W-shaped sculpture on the umbones or on the whole shell. Pseudocardinals irregular, broken into denticles, greatly striate. Laterals lamelliform; there are 2 laterals in each valve (contrast *Hyriopsinae*).

Type species *Mya corrugata* O. F. MÜLLER.

Distribution S-Asia. The Moei River seems to be the easternmost limit. There is only one species known from Thailand.

Parreysia burmana (BLANFORD, 1869).

pl. 21 fig. 39.

- 1869 *Unio burmanus* BLANFORD, Proc. zool. Soc. London, 1869: 449 (Bhamo, Irawadi River).
- 1876 *Unio birmanus* HANLEY & THEOBALD, Conch. Ind., 1: 19, pl. 42 fig. 1 [emend.] (Bhamo, Upper Birmah).
- 1900 *Parreysia (Parreysia) burmanus*, — SIMPSON, Proc. U. S. nation. Mus., 22: 845 (Irawady at Bhamo).
- 1930 *Parreysia burmanus* var. *miyitkyinae* PRASHAD, Rec. Ind. Mus., 32: 250, pl. 8 fig. 5-7 (Kamaing, Myitkyina District, Upper Burma).
- 1969 *Parreysia burmana*, — HAAS, Tierreich, 88: 122 (Fluß Irrawaddy, Birma).

Shell subovate or rounded-rhomboidal, rather solid but not very thick; inequilateral, somewhat compressed; young specimens with yellowish-green periderm which turns brownish-olive or even blackish with age. Umbones not inflated; umbones and the middle and anterior part of the shell sculptured with distinct W-lines; anterior part and margin smooth; umbones with some irregularly placed tubercles. Anterior end narrow, rounded, posterior high, sub-biangular. — Inner surface salmon-coloured, anterior muscle scars very deep, posterior shallow. Laterals long, sharp, arched; pseudocardinals strong, deeply incised, transversely striate.

Size L 35-55 mm; A 27-37 mm; D 18-23 mm.

Only dead shells were collected, thus no data on the animal can be given.

Type locality Irawady River at Bhamo, Burma.

Distribution: Drainage of the Irawady and Salween Rivers. In Thailand only known from the Moei River in Tak Province (frontiere between Thailand and Burma) and one of its tributaries, the Huai Mae Ramat N of Mae Sot, Tak Province.

This species may be conspecific with *P. tavoyensis* (GOULD, 1843), a geographic race known only from the Tavoy River in S-Burma. Closely related is *P. vulcanus* (HANLEY).

Unionetta HAAS, 1955.

Shell of rather small size, rounded-subrhomboidal or squarish, smooth or sculptured with strong wrinkles, of thick texture and covered with a green periderm which turns brownish with age. Hinge plate rather broad, teeth strongly developed. Pseudocardinals thick, stumpy, deeply fractured. Laterals lamelliform, rather short.

Type species *Unio fabagina* DESHAYES.

Distribution: Mekong in Thailand, Laos and Cambodia.

Unionetta fabagina (DESHAYES, 1876).

pl. 20 fig. 32.

1876 *Unio fabagina* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 128, pl. 7 fig. 4-6 (Mékong à Sombor).

1876 *Unio broti* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 129, pl. 7 fig. 1-3 (Mékong à Sombor).

1891 *Unio molleuri* MORLET, J. de Conch., 39: 242, pl. 7 fig. 4 (Vallée du Mékong, sur les bords du rivage de ce fleuve).

1969 *Unionetta fabagina* & *U. broti*, — HAAS, Tierreich, 88: 85, 86 (Kambodscha und Laos; Fluß Mekong bei Sombor).

Shell rather small, semioval or rhomboidal, solid, and rather thick, with greenish periderm which turn brownish with age. Umbones rather prominent, eroded. The sculpture consists of concentric W-lines which may be restricted to the umbones only (type) or covers parts of the shell (*broti*). Anterior slope short, slanting; posterior slope long, descending in an arch to the basal podium. Ventral margin almost straight. — Nacre of the inner surface bluish-white; umbonal cavities deep. Pseudocardinals short, that of the right valve with a

deep notch, that of the left valve with two deep incisions, dividing the pseudo-cardinal into three tubercles of which the middle one is the lowest. Laterals short, strong, arched.

Size L 15-35 mm; A 11-24 mm; D 10-20 mm.

The soft parts have not yet been studied.

Type locality: Mekong at Sombor in Cambodia, for *U. molleuri* Mekong at Muongsun in Cambodia.

Distribution: Mekong in Thailand, Laos and Cambodia. In Thailand also known from the Songkram River and Huai Mae Un near Sri Songkram.

Scabies HAAS, 1911.

Shell rather solid but not very thick; elongately oval, cuneiform or reniform, with yellowish or olivegreen periderm; generally sculptured with brownish zigzag-lines in V- or W-pattern. — The laterals are lamelliform; as there is an auxiliary lateral in the right valve below the main one, both valves have 2 laterals. The pseudocardinals in the right valve consist of a very short, low lamella attached almost to the margin of the hinge plate and a high, triangular tooth which is deeply incised. Those of the left valve consist of a sharp, high but short lamella and a lower, deeply incised tubercular tooth. The anterior muscle scars are deep, the posterior are shallow.

Type species *Unio scobinatus* LEA.

Distribution Thailand, Laos, Cambodia, S-Vietnam, Burma, ? India.

Habitat: Rivers, lakes, larger ponds and trenches.

Key to the Thai species:

1. Shell elongately ovate or cuneiform; sculpture with about 6 folds on 10 mm 2
— Shell elongately reniform; sculpture missing or when present with 9 folds on 10 mm
... *phaselus.*
L 23 mm and smaller *nucleus.*
— L 35 mm and larger *crispata.*

NOTE PRESTON (1915: 142) seems to have been the first to point out the identity of *U. crispata* GOULD with *U. scobinatus* LEA, MORELET (1865: 20) placed his *Unio mandarinus* into the synonymy of *scobinatus*; his *U. pellis-lacerti* was maintained as a species until PRESTON (1915) placed into the synonymy of *crispata*. *U. crispata* GOULD is based on a juvenile specimen. Adult specimens from the type locality do not differ from adult specimens of *scobinatus* from Thailand.

Scabies crispata (GOULD, 1843).

pl. 20 fig. 33.

- 1843 *Unio crispata* GOULD, Proc. Boston Soc. nat. Hist., 1: 141 (Tavoy, Burma).
1856 *Unio scobinatus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).
1857 *Unio scobinatus*, — LEA, J. Acad. nat. Sci. Philad., 3: 297, pl. 26 fig. 11 (Siam).
1864 *Unio mandarinus* MORELET, J. de Conch., 12: 159 (Cochinchine).
1865 *Unio pellis-lacerti* MORELET, J. de Conch., 13: 22 (Siam).
1866 *Unio venustus* MORELET, J. de Conch., 14: 63 (in torrentibus montanis Cambodiae).
1870 *Unio oblitus* LEA, Synops., Fam. Union.: 64 (Cambodia).

- 1875 *Unio scobinatus*, — MORELET, Sér. Conch., 4: 354 (Battambang; province de Saraburi, Siam).
- 1875 *Unio pellis-lacerti*, — MORELET, Sér. Conch., 4: 355 (. toute l'Indochine dans la rivière de Saraburi).
- 1891 *Unio scobinatus* var. *minor* MORLET, J. de Conch., 39: 237 (Ruisseaux du plateau de Xieng-Moi. Dans le Nam-In-Boun, affluent de Mekong).
- 1910 *Nodularia persculpta* HAAS, Conch. Cab. 1, 9 (2): 105, pl. 10 fig. 4-7 (Hunan, Mittelchina).
- 1950 *Nodularia (Nodularia) crispata*, — SUVATTI, Fauna Thailand: 108 (Bangkok, Kwe Pasak, Lem Sing).
- 1952 *Scabies scobinata*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 23 (Me Ping River at Wang Pratart Farm and from the Menam River at Nam Nan).
- 1964 *Unio (Scabis) scobinata*, — HAAS, Life & Nature SE-Asia, 3: 63, pl. 1 fig. 9-10 (Bangkok).
- 1969 *Scabies scobinata* and *Indonaia crispata*, — HAAS, Tierreich, 88: 63, 115 (Kochinchina, Kambodscha, Siam, Birma).

Shell solid, inequilateral, elongate, oval or cuneiform, rarely cylindrical or even elongately reniform; rounded anteriorly and rostrate posteriorly. The colour of the periderm is yellowish or olive-brown, the colour of the sculpture is dark greenish or greenish-brown. This sculpture consists of fine V-lines on the beaks and several strong ridges running radially from the anterior and posterior slopes to the ventral margin where they may unite. On the posterior slope there are some short ridges running from the dorsal margin to the areolar fold. The folds form acute angles with the folds on the posterior part of the shell. These folds are very variable with regard to strength, density and shape. The great number of species placed into the synonymy of *Scabies scobinata* is based on the variable sculpture. In young specimens the folds run to the ventral margin of the shell, in fully adult specimens the part of the shell near the ventral margin is less sculptured and sometimes even smooth. These folds are often ornate with tubercles. — The nacre is of a milky-white colour. The pseudo-cardinals are large and deeply fractured by an average of 6 incisions. The two laterals in the left valve are well developed, the auxiliary second lateral in the right valve is weak and short. The anterior muscle scars are deep, the posterior very shallow.

Size L 35-55 mm; A 20-27 mm; D 17-25 mm.

Type locality Tavoy, Burma.

Distribution In the drainage systems of all Thai rivers southwards to Patalung River (Klong San). In the Mekong and its tributaries in Thailand, Burma, Laos and Cambodia. In Vietnam and probably also in China, if *Nodularia persculpta* HAAS is really identical with this species. There are three geographic races within its area of distribution, the Burmese race from Tavoy with the form from the MaeKlong River in Thailand, the race from Central Thailand and the race from the Mekong. As the species is rather variable within the distribution of the separate races they are here not treated as separate subspecies. They may carry the following names: Burma and W-Thailand: *c. crispata*; C-Thailand: *c. pellislacerti*; and in the Mekong drainage *c. scobinata*. There are intermediate forms between these three races.

Although former authors had already found out the identity between *crispata* and *scobinatus* (PRESTON 1915: 142), these synonyms were placed in most recent publications (HAAS 1969: 63, 115) as different species into different genera, *crispata* into *Indonaia*, *scobinatus* into *Scabies*. *Indonaia* is not closely

related to *Nannonaiia* but to *Scabies*. Although the pseudocardinals of these two genera are thick and well developed, they are lamelliform and not tooth-shaped as in *Scabies* and *Unionetta*. *Unio crispata* is based on a juvenile specimen with comparative coarse sculpture. Adult specimens from the type locality are extremely similar to those from Thailand. Generally the form from C-Thailand is less sharply sculptured (*pellislacerti*) while the Mekong race is again much rougher sculptured and generally less inflated. There is one local form to be mentioned from the Huai Tuai River near Tha Uthen. It is a rather compressed form with extremely coarse sculpture and pointed, cuneiform shape.

Scabies phaselus (LEA, 1856).

pl. 20 fig. 34.

1856 *Unio phaselus* LEA, Proc. Acad. nat. Sci. Philad., 8: 94 (Siam).

1857 *Unio phaselus*, — LEA, J. Acad. nat. Sci. Philad., 3: 297, pl. 26 fig. 11 (Siam).

1969 *Scabies phaseolus* (sic!), — HAAS, Tierreich, 88: 64 (Siam).

Shell smaller and lower than that of the type species, ventral margin generally concave. The sculpture is much denser and consists of obtuse, wavy lines running from the dorsal margin obliquely to the ventral margin. The sculpture may be completely obsolete. The surface of the shell is glossy, not dull like that of the preceding species. The hinge is less strongly developed. The pseudocardinals in the left valve consist of a small, short, lamelliform upper tooth and a raised, triangular lower one. The upper tooth in the right valve is very small, the lower high and sharp. These large pseudocardinals are not long and ridge-like as in *S. scobinata* but short and triangular with a pointed crest. They are not incised or fractured. Otherwise typical for the genus.

Size L 28-48 mm; A 10-18 mm; D 12-19 mm.

Type locality Siam.

Distribution: Mekong valley S of Bung Kan-Paksane. From Thailand known from the Mekong at Nakon Panom, Takrong River at Nakon Ratchasima, Mun River at Tha Tum and Rasi Salai, Songkram River at Sri Songkram and Huai Thuai at Tha Uthen.

Scabies nucleus (LEA, 1856).

pl. 20 fig. 35.

1856 *Unio nucleus* LEA, Proc. Acad. nat. Sci. Philad., 8: 94 (Siam).

1857 *Unio nucleus*, — LEA, J. Acad. nat. Sci. Philad., 3: 303, pl. 28 fig. 21 (Siam).

1969 *Scabies nucleus*, — HAAS, Tierreich, 88: 64 (Siam).

Shell small, subquadrate, thick, greenish, with coarse, radial V-line sculpture. Hinge well developed. Pseudocardinals thick, stumpy, short, deeply fractured. Laterals short, lamelliform, thick, arched, right valve with an accessory lateral. Muscle scars distinct, the anterior particularly deep. Nacre bluish-white, iridescent.

Size L 22 mm; A 14 mm; D 11 mm.

Type locality "Siam"

Distribution In Thailand only known from the Takrong River in Thailand, where it was found again by W. HEARD in 1971, and in the Lam Se Bok, a lower tributary to the Mun River. Extralimitarily known from Laos (Mekong and Sedone River).

Harmandia ROCHEBRUNE, 1881.

Shell inaequilateral, compressed, with strong, radial sculpture. Hinge teeth strong, pseudocardinals short, strong, oblique, laterals strong, lamelliform, two in each valve.

Type species *Harmandia somboriensis* ROCHEBRUNE.

Distribution Mekong and Mun River.

Note FRIERSON (1913, *Nautilus*, 26: 141) considered the genus *Harmandia* to be based on young specimens of *Hyria* from South America. HAAS (1914: 257) corroborated this opinion. Both are wrong. The present author collected adult specimens of the type species at Cham Passak in Laos about 200 km north of the type locality (Sombor in Cambodia). Compared with young specimens of *Tripodon corrugatus* to which ROCHEBRUNE's species were assigned, the Mekong species does not show any similarity with the Southamerican Hyriinae. *Harmandia* is a valid genus, its type species is known from Sombor in Cambodia and from Cham Passak and Khong Island in Laos. *H. castelneau* ROCHEBRUNE is based on a more strongly sculptured specimen but synonymous with *somboriensis*. The specimen from Cham Passak is more weakly sculptured but without doubt it is this species. The type species has not yet been collected in Thailand but a new species assigned to this genus is known from the Mun River.

Harmandia munensis n. sp.

pl. 21 fig. 38.

Diagnosis: A species of *Harmandia* which differs from the type species by having only the posterior slope sculptured with ridges and by its inferior pseudocardinal in the right valve which is broad and deeply transversely furrowed.

Description: Shell rather small and thin, trapezoidal, compressed, with low anterior end and higher posterior end. Anterior end elongately rounded, posterior end rostrate; the posterior part of the dorsal margin forms an obtuse angle, podium somewhat rostrate, ventral margin almost straight. The thin shell is covered by a yellowish-green periderm which is somewhat cutaneous at the growth lines. The umbones are placed near the anterior end of the shell at about 18-100 of the length of the shell. They are eroded. The posterior slope is sculptured with oblique, parallel ridges running from the dorsal margin to the posterior ridge. — Hinge plate rather broad for the thin shell. Pseudocardinal strong, divided into two teeth in each valve. The inferior tooth in the right valve is broad and flattened and its top is transversely furrowed. The superior tooth is small and ridge-like. The inferior tooth in the left valve is deeply fractured, the superior is almost obsolete. The laterals are thin and lamelliform. There are 2 laterals in the left valve, but only 1 in the right valve. The 2 laterals in the left valve are placed closely together and somewhat arched. Nacre bluish, iridescent. Anterior muscle scars moderately deep, posterior shallow. Pallial line barely visible.

Size (Holotype) L 33 mm; A 17 mm; D 9 mm.

Type locality Mun River at Pibun Mangsahan.

Distribution: Known from the type locality only.

Material Holotype SMRL 5792/A.

Indonaia PRASHAD, 1918.

Shell ovate or rounded-trapezoidal, rather thin or moderately solid. Umbones, parts of the shell or the complete shell sculptured with narrow zigzag-lines. Hinge teeth well developed, pseudocardinals short and stout, laterals lamelliform.

Type species *Unio caeruleus* LEA, 1831.

Distribution: India, Burma, Thailand.

Note This genus is closely related to *Radiatula* BENSON. HAAS (1969: 113-114) placed several Thai, Cambodian and Burmese species into the synonymy of *I. caerulea* (LEA): *substriatus* LEA, *humilis* LEA, *pachysoma* BENSON, *pilatus* LEA and *andersonianus* NEVILL. While some may be regarded as races of the type species, these species from Thailand are definitely different species and have to be treated separately. The close relationship between *Scabies* and *Indonaia* is proved by the fact that HAAS (1969: 115) placed *Unio crispata* GOULD into *Indonaia*, but *Unio scobinatus* LEA which is only a synonym of that species, into *Scabies*.

Key to the Thai species:

- | | |
|---|---------------------|
| 1. Length less than 30 mm | . 2 |
| — Length more than 40 mm | . <i>pilata</i> . |
| 2. Sculpture only on the umbones | <i>substriata</i> . |
| — Sculpture on the umbones and on the upper half of the shell | <i>humilis</i> . |

Indonaia substriata (LEA, 1856).

pl. 21 fig. 40.

1856 *Unio substriatus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).

1857 *Unio substriatus*, — LEA, J. Acad. nat. Sci. Philad., 3: 300, pl. 26 fig. 14 (Siam).

1915 *Nodularia (Nodularia) caeruleus*, — PRESTON, Fauna Brit. India, Moll.: 136 [partim] (India).

1969 *Indonaia caerulea*, — HAAS, Tierreich, 88: 113 [partim] (Indien, Assam, Birma, Thailand).

Shell rather small, elongate, with rounded anterior end and long, tapering posterior end with pointed podium. Dorsal margin almost straight and horizontal, almost parallel to the long, straight ventral margin. Covered with a dull, greyish periderm. Umbones moderately inflated, with several tubercles and irregular V-lines. The remainder of the shell is smooth except for the growth lines. Hinge plate narrow; teeth thin; pseudocardinals lamelliform, thin, two in the right valve and one in the left; laterals long and thin, two in the left valve and one in the right. Nacre bluish-white, iridescent. Upper posterior end with two ridges.

Size L 25-28 mm; A 14-16 mm; D 9-11 mm.

Type locality: Siam.

Distribution: Only known from Thailand: Maeklong River, Maenam Kwae Noi, Maenam Kwae Yai, Maenam Chao Praya, Maenam Ping, Maenam Nan, Maenam Kaek (Pitsanulok). A river species whose distribution is restricted to the Mae Klong and Chao Praya drainage systems only.

Authorities who placed this species in the synonymy of *I. caerulea* overlooked certain distinctive characteristics of this species. The more depressed shell and the constant lack of shell sculpture together with the smaller size justify a specific separation from *I. caerulea*.

Indonaia pilata (LEA, 1866).

pl. 21 fig. 41.

1866 *Unio pilatus* LEA, Proc. Acad. nat. Sci. Philad., 10: 133 (Siam).

1868 *Unio pilatus*, — LEA, J. Acad. nat. Sci. Philad., 6: 281, pl. 33 fig. 95 (Siam).

Shell similar in shape to that of a *Uniandra*, of medium size, rather solid, anterior part low, posterior much higher; dorsal margin almost horizontal; anterior part rounded, posterior rostate, ventral margin almost straight. Beaks in the anterior third of the shell, moderately inflated. Umbones with radial wrinkles which continue on the posterior and anterior slopes. The colour of the periderm is greenish in young specimens and brownish in adults. The beaks are generally eroded. Ligament short and protruding. Hinge plate narrow but teeth rather strong. Laterals sharp, lamelliform, almost straight, the two laterals in the left valve somewhat diverging. Pseudocardinals in the right valve strong, short, the inferior tooth much higher and stronger than the superior. The single pseudocardinal in the left valve rather long and low. Nacre bluish-white, iridescent.

Size L 36-46 mm; H 18-25 mm; D 12-16 mm.

Type locality: Siam, probably Mekong River.

Distribution Mekong in Thailand, Laos and Cambodia and several of its tributaries.

Note: This species was wrongly placed by several authorities (PRESTON, PRASHAD, HAAS) into the synonymy of *Indonaia caerulea*, as also was the following species.

Indonaia humilis (LEA, 1866).

pl. 21 fig. 42.

1856 *Unio humilis* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).

1858 *Unio humilis*, — LEA, J. Acad. nat. Sci. Philad., 3: 298, pl. 26 fig. 10 (Siam).

Shell lower and more elongate than that of the preceding species. The shape of the shell is similar to that of *Scabies phaselus* (LEA), as the ventral margin is often concave in the middle part. Anterior end low and rounded, posterior part higher and rostrate. Covered with a rather thin, green periderm. The moderately prominent umbones are covered with zigzag-sculpture which extends over the posterior and anterior slopes. Hinge teeth compressed; the long laterals are somewhat curved, the lamelliform pseudocardinals are low and sharp. The inferior pseudocardinal in the right valve is somewhat stronger than the superior. Nacre whitish and iridescent.

Size L 35-39 mm; D 17-19 mm; D 13-16 mm.

Type locality: Siam, probably Mekong River.

Distribution: Mekong S of Lao Luang in Thailand, Laos and Cambodia, probably also in Vietnam. Also known from several tributaries in Thailand, Laos and Cambodia.

Note These two species which are tentatively assigned to this genus are very similar to each other but as they are found together they cannot be treated as races of the same species. *N. pilata* looks similar to a slender *Uniandra*, *N. humilis* connects this genus with *Scabies*.

Rectidentinae MODELL, 1942.

(Contradentinae MODELL, 1942).

Shell ovate, rhomboidal or cuneiform, generally of thin texture; the sculpture, if present, consists of double concentric bows and V- or W-lines; these may be dissolved into single lines of hooks. — Hinge plate very narrow, pseudo-cardinals lamelliform (contrast Hyriopsinae, Pseudodontinae, Parreysiinae), often very weak. Laterals long, thin lamelliform, right valve without accessory lateral. As far as examined all genera have marsupia in all 4 demibranchs.

Distribution S-, SE- and E-Asia; several Indonesian and Philippine Islands.

Note: The Contradentinae which its author MODELL later placed into the synonymy of Anodontinae, is here united with Rectidentinae. The genera of these two subfamilies of MODELL are so closely related, that other authors (HAAS 1969) placed subspecies of some of the species partly into *Ensidents* (Rectidentinae) and partly into *Contradens* (= *Uniandra*) (Contradentinae).

Key to the Thai genera:

- | | |
|---|-----------------------|
| 1. Hinge teeth rather or extremely weak | 2 |
| — Hinge teeth relatively strong | 3 |
| 2. Shell more or less inflated | <i>Physunio</i> . |
| — Shell compressed | <i>Trapezoidens</i> . |
| 3. Shell ovate; with angled umbonal sculpture | <i>Uniandra</i> . |
| — Shell cuneiform; without umbonal sculpture | <i>Ensidents</i> . |

Ensidents FRIERSON, 1911.

Shell elongately cuneiform, with rounded anterior end and pointed posterior. Each valve with 2 pseudocardinals, the one in the left valve below the beak may become obsolete. Laterals long, lamelliform.

Supraanal opening separated from the anal opening by a narrow bridge. All 4 demibranchs contain embryos. Glochidia semioval, lower margin with a row of tubercles.

Type species *Unio ingallsianus* LEA.

Distribution: SE-Asia (excluding Burma), Java, Borneo.

For *Unio ingallsianus* LEA and related species, FRIERSON established in 1911 a separate genus *Ensidents*. As all "species" assigned to this genus are now considered races of *ingallsianus*, this genus is identical with the rassenkreis of that species. The differences between *Rectidents* and *Ensidents* have barely generic value.

The Rassenkreis of *Ensidents ingallsianus* (LEA).

Five taxa, described as species, should be assigned to this rassenkreis: *ingallsianus* LEA, *sagittarius* LEA, *pazii* LEA, *jaculus* ROCHEBRUNE and *dugasti* MORLET. The first three species are almost identical and have not even subspecific value. The fourth is a local form of the Mekong in S-Laos and Cambodia. Only *dugasti*

is a well defined subspecies, which, if not intermediate forms were known, could well be considered a separate species.

Distribution: Thailand, Laos, Cambodia, Malayan Peninsula.

Habitat: Rivers with moderate current, klongs, lakes and larger ponds, canals and trenches.

***Ensidents ingallsianus ingallsianus* (LEA, 1852).**

pl. 24 fig. 47.

- 1852 *Unio ingallsianus* LEA, Trans. Amer. phil. Soc., (NS) 10: 382 (Siam).
1852 *Unio ingallsianus*, — LEA, Obs. Unio, 5: 38, pl. 24 fig. 41 (Siam).
1856 *Unio sagittarius* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).
1857 *Unio sagittarius*, — LEA, Obs. Unio, 6: 18, pl. 26 fig. 12 (Siam).
1862 *Unio pazii* LEA, Proc. Acad. nat. Sci. Philad., 6: 176 (China, Siam).
1866 *Unio pazii*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 61, pl. 21 fig. 60 (Siam).
1882 *Unio jaculus* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 44 (Mékong à Sombor, Cambodge).
1950 *Ensidents ingallsianus*, — SUVATTI, Fauna Thailand: 107 (Upper Supan River, Kwe Pasak, Nangkok).
1952 *Ensidents (Ensidents) ingallsianus* and *sagittarius*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 22 (Me Nam River at Nam Nan; Me Ping River at Wang Pratart Farm).

Shell solid, elongately cuneiform, rounded anteriorly and pointed posteriorly. Smooth except for the growth lines, greyish or olive-green; the swollen beaks are placed almost at the anterior end; an obtuse keel runs from the umbones to the posterior end. Embryonic shell without sculpture. The interior of the shell is whitish-nacreous. The muscle scars are rather shallow. Pseudocardinals weak, elongate, corrugated, double or single in the left valve and always double in the right. Laterals long, lamelliform, sharp and thin. Cavity of shell and beaks rather deep.

Size: L 55-85 mm; A 15-34 mm; D 21-25 mm.

Type locality: "Siam"

Distribution: Thailand, Laos, Cambodia, Vietnam, Malayan Peninsula. The report from China needs to be confirmed. However, it is possible that this species may also be found in NE-Burma and in S-China in the Mekong valley. In Thailand this species was found in the following provinces: Nong Kai, Udon, Nakhon Panom, Nakhon Sakon, Buriram, Korat, Surin, Sri Saket, Ubon, Saraburi, Ayutthia, Supanburi, Bangkok, Thonburi, Chiang Mai, Pattalung, Pitsanulok, Trat, Chaiyapum, Nakhon Sritamarat, Ang Tong, Sakon Nakhon, Ratburi. In C- and in E-Thailand it may be found at all favourable habitats.

***Ensidents ingallsianus dugasti* (MORLET, 1892).**

pl. 24 fig. 48.

- 1892 *Unio dugasti* MORLET, J. de Conch., 40: 86 (Rivière Outhène, petit affluent du Mékong, Laos).
1893 *Unio dugasti*, — MORLET, J. de Conch., 41: 156, pl. 6 fig. 4 (Dans l'Outhène; petit affluent de la rive droite du Mékong, dans le Laos).

This race differs from the type subspecies by its extremely low shell, which is almost similar to the Japanese genus *Lanceolaria*. Dorsal and ventral margins are almost parallel.

Size: L 56-65 mm; A 18-23 mm; D 15-20 mm.

Type locality: Huai Thuai near Tha Uthen, formerly called Uthen River by the French.

Distribution: Known from the Huai Thuai and from the Songkram River near Sri Songkram only. Both places are in the province of Nakhon Phanom.

Uniandra HAAS, 1912.

(*Conradens* HAAS, 1913, *Schizocleithrum* HAAS, 1913, *Sprickia* MODELL, 1942).

Shell more or less elongately ovate, with rounded or moderately truncate anterior end and tapering posterior end. Beaks prominent, with angular umbonal sculpture. Shell smooth or partly, often completely, sculptured with irregularly concentric wrinkles. Left valve with 1 small, compressed pseudo-cardinal and 2 long, thin lamelliform laterals, right valve with 2 short pseudo-cardinals and 1 long lateral. — Supraanal opening separated from the anal opening. Marsupia in the outer demibranchs, and in parts of the inner. Glochidia ovate, similar to those of *Rectidens*.

Type species: *Unio conradens* LEA.

Distribution: From C-China southwards to the Malayan Peninsula, Sumatra, Vietnam and Cambodia.

This common and widely distributed genus contains 20 species, attributed to it by several authors in the last 100 years. A critical revision may find two or three of them to be valid species, some of them acceptable as races but most to be synonyms. All species from SE-Asia may be considered to be one *rassenkreis*, *U. conradens* (LEA). *Uniandra c. conradens* with *javanus* LEA, *exilis* DUNKER, *mutatus* MOUSSON and *mederianus* KÜSTER is the race from Java; *U. c. dimotus* (LEA) with *sumatrensis* LEA (non DUNKER), *hageni* STRUBELL, *pajacomboensis* BULLEN, *Microcondylaea bicristata* STRUBELL and *Conradens dimotus* var. *lugens* PRASHAD from Sumatra. *Conradens (Sprickia) verbeeki* (MARTENS) is the lake-form of this race with strong sculpture. Such strongly sculptured lake-forms are found in all races of *Uniandra conradens*. *U. c. ascia* (HANLEY) replaces the Indonesian races on the Malayan peninsula. The predominant race of this *Rassenkreis* in Thailand is *c. tumidula* (LEA) with *inornatus* REEVE, *asperulus* LEA, *versus* LEA and *inaequalis* ROCHEBRUNE as synonyms. The oldest available name for the form from the Mekong basin seems to be *cambodiensis* SOWERBY. Unfortunately this form is more similar to the Thai race *c. tumidula* in shape (not in sculpture) than to the forms of the Mekong drainage. To this group of forms belong *dautzenbergi* MORLET, *semidecoratus* MORLET, *fischerianus* MORLET, *crossei* DESHAYES, *soboles* FISCHER, *siamensis* MORLET, *thaiensis* HABE and *paivanus* MORELET.

Uniandra conradens ascia (HANLEY, 1856).

pl. 24 fig. 49.

1856 *Unio ascia* HANLEY, Cat. rec. Bivalve Shells: 385, pl. 23 fig. 20 (Penang).

1923 *Conradens ascia ascia*, — HAAS, Abh. senckenb. naturf. Ges., 38: 197, pl. 15/16 fig. 12 (Penang).

Oval-subtrapezoidal, inequilateral, moderately thick, tumid, glossy, brownish-olive, with concentric wrinkles which may sometimes be restricted

to the umbonal area only. Ventral and dorsal margin convex, the former rising posteriorly, the latter slightly sloping; anterior end rounded, posterior end biangulate or truncate, rarely produced into a beak. There are two weak ridges running from the umbones to the posterior part of the shell. Ligament straight or somewhat curved, brownish, placed behind the umbones. Teeth comparatively strong, typical for the genus.

Size: L 45-75 mm; A 30-45 mm; D 24-35 mm. — Extremely large specimens with produced posterior end look quite different from medium sized specimens with regard to shape.

Type locality Penang. The author has never found any *Uniandra* on Penang Island, only in continental Malaysia.

Distribution: Malayan Peninsula S of Ratburi Province. In Thailand known from the Petburi River and S of it.

***Uniandra contradens rusticoides* n. subsp.**

pl. 24 fig. 50.

Diagnosis: A subspecies of *U. contradens* (LEA) which differs from *c. ascia* (HANLEY) by its strong zigzag sculpture which covers the whole shell. It is similar in sculpture to *c. rustica* (LEA) but differs by being more regularly ovate. It is a strongly sculptured form of *c. ascia*, while *c. rustica* is the strongly sculptured form of *c. tumidula* (LEA).

Size: L 38-46 mm; A 25-30 mm; D 20-24 mm.

Type locality: Klong Min near Chandi, Chawang.

Distribution: Only known from the type locality and from the Klong Sog, 96 km from Phun Phin to Takua Pa.

Material: Holotype SMRL 2435/A; paratypes 2435/40. — SMRL 2340/8-Klong Sog, between Surath Thani and Takua Pa.

***Uniandra contradens tumidula* (LEA, 1856).**

pl. 24 fig. 51-52.

1856 *Unio tumidulus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).

1857 *Unio tumidulus*, — LEA, Observ. Unio; 6: 15, pl. 25 fig. 8 (Siam).

1858 *Unio tumidulus*, — LEA, J. Acad. nat. Sci. Philad., 3: 295, pl. 25 fig. 9 (Siam).

1860 *Unio inornatus* [non LEA] and *U. tumidulus*, — MARTENS, Proc. zool. Soc. London, 1860: 15 (Siam).

1865 *Unio inornatus* REEVE, Conch. Icon., 16: pl. 29 fig. 147 [non LEA 1856] (Cambodia).

1866 *Unio asperulus* LEA, Proc. Acad. nat. Sci. Philad., 10: 133 (Siam).

1866 *Unio asperulus*, — LEA, J. Acad. nat. Sci. Philad., 6: 280, pl. 38 fig. 94 (Siam).

1870 *Margaron (Unio) versus* LEA, Syn.: 46 (Siam).

1875 *Unio tumidulus*, — MORELET, Sér. Conch., 4: 351 (Cambodge).

1889 *Unio tumidulus*, — MORLET, J. de Conch., 37: 165 (Grand Lac, ses affluents et les étangs du Cambodge, la rivière de Pékin et celle de Srakéo, à Srakéo).

1889 *Unio semidecoratus* MORLET, J. de Conch., 37: 192, pl. 8 fig. 4 (Rivière de Srakeo à Srakeo).

1904 *Unio tumidulus*, — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 440 (Rivière de Srakéo, de Pékin et de Pakpriau, Siam).

- 1950 *Nodularia tumidula*, — SUVATTI, Fauna Thailand: 108 (Kwe Pasak; Klong Koh Nang Leung; Meklong River; Rajaburi, Nontaburi; Bangkok).
- 1952 *Ensidents (Uniandra) asperulus* and *Contradens ascia*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 22, 23 (Me Nam River at Nam Nan; Me Ping River at Wang Pratart Farm).

This race is the predominant race of *U. contradens* in Thailand. Its wedge-like shape and almost smooth surface separates it from all other forms. The thin form (*asperulus* LEA) is the river form, *tumidulus* LEA s. str. is the ecological form found in trenches, canals, klongs and ponds. The zigzag sculpture is restricted to the umbones and to the escutcheon. The two diagonal keels are more or less distinct. Hinge and teeth typical, but generally not so strongly developed as in *c. ascia*.

Size: L 35-75 mm; A 26-40 mm; D 20-30 mm.

Type locality: "Siam"

Distribution: Thailand, Laos, Cambodia, S-Vietnam. The distribution of this race partly overlaps that of *c. ascia*. The intermediate forms, however, preclude a separation into two species.

***Uniandra contradens rustica* (LEA, 1856).**

pl. 24 fig. 53.

- 1856 *Unio rusticus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).
- 1857 *Unio rusticus*, — LEA, Observ. Unio, 6: 14, pl. 25 fig. 7 (Siam).
- 1860 *Unio rusticus*, — MARTENS, Proc. zool. Soc. London, 1860: 14 (Siam).
- 1865 *Unio paivanus* MORELET, J. de Conch., 13: 227 (Siam).
- 1866 *Unio cambodiensis* SOWERBY, Conch. Icon., 16: pl. 42 fig. 231 (Cambodia).
- 1889 *Unio siamensis* MORLET, J. de Conch., 37: 194, pl. 7 fig. 2 [non LEA] (Rivière de Sutrang).
- 1889 *Unio dautzenbergi* MORLET, J. de Conch., 37: 180, pl. 8 fig. 5 (Rivière de Srakeo à Srakeo).
- 1891 *Unio soboles* P. FISCHER, Bull. Soc. nat. Hist. Autun, 4: 222 (Rivière de Sutrang).
- 1950 *Nodularia rustica*, — SUVATTI, Fauna Thailand: 108 (Bangkok).
- 1952 *Contradens rusticus*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 23 (Me Ping and Klong Klung River at Wang Pratart Farm).
- 1964 *Unio thaiensis* HABE, Nature & Life in Southeast Asia, 3: 62, pl. fig. 3, 4 (Borapet Swamp).

This form differs from the type race by having the complete or nearly complete shell sculptured with strong, obtuse and concentric wrinkles. Occasionally the outer part of the shell, near the margin, is smooth except for the growth lines (*semidecoratus* MORLET). Such specimens may be found also among *c. tumidula*. *U. siamensis* MORLET is the extreme adult form with beaklike produced posterior end.

Size: L 40-55 mm; A 25-35 mm; D 20-30 mm.

Type locality "Siam"; for *siamensis* MORLET the type locality is the Sutrang River between Sisophon and Aranyapratet in Cambodia (formerly Thailand); *semidecoratus* and *dautzenbergi* were described from the Klong Satung near Srakeo; HABE described his *U. thaiensis*, although half a dozen names were already available, from the Lake Borapet near Nakon Sawan.

Distribution Petburi River; drainage of the Chao Praya River; Bang Prakon River (the upper reaches of which are called Klong Satung and the middle reaches Prachinburi River); Mekong basin in Thailand and Cambodia.

Uniandra contradens crossei (DESHAYES, 1876).

pl. 24 fig. 54.

1876 *Unio crossei* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. nat. Hist. Paris, 10: 124, pl. 6 fig. 5-7 (Cambodge).

1889 *Unio crossei*, — MORLET, J. de Conch., 37: 163 (Bo Chien, Saigon).

1914 *Contradens crossei*, — HAAS, Conch. Cab., 9 (2, 2): 185, pl. 20 fig. 1 [not figs. 2-3; the plates were issued in 1911].

Shell very short and inflated, very similar to *U. c. ascia* (HANLEY) but shorter and more rounded. The posterior part of the ventral margin and the posterior end are triangular; the posterior part of the dorsal margin ascends behind the umbones and after forming an angle, suddenly slopes down to the posterior upper angle.

Size L 35-42 mm; A 25-28 mm; D 16-24 mm.

Type locality "Cambodge"

Distribution Mekong and eastern affluents between Tha Uthen and Saigon.

Uniandra contradens fischeriana (MORLET, 1883).

pl. 24 fig. 55.

1883 *Unio fischerianus* MORLET, J. de Conch., 31: 109, pl. 4 fig. 6 (Cambodge).

1900 *Nodularia fischeriana*, — SIMPSON, Proc. U. S. nat. Mus., 22: 818 (Cambodia).

1913 *Contradens dimotus fischerianus*, — HAAS, Conch. Cab., 9 (2, 2): 183, pl. 19 fig. 8 (Cambodja).

This subspecies differs from all other subspecies by its laterally compressed shell which is still thinner than that of *U. c. asperula*. It differs also by its winged posterior part of the dorsal margin which is still higher than that of *c. crossei* and *c. ascia*.

Size L 45-58 mm; A 30-34 mm; D 24-27 mm.

Type locality: "Cambodge", probably the Sutrang River in W-Cambodia.

Distribution This form was only found in the Sutrang River in E-Thailand and W-Cambodia. In 1889 MORLET described a *Unio siamensis* (non LEA) from this river. FISCHER replaced the preoccupied name by *Unio soboles*. The type of this race is the sculptured *U. cambodjensis* SOWERBY with produced posterior end. Our collecting teams never found sculptured specimens in this river.

In 1882 ROCHEBRUNE described a *Uniandra* from the Mekong at the rapids of Sambor (more correctly called rapids of Samboc, a village about 20 km S of Sambor and about 15 km N of Kratie). The present author collected several days at the above rapids but did not find any *contradens* forms. No type material has been found in the collection in Paris and the paratype which HAAS figured in 1911 as *Oxynaia inaequalis* (: pl. 12a fig. 5) was lost during WW II.

The forms of *contradens* which are found in the Chantaburi River and other small rivers in SE-Thailand in the Provinces of Chonburi, Rayong, Chantaburi and Trad are tentatively placed in the subspecies *c. fischeriana*. They are small, brownish and look very similar to small forms of *Pseudodon* from mountain streams. The hinge teeth, however, make identification easy.

***Uniandra subcircularis* n. sp.**

pl. 24 fig. 56.

Diagnosis: A species of *Uniandra* HAAS which differs from all other species of the genus by its subcircular shape and very thick pseudocardinals.

Description: Shell small for the genus, subcircular, thick and solid, covered with a greenish periderm. Anterior end somewhat lower than the posterior, all margins regularly rounded. The umbones are moderately inflated, they are placed in the anterior half of the shell and are inclined inwards and forwards. They are sculptured with delicate zigzag-lines which are continued over the upper half of the shell. The rest of the shell is sculptured with rough growth lines only. The hinge plate is short and broad. The ligament is brown, short and not greatly protruding. The pseudocardinals (2 in each valve) are very strong. The accessory pseudocardinal is but a slight thickening of the margin in the right valve. The main pseudocardinal in the right valve is a short, blunt and somewhat arched tubercle. The pseudocardinals in the left valve consist of two roughened, sharp ridges which are placed behind each other. The inner tooth is pointed, the outer tooth somewhat lamelliform. The laterals are rather short. The single lateral in the right valve is curved. The inferior lateral in the left is bluish-white and iridescent. The anterior muscle scar is deep, the posterior shallow. Pallial line very shallow, not sinuous. — Animal not studied.

Size L 25.6 mm; A 20 mm; D 15.6 mm.

Type locality: Mekong between Takek and Nakon Panom.

Distribution: Known from the type locality only.

Material Holotype SMRL 16921/A; paratype 16921/1.

***Physunio* SIMPSON, 1900.**

Shell thin or moderately solid, rhomboidal or ovate, with more or less high posterior wing and rather low anterior end. Umbones in the anterior third of the shell, smooth or sculptured with concentric zigzag-lines. Often with radial corrugation on the posterior slope. Hinge with 1 pseudocardinal in each valve or with 2 in the right valve. Laterals long and thin, right valve with 1 lateral, left valve with 2. The upper lateral in the left valve and the lateral in the right valve may be bifid at the end.

Type species *Unio gravidus* LEA, 1856 = *Unio superbus* LEA, 1843.

Distribution Thailand, Laos, Cambodia, S- Vietnam, Burma, Assam, Sumatra, Java, Celebes.

Key to the Thai species:

- | | |
|--|----------------------|
| 1. Height of adult shell more than 60 mm; shell greatly inflated | <i>superbus.</i> |
| — Height of shell less than 60 mm; shell not or moderately inflated | 2 |
| 2. Shell trapezoidal, compressed | 3 |
| — Shell ovate, moderately inflated | 4 |
| 3. Wing higher than 30 mm, laterals distinct, diverging | <i>eximius.</i> |
| — Wing 30 mm and lower; laterals very thin, parallel | <i>cambodiensis.</i> |
| 4. Shell with distinct wing and oblique dorsal margin; laterals strong, diverging | 5 |
| — Shell without distinct wing; dorsal margin almost parallel to ventral; laterals thin, parallel | <i>modelli.</i> |
| 5. Size of adult shell 50 : 28 or smaller | <i>inornatus.</i> |
| — Size of adult shell 50 : 32 or larger | <i>mipropterus.</i> |

Distribution: Petburi River; drainage of the Chao Praya River; Bang Prakon River (the upper reaches of which are called Klong Satung and the middle reaches Prachinburi River); Mekong basin in Thailand and Cambodia.

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pl. 24 fig. 54.

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pl. 24 fig. 56.

Diagnosis: A species of *Uniandra* HAAS which differs from all other species of the genus by its subcircular shape and very thick pseudocardinals.

Description: Shell small for the genus, subcircular, thick and solid, covered with a greenish periderm. Anterior end somewhat lower than the posterior, all margins regularly rounded. The umbones are moderately inflated, they are placed in the anterior half of the shell and are inclined inwards and forwards. They are sculptured with delicate zigzag-lines which are continued over the upper half of the shell. The rest of the shell is sculptured with rough growth lines only. The hinge plate is short and broad. The ligament is brown, short and not greatly protruding. The pseudocardinals (2 in each valve) are very strong. The accessory pseudocardinal is but a slight thickening of the margin in the right valve. The main pseudocardinal in the right valve is a short, blunt and somewhat arched tubercle. The pseudocardinals in the left valve consist of two roughened, sharp ridges which are placed behind each other. The inner tooth is pointed, the outer tooth somewhat lamelliform. The laterals are rather short. The single lateral in the right valve is curved. The inferior lateral in the left is bluish-white and iridescent. The anterior muscle scar is deep, the posterior shallow. Pallial line very shallow, not sinuous. — Animal not studied.

Size L 25.6 mm; A 20 mm; D 15.6 mm.

Type locality Mekong between Takek and Nakon Panom.

Distribution Known from the type locality only.

Material Holotype SMRL 16921/A; paratype 16921/1.

***Physunio* SIMPSON, 1900.**

Shell thin or moderately solid, rhomboidal or ovate, with more or less high posterior wing and rather low anterior end. Umbones in the anterior third of the shell, smooth or sculptured with concentric zigzag-lines. Often with radial corrugation on the posterior slope. Hinge with 1 pseudocardinal in each valve or with 2 in the right valve. Laterals long and thin, right valve with 1 lateral, left valve with 2. The upper lateral in the left valve and the lateral in the right valve may be bifid at the end.

Type species *Unio gravidus* LEA, 1856 = *Unio superbus* LEA, 1843.

Distribution Thailand, Laos, Cambodia, S- Vietnam, Burma, Assam, Sumatra, Java, Celebes.

Key to the Thai species:

- | | |
|--|-----------------------|
| 1. Height of adult shell more than 60 mm; shell greatly inflated | <i>superbus</i> . |
| — Height of shell less than 60 mm; shell not or moderately inflated | 2 |
| 2. Shell trapezoidal, compressed | 3 |
| — Shell ovate, moderately inflated | 4 |
| 3. Wing higher than 30 mm, laterals distinct, diverging | <i>eximius</i> . |
| — Wing 30 mm and lower; laterals very thin, parallel | <i>cambodiensis</i> . |
| 4. Shell with distinct wing and oblique dorsal margin; laterals strong, diverging | 5 |
| — Shell without distinct wing; dorsal margin almost parallel to ventral; laterals thin, parallel | <i>modelli</i> . |
| 5. Size of adult shell 50 : 28 or smaller | <i>inornatus</i> . |
| — Size of adult shell 50 : 32 or larger | <i>micropterus</i> . |

Physunio superbus (LEA, 1843).

pl. 25 fig. 57.

- 1843 *Unio superbus* LEA, Proc. amer. philos. Soc. Cambridge, 4: 11 (New Holland).
1845 *Unio superbus*, — LEA, Trans. amer. philos. Soc., Philad., 9: 281, pl. 42 fig. 11 (New Holland).
? 1846 *Unio macropterus* DUNKER, Z. Malak., 3: 109 ("Ut putamus, Brasilia").
? 1856 *Unio velaris* HANLEY, Cat. rec. Biv. Shells: 385, pl. 23 fig. 42 (Bugis, Celebes).
1856 *Unio gravidus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).
1857 *Unio gravidus*, — LEA, J. Acad. nat. Sci. Philad., 3: 292, pl. 24 fig. 5 (Siam).
1862 *Unio abnormis* MORELET, Rev. Mag. Zool., 14: 480 (Bangkok).
1864 *Unio massini* MORELET, J. de Conch., 12: 288 (Cochinchine).
1875 *Unio massini*, — MORELET, Sér. Conch., 4: 348, pl. 15 fig. 1, 3 (Cochinchine).
1889 *Unio gravidus*, — MORLET, J. de Conch., 37: 163 (Grand Lac).
1903 *Unio gravidus*, — BLANFORD, Proc. malac. Soc. London, 5: 283 (Siam).
1904 *Unio massiei* [emend.], — FISCHER & DAUTZENBERG, Miss. Pavie, 3: 438 (Cochinchine).
1950 *Physunio gravidus*, — SUVATTI, Fauna Thailand: 108 (Kwe Pasak; Menam Chao Phya at Paknam; Meklong River).
1952 *Physunio (Physunio) gravidus*, — HAAS, Nat. Hist. Bull. Siam Soc., 15: 22 (Menam at Nam Nan).
1953 *Physunio eximius*, — VAN BENTHEM JUTTING, Treubia, 22: 43 [non LEA, 1856] (Cambodia, Siam, Java).
1959 *Physunio superbus*, — VAN BENTHEM JUTTING, Beaufortia, 7 (83): 175 (Sumatra).
1969 *Physunio (Physunio) superbus*, — HAAS, Tierreich, 88: 89 (Thailand, Kambojscha, Laos, Annam, Cochinchina, Sumatra).

Shell relatively large, very inequilateral, with very low and pointed anterior end (young specimens with small anterior wing) and very high and winged posterior end. Umbones high, turned backwards; ventral margin anteriorly short, posteriorly long, forming one slanting, straight line. The posterior end is rounded or subrostrate; the ventral margin is equally arched or even somewhat straight in the middle part. The umbones are sculptured with some irregular tubercles and sometimes with some parallel, almost straight grooves; a posterior ridge runs from the umbones to the upper part of the posterior end; there are several shallow radial striae crossing the growth lines. The colour of young specimens is yellowish-green, that of older specimens olive or brownish. — The nacre is bluish-white and iridescent. The pseudocardinal in the left valve is a strong, roughened lamella, those of the right valve consist of two short, parallel lamellae of which the superior is shorter than the inferior. The laterals, 2 in the left and 1 in the right valve, are curved and smooth. The end may be bifid, thus giving the impression of 3 in the left valve and 2 in the right. Older specimens may also show a weak accessory lateral above the main one in the right valve. The anterior muscle scars are confluent and rather deep, the posterior is large and shallow.

Size: L 90-130 mm; A 70-82 mm; D 45-55 mm. — Specimens of the maximum dimension are very rare and were found by this team for the first time.

Type locality: "New Holland"

Distribution Thailand, Malaysia, Sumatra, Java, ? Laos, ? Cambodia, ? S-Vietnam, ? Celebes. In Thailand this species is found sporadically in the South, but is not uncommon in the drainage systems of the Maeklong River, Chao Praya, Prachinburi

River. In most parts of the Mekong drainage it is replaced by *P. eximius*. Distribution in Laos, Cambodia and S-Vietnam is quoted from the literature. The present author has never seen authentic material of this species from above named countries.

Physunio eximius (LEA, 1856).

pl. 25 fig. 58.

1856 *Unio eximius* LEA, Proc. Acad. Nat. Sci. Philad., 8: 93 (Siam).

1857 *Unio eximius*, — LEA, J. Acad. nat. Sci. Philad., 3: 294, pl. 25 fig. 8 (Siam).

1866 *Unio semiquadrata* SOWERBY, Conch. Icon., 14: 63, pl. 15 fig. 6 (Cambodia, Laos mountains).

1950 *Physunio (Lens) eximius*, — SUVATTI, Fauna Thailand: 109 (Siam).

1969 *Physunio (Physunio) eximius*, — HAAS, Tierreich: 88: 89 (Thailand, Kambodscha, Java).

Shell smaller and much more compressed than the type species, not inflated, of rhomboidal or rounded-trapezoidal shape; anterior end low and short, posterior end high and winged. Dorsal margin slanting, almost straight, posterior margin rounded or subrostrate, ventral margin straight in the middle part. There are normally two obtuse posterior ridges. The colour of the periderm is yellowish-green with darker green zones and rays. The sculpture consists of few short, irregular and wavy ridges only. — Hinge plate very narrow. The laterals, 2 in the left valve and 1 in the right, are narrow and somewhat curved. In old specimens an accessory weak lateral may be found above the normal laterals. The pseudocardinals are weak. That of the left valve consists of a small, triangular tooth which extends downwards as a short, roughened ridge. Those in the right valve consist of a small, round tubercle above the beak cavity and a short, rough ridge beside it. In old specimens a very weak and short lamella is sometimes found above it. The nacre is bluish-white and iridescent. The muscle scars are shallow, particularly the posterior.

Size L 50-90 mm; A 35-60 mm; D 15-25 mm. The sizes given by other authors refer to not fully adult specimens.

Type locality Siam.

Distribution: Mekong S of Nakon Panom and several of its tributaries in Thailand, mainly in the drainage system of the Mun River: Mun River, Lam Chi River, Pong River, Lam Choen River. Also known from the Lam Don Yai River in Udon Province and from the Songkram River at Sri Songkram and Wanninovat. Extralimitarily this species was found in the Mekong in Laos at Paksé and in the Sedone River at Khong Sedone N of Paksé. The report from Java (VAN BENTHEM JUTTING 1953: 43) refers to *P. superbus*. *P. eximius* has never been found outside of the Mekong drainage.

Physunio inornatus (LEA, 1856).

pl. 25 fig. 59.

1856 *Unio inornatus* LEA, Proc. Acad. nat. Sci. Philad., 8: 93 (Siam).

1857 *Unio inornatus*, — LEA, J. Acad. nat. Sci. Philad., 3: 293, pl. 24 fig. 6 (Siam).

1875 *Unio inornatus*, — MORELET, Sér. Conch., 4: 352 (Rivière de Saraburi).

1889 *Unio inornatus*, — MORLET, J. de Conch., 37: 164 (Rivière de Sutrang, Siam).

1891 *Unio inornatus*, — MORLET, J. de Conch., 39: 238 (Rivière de Ménam-Pinh et ses affluents).

1969 *Physunio (Physunio) inornatus*, — HAAS, Tierreich, 88: 88 (Siam).

Shell elongately ovate, inequilateral, thin, only moderately inflated, short and low anteriorly but long and higher posteriorly. Anterior end rounded, posterior somewhat tapering and truncate. Umbones placed at the anterior third of the shell, somewhat inflated and prominent, with 3-4 concentric zigzag-lines. Periderm not silky, greenish or olive-brown, posterior wing of darker greenish colour. Posterior ridges more or less distinct, the posterior slope with fine corrugation or almost smooth. — Hinge plate narrow, teeth thin, typical for the genus, but much thinner than those of *superbus* and *eximius*.

Size L 35-50 mm; A 20-28 mm; D 14-21 mm.

Type locality: Siam.

Distribution: Thailand, Laos, Cambodia. In Thailand this species has been found in the Mekong and in most of its tributaries, but it is also reported from the Chao Praya drainage (Saraburi River = Maenam Pasak; Ping River at Chieng Mai).

MODELL (personal communication) wanted to add *P. eximius* and *P. inornatus* as races to *P. superbus*. As there are no intermediate forms and as the sculpture of the umbones differs among these three species the present author is convinced of the specific validity of all three species.

This species connects *Physunio* with *Uniandra*. It is very similar to *U. contradens asperula* (LEA); it differs from this species by its higher wing and thinner texture.

Physunio micropterus (MORELET, 1866).

pl. 25 fig. 60.

- 1866 *Unio micropterus* MORELET, J. de Conch., 14: 63 (in torrentibus montanis Cambodidae).
1875 *Unio micropterus*, — MORELET, Sér. Conch., 4: 349, pl. 15 fig. 6 (Rivière de Battambang).
1876 *Unio semialatus* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Hist. nat. Paris, 10: 123, pl. 6 fig. 1-2 (Arroyo de Pean-Chelang).
1889 *Unio micropterus*, — MORLET, J. de Conch., 37: 164 (Rivière de Battambang, celle de Srakéo à Srakéo).
1891 *Unio micropterus*, — MORLET, J. de Conch., 39: 237 (Rivière du Ménam-Pinh).

Shell irregularly ovate, very inequilateral, very short and low anteriorly but high and long posteriorly; podium truncate; thin, moderately inflated. Umbones placed in the middle of the anterior half of the shell, not very high, with concentric zigzag-lines. Posterior ridge more or less distinct, with undulated lines between the two ridges. Periderm greenish-yellow, with silky lustre when young. — Hinge typical for the genus, teeth relatively thin, often with accessory laterals; inferior pseudocardinal rather high. Nacre bluish-white, iridescent. Muscle scars shallow.

Size L 50-85 mm; A 32-53 mm; D 16-24 mm.

Type locality: Cambodia, probably Stung Sangké.

Distribution Cambodia, Thailand. In Thailand reported from the Ping River and Srakéo River. As this species has not yet been found again in the Ping River, this report may refer to another species. Also found in the upper reaches of the Sutrang River and in the Huai Wat Luang at Aranyapratet.

Note HAAS (1969: 87) placed *Physunio micropteroïdes* and *P. ferrugineus* ANNANDALE in the synonymy of *P. micropterus*, but did not mention the Shan-States

from which these two species originate under the distribution. The present author doubts that *micropterus* lives outside of the Mekong and Prachinburi River drainages.

The specific validity of *P. micropterus* is still doubtful. It may be only an extremely large race of the preceding species.

Physunio cambodiensis (LEA, 1856).

pl. 25 fig. 61.

1856 *Unio cambodiensis* LEA, Proc. Acad. nat. Sci. Philad., 8: 103 (Takrong River at Korat, Siam).

1857 *Unio cambodiensis*, — LEA, J. Acad. nat. Sci. Philad., 3: 313, pl. 30 fig. 28 (Takrong River at Korat).

1889 *Unio cambodiensis*, — MORLET, J. de Conch., 37: 163 (Etang de Pnom-Penh).

1969 *Physunio (Physunio) cambodiensis*, — HAAS, Tierreich, 88: 89 (Thailand, Kam-bodscha).

Shell rather small, ovate, thin, with low posterior end and high anterior; rather compressed or only moderately inflated. Young specimens with yellowish-green periderm which turns brownish with age. The shape of adult shells is very similar to that of *Trapezoidens exolescens*, young shells (like the holotype) are more ovate. Umbones placed in the first third of the shell, somewhat inflated, with concentric, wavy furrows. Posterior ridges weak in adult specimens. Lunule marked in young specimens only, escutcheon not marked, smooth or with fine ridges. — Hinge plate very narrow, teeth very feeble, typical for the genus.

Size: L 25-63 mm; A 15-40 mm; D 10-18 mm.

Type locality Takrong River near Nakon Ratchasima (formerly called Korat).

Distribution Laos, Cambodia, Thailand. In Thailand, this species is rather common. The southernmost locality is in Phang Nga Province, the northernmost in Chiang Rai. It is found in the Mekong and most of its tributaries and is common in the Chao Praya drainage.

Note: The holotype in the USNM (No. 84909) is a very young specimen. Adult specimens have a different shape. The posterior end is much higher and the outline is trapezoidal, not ovate.

Physunio modelli n. sp.

pl. 25 fig. 62.

Diagnosis: A species of *Physunio* SIMPSON which differs from all other species of this genus by its regular ovate shape, very low or missing posterior wing, regularly curved ventral margin and very long and extremely thin pseudocardinals. From its closest relative, *P. inornatus*, it differs by its still thinner texture, thinner and parallel laterals and lack of posterior ridges.

Description: Shell of medium size for the genus, elongately ovate, with short, rounded anterior end and long, tapering posterior end without or with rather low wing. The podium is roundedly pointed, not truncate. The dorsal margin forms an almost straight line which is only slightly slanting; the ventral margin is very regularly curved between podium and gonium. There is either no trace of a posterior wing at all or the wing is very low, lower than in all other species of this genus. The periderm is of a dullish olive-green; the wing or upper

posterior part is generally of a much darker green. The umbones are placed in the middle of the anterior half of the shell; on their tips there are 3 irregular furrows in zigzag-pattern. Within the posterior ridges which may consist of 1-3 fine lines, there is a distinct radial corrugation. Lunule very narrow, smooth except for the growth lines, bordered by a sharp, fine line on either side. The slopes of these lines beside the lunule are furrowed. — Ligament straight, thin, brownish. Hinge plate very narrow. Pseudocardinalis lamelliform, fine, long and sharp, 2 in the right valve, 1 in the left. Laterals long and thin, barely curved, 2 in the left valve, parallel, and 1 in the right. Nacre bluish-white, iridescent. Muscle scars very shallow.

Size L 60-70 mm; A 33-42 mm; D 18-23 mm.

Type locality Maenam Pong at Pong Nip Dam, Kon Kaen Province in the northern part of Central Thailand.

Distribution Thailand and Laos, in the drainage system of the Mekong River.

Material Holotype SMRL 2523/A; paratypes 2523/10. — SMRL 2309/3-Huai Tuai at Tha Uthen, Nakhon Phanom Prov.; 2310/2-Huai Un at Sri Songkram, Nakhon Phanom Prov.; 2311/9-Lam Dom Yai at Det Udon, Ubon Prov.; 2312/25-Lam Pao (Lam Tan) at Kalasin; 2313/12-Mun River at Rasi Salai, Sri Saket Prov.; 2314/15-Lam Chi River at Mahachanachai, Ubon Prov.; 2315/6-Lam Chi River at Ta Sabaeng, Roi Ert Prov.; 2317/6-Maenam Songkram at Wannonivat, Sakon Nakhon Prov.; 2318/1-Maenam Songkram at Sri Songkram, Nakhon Phanom; 2319/4-Maenam Gham at Tat Panom; 2320/3-Huai Gaeng Yai, Pibun, Ubon Prov.; 2477/5-Maenam Choen W of Kon Kaen; 2479/18-Maenam Mun at Ban Ta Thum, Surin Prov.; 2484/5-Maenam Pong at Ban Pa Nog Kao, Loei Prov.; 2485/17-Klong Sam Mo at Gaeng Kro, Chaiyapum Prov.; 2487/3-Huai Ja near Gaeng Kro; 17990/20-Mekong at Paksé, Laos; 2488/6-Maenam Pong N of Kon Kaen; 2490/7-Pasak River at Gaeng Koi.

Note: This species lives together with *P. eximius* and *P. cambodiensis*, but because of the different shape and the delicate, parallel laterals it cannot be confused with that species. Small specimens with a distinct wing may look similar to *P. inornatus*, but *inornatus* is more inflated, the umbones are higher and the posterior ridges much more distinct. *P. inornatus* has the diverging laterals typical for *Physunio*, while the laterals of this species are parallel. *P. cambodiensis* is smaller and has a much higher wing. This species differs from all other species of *Physunio* by having much thinner laterals which run parallel and do not diverge as in the five preceding species.

Trapezoideus SIMPSON, 1900.

Shell trapezoid or elongately reniform, with more or less high posterior wing. Umbones placed in the anterior third of the shell, barely inflated, sculptured with concentric V-lines which may be dissolved into radial or horizontal grooves. Hinge plate narrow; there are usually 2 laterals in the left valve and 1 in the right, and there is 1 pseudocardinal in the left valve and usually 2 in the right. Muscle scars rather shallow particularly the posterior. The teeth may be reduced to 1 pseudocardinal and 1 lateral in each valve.

Type species *Unio foliacea* GOULD (= juvenile of *Unio exolescens* GOULD).

Distribution India, Assam, Burma, Thailand, Laos, Cambodia and (?) S-Vietnam.

Note: A great number of species were assigned to this genus; they can easily be reduced to 2 or 3 species. All other either synonymize with these species or may be

considered subspecies or geographic races. The type species is based on a single, juvenile, comparatively trapezoid specimen; as it synonymizes with *U. exolescens* GOULD and this name is based on an adult specimen, the generally used name *foliaceus* is herewith placed into the synonymy of *exolescens*. The present author has studied the types of both taxa.

The Rassenkreis of *Trapezoides exolescens* (GOULD).

If the suspicion of this author that *Trapezoides prashadi* HAAS does not belong to this genus proves to be justified, *Trapezoides* may be a monotypical genus. For description of the Rassenkreis see above below the genus.

Distribution Burma, Assam, Thailand, Laos, Cambodia and (?) S-Vietnam.

Key to the Thai subspecies:

- | | |
|---|---------------------|
| 1. Shell trapezoid, posterior end much higher than anterior | .. 2 |
| — Shell subcylindrical, posterior end not much higher than anterior | <i>exolescens</i> . |
| 2. Adult shell very solid, teeth well developed | <i>comptus</i> . |
| — Adult shell thin, teeth weak, in adult shells obsolete | <i>pallegoixi</i> . |

Trapezoides exolescens exolescens (GOULD, 1843).

pl. 26 fig. 63.

- 1843 *Unio exolescens* GOULD, Proc. Boston Soc. nat. Hist., 1: 141 (Tavoy, British Burmah).
- 1843 *Unio foliaceus* GOULD, Proc. Boston Soc. nat. Hist., 1: 141 (Tavoy, British Burmah).
- 1865 *Unio misellus* MORELET, J. de Conch., 13: 21 (Siam).
- 1865 *Unio peguensis* ANTHONY, Amer. J. Conch., 1: 351, pl. 25 fig. 2 (Pegu, Burma).
- 1866 *Unio siamensis* LEA, Proc. Acad. nat. Sci. Philad., 10: 133 (Siam).
- 1869 *Unio siamensis*, — LEA, J. Acad. nat. Sci. Philad., (2) 6: 279, pl. 38 fig. 94 (Siam).
- 1875 *Unio misellus*, — MORELET, Sér. Conch., 4: 341, pl. 14 fig. 2 (Eaux vives, province de Salaburi, Siam).
- 1876 *Unio misellus*, — CROSSE & FISCHER, J. de Conch., 24: 327 (partim) (Salaburi, Siam).
- 1891 *Unio misellus*, — MORLET, J. de Conch., 39: 238 (partim) (Rivière de Menam-Pinh).
- 1899 *Unio misellus* var. *subclathratus* MARTENS, Arch. Naturg., 65: 44, pl. 6 fig. 3 (Chindwin-Fluß bei Kalewa, Burma).
- 1912 *Trapezoides foliaceus* var. *zayleymanensis* PRESTON, Rec. Ind. Mus., 7: 307 (Bhamo, Burma).
- 1915 *Trapezoides foliaceus*, *misellus* and *exolescens*, — PRESTON, Fauna Brit. India, Moll.: 193, 194, 195 (Tavoy; Zayleyman; Bhamo; Siam; Tenasserim; Irravady River at Sagaing).
- 1921 *Trapezoides dhanushori* PRASHAD, Rec. Ind. Mus., 22: 611 (Manipur, Assam).
- 1952 *Trapezoides pulcher*, — HAAS, Bull. nat. Hist. Siam Soc., 15: 23 [non TAPPARONE-CANEFRI] (Klong Klung River near wat Pratart Farm).

Shell tongue-shaped or elongately trapezoidal, dorsal and ventral margin either parallel or tapering to the gonium, sometimes even reniform with concave

ventral margin. Very inequilateral with very low anterior end and moderately raised posterior end, laterally compressed, with barely raised umbones. The periderm of young specimens is greenish, of old ones it is brown. The umbones are sculptured with irregular radial ridges arranged in two loops. The remainder of the shell has radial ridges on the posterior slope and generally few short grooves on the middle part. The hinge teeth are very weak, more so in old specimens. These may look similar to those of *Pseudodon* in shape and hinge characters.

Size L 45-75 mm; A 28-40 mm; D 18-28 mm.

Type locality: "Siam"

Distribution Burma, Thailand, Assam, Laos, Cambodia. In Thailand from Yala in the S to the northern border. This species has not been found in the MaeKlong basin.

Note The present author had the opportunity to study the types of *Unio exolecens* and *U. foliaceus* of GOULD and of *U. siamensis* LEA and concludes that they are identical. The type of *Unio misellus* MORELET is lost. *U. foliaceus* is a young specimen of this species with slightly raised posterior end, similar to the following race which replaces this race in the Mekong N of Cambodia and in the Thai tributaries of the Mekong.

***Trapezoideus exolecens pallegoixi* (SOWERBY, 1867).**

pl. 26 fig. 64.

1867 *Anodon pallegoixi* SOWERBY, Conch. Icon., 17: pl. 8 fig. 17 (Siam).

1877 *Unio fragilis* NEVILL, J. Asiat. Soc. Bengal, 46: 39 (Cambodge).

1891 *Unio misellus*, — MORLET, J. de Conch., 39: 238 [partim] (Vallée du Mekong).

1950 *Trapezoideus pallegoixi*, — SUVATTI, Fauna, Thailand: 110 (Lam Tong Lang, north of Pak Jong).

This race differs from the type race by its trapezoidal shape with high posterior end and by its smoother, greenish periderm.

Size L 45-75 mm; A 24-40 mm; D 17-26 mm.

Type locality: "Siam"

Distribution Tributaries of the Mekong in E-Thailand, Laos and N-Cambodia.

***Trapezoideus exolecens comptus* (DESHAYES, 1876).**

pl. 26 fig. 65.

1876 *Unio comptus* DESHAYES in DESHAYES & JULLIEN, Nouv. Arch. Mus. Paris, 10: 126, pl. 6 fig. 3-4 (Cambodge).

1881 *Diplodon ludovicianum* ROCHEBRUNE, Bull. Soc. philom. Paris, (7) 6: 43 (Preck-Scholl, Haut Mekong, Cambodge).

Differs from the two preceding races by its larger size, thicker texture, stronger developed hinge teeth and generally stronger sculpture.

Size L 60-80 mm; A 35-48 mm; D 18-26 mm.

Type locality Cambodge, Mekong.

Distribution: Mekong S of Bandan, Khong Sedone River in Laos and Sekong River in Cambodia.

Modellnaiinae n. subfam.

A new subfamily of Amblemidae which differs from all other subfamilies of this family by the hook-like produced anterior part of the shell. In the anterior third the ventral margin forms an angled bay, then a hook-like process before it runs almost straight to the gonium. Hinge without teeth, ligament thick and prominent.

Type genus *Modellnaia* n., the only genus known.

Distribution Mun River in Thailand.

Modellnaia n. gen.

A genus of Modellnaiinae (Amblemidae) which differs from all other genera of Amblemidae by the characteristics given in the diagnosis of the subfamily. For further description see below under the monotype.

Type species *Modellnaia siamensis* n. sp.

Modellnaia siamensis n. sp.

pl. 26 fig. 66.

Diagnosis: A species of *Modellnaia* n. which differs from all other species of Amblemidae by its hook-like process at the anterior part of the ventral margin. It looks extremely similar to *Bartlettia* H. ADAMS, a South American genus of Aetheriidae.

Description: Shell of medium size for the family, solid, irregular, with cuneiform posterior end and hook-shaped anterior part. Dorsal margin almost straight posteriorly, slanting anteriorly. Anterior slope and ventral line of the „hook“ form at the gonium a right angle. Posterior end tapering to the rostrate podium. Ventral line posteriorly straight, horizontal; it forms a sharp angle at the beginning of the first third of the shell, turns backwards thus forming a pointed hook. Shell surface very rough, with radial ridges which are irregularly crossed by concentric grooves. Umbones very high, turned inwards and forwards. There is a strong ridge running from the umbones to the hook-shaped part of the shell. The colour of the periderm is brownish-green, but in adult specimens the periderm is generally eroded. — Hinge plate narrow, turned inward. There are no hinge teeth. Ligament very short, brown, prominent. Anterior muscle scars moderately deep, posterior very deep. Nacre bluish-white, iridescent; pallial line moderately sinuate.

Size L 50-60 mm; A 30-40 mm; D 20-24 mm.

Mantle lobes connected anteriorly only. Marsupia in all four demibranchs. Foot small, pointed, with a sharp ridge. Glochidia semioval, without hooks.

Type locality Mun River in Thailand, about 6 km above Ban Tha Tum, Surin Province.

Distribution Middle reaches of the Mun River.

Material: Holotype SMRL 2641/A; paratypes 2641/20.

Note: This species is extremely similar to *Bartlettia stefanensis* (MORICAND) from South America. Animal and larval forms of this genus which has

been placed into the Etheriidae, are still unknown. As the juvenile shell of *Bartlettia* is extremely similar to that of *Anodontites* a close relationship may be assumed in spite of the great difference in shape. The glochidium of *Modellnaia* is exactly alike that of Amblemninae, Rectidentinae and Hyriopsinae. The similarity in shape may be a convergence because of similar biology. The animals live similar to *Bartlettia* hooked with the anterior part into the tough clay-bottom of the river. Etheriidae are said to have reduced the foot. This is comparatively small in *Modellnaia* but still well developed. Both adductors are well developed; in Etheriidae the anterior adductor is rudimentary. The triangular sinus behind the hinge plate is similar to that of *Bartlettia*; this characteristic may lead to the conclusion of closer relationship between the Asian and the American genera.

Unionidae FLEMING, 1828.

Shell characters like those of the superfamily. Marsupia only in the two outer demibranches. Glochidia triangular, with hooks or hookless.

The type subfamily, Unioninae, is represented in SE-Asia by two genera, *Unio* RETZIUS and *Oxynaia* HAAS. Species of these two genera are widely distributed in Burma and Tonkin, but have never been found in Thailand.

Sinanodonta MODELL, a genus barely different from *Anodonta* LAMARCK, has been imported to W-Malaysia, but has not yet been found in Thailand. It is known from Tonkin and N-Laos; its report as *Anodonta magnifica* LEA from the Tonle Sap in Cambodia may refer to *Cristaria plicata*, a species erroneously assigned by recent authors to Anodontinae. In the Tale Luang in S-Thailand near Pattalung our team found one specimen of a clam which looks almost like an American *Sulcularia badia* RAFINESQUE. The lake and its confluent were carefully screened for more specimens but unsuccessfully. As only one specimen was found and this later broken, we still hesitate to base a new subfamily, genus and species on it. A short description may, however, be given.

Shell small, broadly oval, rather thin, compressed, covered with an olive periderm, without any sculpture. Hinge plate broad, teeth very obtuse. The front tooth of the 2 pseudolaterals in the left valve elongate, the second tooth knob-like, turned backward. The single pseudocardinal in the right valve is only represented by a low, obtuse tubercle. Laterals (1 in each valve) short and obtuse. Nacre whitish, muscle scars large and rather deep, transversely striate. L 30 mm; A 21 mm; D 9 mm.

The single specimen was found in the Tale Luang at Lam Pam near the mouth of the Klong of the same name. It may also have originated from that Klong.

Heterodonta NEUMAYR, 1884.

Hinge teeth, when present, with well developed "heterodont" cardinals and generally with laterals on either side. — Gills eulamellibranch, mantle edges ventrally united, with inhalent, exhalent and supraanal opening.

As the shell characteristics of the two recognized orders are very heteromorphic, the below given key refers to the superfamilies. Its characteristics may not be generalized extralimitarily.

Key to the Thai subfamilies of the subclass:

- | | |
|---|---------------|
| 1. Hinge teeth with laterals . | Corbiculacea. |
| — Hinge teeth without laterals | 2 |
| Hinge teeth with cardinals . | 3 |
| — Hinge teeth without cardinals | Dreissenacea. |
| 3. Hinge teeth tooth-like . | 4 |
| — Hinge teeth claw-shaped | Solenacea. |
| 4. Hinge with 3 cardinals in each valve | Veneracea. |
| — Hinge with 2 cardinals in each valve | Tellinacea. |

Veneroida H. & A. ADAMS, 1858.

Astartedontina KOROCHKOV, 1953.

Solenacea LAMARCK, 1809.

Shell gaping at both ends, ligament externally but often extended by a cartilageous layer into the umbonal cavities. Cardinals of different shape. Pallial sinus shallow. — Mantle edges ventrally connected, leaving openings for the foot and the siphons only. Siphons generally long and retractable.

Distribution: Cosmopolitan.

Habitat: Predominantly marine, few genera have representatives in brackish and freshwater.

Solenacea are represented by two families in fresh and brackish water:

- | | |
|--|--------------|
| 1. Cardinals moderately long, distantly placed | Novaculidae. |
| 2. Cardinals long and sabre-shaped, compressed | Solenidae. |

Novaculidae GHOSH, 1920.

Shell subinequivalve, inequilateral, thin to moderately thick. Extremities gaping. There are 2 cardinals in the right valve and 3 in the left. — Foot thick, short, cylindrical and very muscular, enlarged at the extremity into a disc. Siphons separated, opening not ciliated.

Type genus: *Novaculina* BENSON, 1830.

Distribution: S- and SE-Asia.

Novaculina siamensis MORLET, 1889.

pl. 26 fig. 67.

1889 *Novaculina siamensis* MORLET, J. de Conch., 37: 198, pl. 9 fig. 4 (Marais de Chantakam, Siam).

Shell elongate, inequilateral, with both extremities gaping, rather thin, with yellowish periderm and sculptured with coarse growth lines. Dorsal and ventral margins almost parallel. — Hinge plate narrow; ligament brown, somewhat prominent. In each valve there are 2 diverging cardinals, but no

laterals. — Muscle scars very shallow, pallial line barely visible. Interior whitish, not iridescent.

Size: L 30-38 mm; A 13-18 mm; D 10-15 mm.

Type locality: Chantaburi [? River], Thailand.

Distribution Known from the type locality and from the Pasak River near Saraburi only.

Solenidae LAMARCK, 1809.

The type genus is represented from brackish water by an unidentified species from Paknam Grabi, and another species from mangrove forests near Palian.

Only one species is known from freshwater. It seems to be still undescribed.

Pharella GRAY, 1854.

Type species: *P. javanica* (LAMARCK).

Distribution: Coastal areas of the Indo-Pacific Ocean.

Habitat: All reported species are known from brackish water. The following species lives in fresh water, however, in the tidal zone.

Pharella waltoni n. sp.

pl. 26 fig. 68.

Diagnosis: A species of *Pharella* GRAY, which differs from all described species of this genus by its high, ovale shape.

Description: Shell rather small for the genus, thin, fragile, covered with a yellowish-grey periderm; smooth except for the concentric growth lines. The shell has the shape of a tiny *Pilsbryoconcha*. Anterior end rounded, posterior end somewhat truncate, dorsal and ventral margins almost parallel. Umbones placed at about $\frac{3}{8}$ of the length of the shell, not inflated, somewhat corroded. There are 2 very weak posterior ridges running from the umbones to the podium, giving the podium a biangulate shape. Interior whitish and glossy, but not iridescent. Hinge plate extremely narrow. Ligament very short and not prominent. It is extended inwards by a semicircular line which encircles a shield in the umbonal pits. This line has been observed in several genera of Solenidae, however, the author has never seen a species in which the line forms an irregular semi-circle from the dorsal slope to the ligament. Lateral teeth are missing. There are 2 claw-shaped cardinals in the right valve and 3 in the left. C3 is always cleft, C4 sometimes. Interior of the shell glossy, milky-white, not iridescent. Muscle scars and pallial line extremely shallow.

Size: L 29-39 mm; A 19-22 mm; D 10-13 mm.

Mantle edges almost completely united, leaving openings for the large foot and the siphones only. These are fringed at their tips. Gill lobes narrow, folded, mouth with large palps.

Type locality: Klong Bang Sue at Bangkok.

Material and Distribution: Holotype SMRL 2631/A; paratypes 2631/40. — SMRL 2633/10-Klong Ban Ko at Prapadaeng, Samut Prakan; 2632/20-Klong Bang Pra, Thonburi.

Note: This species looks similar to *Novaculina siamensis* MORLET. The cardinals, however, show its systematic position to be within the Solenidae. Its place in *Pharella* is tentative. All other species of *Pharella* show a normal C3 which in this species is deeply cleft giving the impression of 4 cardinals.

For identification of the superfamilies we refer to the key given below the subclass.

Tellinacea BLAINVILLE, 1824.

Hinge plate generally with 2 cardinals on each side; laterals are generally missing. Foot without byssus, siphones long, not united.

There is only one family represented in brackish water in Thailand. The genera of this superfamily are generally marine.

Psammobiidae FLEMING, 1828.

Shell generally ovate, with 2 cardinals in each valve. As the below named species do not actually belong to the inland fauna, they are only mentioned here.

Elizia GRAY, 1854.

E. orbiculata (WOOD) has been reported from Thailand (FISCHER 1891: 158), but it has never been found by this collecting team.

Psammotaea LAMARCK, 1818.

P. violacea LAMARCK is found on sandy bottom of the estuaries of small rivers; it is particularly abundant in Chonburi Province (Ban La Mung; Klong Na Glua). It is often eaten by the local population.

Solenotellina BLAINVILLE, 1824.

Another estuarine species of this family is *S. truncata* (GMELIN) which is found plentiful in the Na Glua River.

Psammobia LAMARCK, 1818.

P. togata (DESHAYES) is not rare in mud flats of the peninsula, *P. layardi* (REEVE), generally placed into the genus *Psammotaea*, may better belong into this genus. It is found in abundance in the lower reaches of the Chantaburi River in almost fresh water, but still under tidal influence.

Solenocurtus BLAINVILLE, 1825.

This genus is represented by another inhabitant of the mud flats, *S. abbreviatus* (GOULD), originally described from the harbour of Hongkong.

This heteromorphic (and probably also heterogeneous) suborder comprises three Thai superfamilies: Dreissenacea, Corbiculacea and Veneracea. The latter is predominantly marine and only one of its families is represented in the non-marine fauna, the two other superfamilies are found in fresh and brackish water.

For identification of the superfamilies we refer to the key given below the subclass.

Dreissenacea GRAY, 1840.

Shell rounded-triangular, pointed anteriorly and rounded posteriorly, with rounded dorsal margin and almost straight or even concave ventral margin, posterior end sometimes distinctly winged. The pointed umbones are placed anteriorly. The dorsal sides slope regularly to the base, the ventral side is flattened and bordered by an obtuse keel which runs from the umbones to the podium. Inside the anterior corner of each valve is a small septum at which the anterior adductor inserts. Ligament external, hinge plate without teeth. Mantle edges united except for openings for the foot and the siphons. Foot with byssus.

Dreissenidae GRAY, 1840.

Characteristics of shell and animal like those of the superfamily. Reproduction by free-swimming veliger larvae.

Distribution: Cosmopolitan except for Australia.

Habitat: Freshwater, in rivers, lakes and canals.

All species described from SE-Asia are assigned to the genus *Sinomytilus* THIELE, which was placed by its author as a subgenus into the genus *Mytilus* LINNAEUS. Whether the separation of Dreissenidae and Mytilidae into different subclasses is justified or not cannot be discussed in this faunistic report.

Sinomytilus THIELE, 1934.

This taxon was established as a section of *Chloromya* MÖRCH, a subgenus of *Mytilus* LINNAEUS, for several E- and SE-Asian species, originally described as *Dreissena*. Recent authors (VOKES 1967: 298) replaced this taxon into Dreissenidae. Although the gills consist of separate filaments (contrast *Dreissena* whose gills consist of lobes) and the anterior adductor is greatly reduced, the systematic position in Dreissenidae seems to be more correct, as the animals reproduce through free-swimming veliger larvae (contrast *Limnoperna*, Mytilidae, which is ovoviviparous). However, also Corbiculacea show both forms of reproduction.

Type species *Dreissensia crosseana* MORLET = *D. harmandi* ROCHEBRUNE.

Distribution: China, SE-Asia.

Habitat: Fresh water, generally in rivers.

Sinomytilus harmandi (ROCHEBRUNE, 1881).

pl. 26 fig. 69.

- 1881 *Dreissena harmandi* ROCHEBRUNE, Bull. Soc. philom. Paris, 6: 100 (Lac de Vinh-Long, Cochinchine).
1884 *Dreissensia crosseana* MORLET, J. de Conch., 32: 402, pl. 13 fig. 3a-c (Cambodge).
1889 *Dreissensia crosseana*, — MORLET, J. de Conch., 37: 162 (Etangs de Pnom-Penh, Cambodge; Cochinchine).
1892 *Dreissensia massiei* MORLET, J. de Conch., 40: 85 (Rivière Nam-Phak, près Muong-Sung et près Sambor dans le Laos).
1892 *Dreissensia massiei*, — MORLET, J. de Conch., 40: 329, pl. 6 fig. 5, 5a-b (Dans le Nam Phak, affluent du Nam-Ou, près Muong-Sung, province du Laos; et près des rapides de Sambor, même province).

Shell mytiliform, elongate, inequilateral, with pointed anterior end and rounded posterior. The highest part of the shell is near the middle. Umbones anteriorly. Dorsal margin regularly curved, ventral margin straight. Ventral part of the shell flattened, sometimes concave, bordered by an obtuse keel which runs from the umbones to the podium. The sides are violet-brown, the base is straw-coloured. The sculpture consists of rough growth lines only. Interior with a thin, bluish-white nacre. Septum small, anterior adductor obsolete. Foot retractor strong, so is the posterior adductor.

Size: L 22-24 mm; A 9-11 mm; D 8-10 mm.

Type locality: Lac de Vinh-Long, Cochinchine.

Distribution Mekong S of Kemmarath in Thailand, Laos and Cambodia. In Thailand also in the Mun and Lam Chi Rivers.

Sinomytilus morrisoni n. sp.

pl. 26 fig. 70.

Diagnosis: A species of *Sinomytilus* THIELE which differs from all its relatives hitherto known by its small size and its habitat which is in the grooves of *Modellnaia*.

Description: Shell small, elongate-triangular, brownish, thin, almost dull, smooth except for the rough growth lines. Dorsal margin with straight anterior slope and curved posterior. Ventral margin straight or concave, with a narrow opening for the byssus. It is laterally bordered by a straight basal ridge, running parallel to the ventral margin from the umbones to the posterior extremity. Umbones pointed, placed at the extreme anterior end of the shell.

Ligament short, thin, internally placed; hinge without teeth but with a thin ridge running parallel to the anterior slope of the dorsal margin. Internal shell with thin bluish nacre and several brown patches. Cicatrices very shallow.

Posterior adductor well developed, anterior weak. Mantle lobe with two short siphons in separate openings (contrast *Limnoperna*). Foot small, finger-shaped with byssiferous groove.

Size: L 6.7 mm; D 2.8 mm; A 2.9 mm.

Type locality: Mun River about 6 km W of Ban Ta Thum, Surin Province.

Distribution Known from the type locality only.

Habitat: The animal lives attached by its byssus in the umbonal grooves of the shells of *Modellnaia*.

Material Holotype SMF 229202; paratypes SMF 229203/3, Coll. USNM and Coll. BRANDT.

Etiology: It gives me great pleasure to dedicate this species to Dr. J. P. E. MORRISON, Washington, who detected this species in shells of *Modellnaia* sent to him, and who identified it as a new species of *Sinomytilus*.

Corbiculacea GRAY, 1847.

Shell rounded, triangular or cardiiform, with well developed cardinals and 1 or 2 laterals at each side. Pallial line without or with very shallow sinus. Siphons short, mantle edges ventrally or partially united; gills lamelliform, united posteriorly, with interlamellar septa. Foot without byssus.

Distribution: Cosmopolitan.

Habitat: Fresh and brackish water.

Key to the families:

1. Hinge with 3 cardinals in each valve; reproduction through veliger larvae Corbiculidae.
2. Hinge with 1 or 2 cardinals in each valve; reproduction ovoviviparous Pisidiidae.

Corbiculidae GRAY, 1847.

Shell size moderate to large, solid to very thick, oval, triangular, suborbicular or cardiiform, with strong periderm, generally with concentric sculpture. Hinge with 3 cardinals in each valve; ligament external. Reproduction through veliger larvae.

Distribution: S-Europe, Africa, Asia, America and Australia.

Key to the Thai genera:

1. Laterals smooth, surface without concentric ribs *Polymesoda* (*Geloina*).
— Laterals serrate 2
2. Surface with growth lines only; length of shell more than 50 mm *Batissa*.
— Surface with concentric ribs; length less than 45 mm. *Corbicula*.

Polymesoda RAFINESQUE, 1820.

Shell large and thick, suborbicular, rhomboidal or subtriangular, with greenish, rough periderm, but without concentric ribs. Each valve with 3 cardinals, left valve with 1 lateral on either side, right valve with 2. Laterals smooth. Interior white, never tinted.

Type species: *P. caroliniana* Bosc.

Distribution America, Asia and Oceania.

Habitat: Brackish water in the estuarine area of rivers.

The type subgenus is only found in America. The genus is represented by one subgenus in Thailand only.

Polymesoda (Geloina) GRAY, 1842.

Shell suborbicular, subtrigonal or rhomboidal, thick, with rough, greenish periderm and white interior. Pallial line complete, without a noticeable sinus. Siphons very short, foot large, trigonal, gills of unequal size, labial palps triangular.

Type species: *Venus ceylonica* CHEMNITZ = *Venus coaxans* GMELIN.

Distribution: Tropical regions of Africa, Asia and Australia.

Habitat like that of the genus.

Key to the Thai species:

- | | |
|-----------------------------|----------------------|
| 1. Shell not orbicular | 2 |
| — Shell orbicular | <i>proxima</i> . |
| — Shell subtrigonal | <i>bengalensis</i> . |
| — Shell ovate-subrhomboidal | <i>coaxans</i> . |

All other forms, originally described as separate species, may be assigned to any of the above three species.

Note: The first species of this genus to be reported from Thailand was *siamica* PRIME, which is almost identical with *sumatrensis* SOWERBY. It is now generally agreed, that *sumatrensis* is synonymous with the rather variable *bengalensis* LAMARCK. MORLET (1889: 170) reports *sumatrensis* from Rayong in Thailand. PRASHAD (1915) reports only *siamica* and *proxima* from Thailand, and SUVATTI (1950) cited 3 species: *cyprinoides* QUOY & GAIMARD (= *coaxans* GMELIN), *proxima* PRIME and *decipiens* DESHAYES (= *bengalensis* LAMARCK). The Sumatran species *buschi* PHILIPPI, *excavata* MARTENS and *suborbicularis* PHILIPPI may also be assigned to above named 3 species. With great hesitation the present author adds a fourth species of this genus to the Thai fauna, *galathea* MÖRCH. As it is still possible that the specimens assigned to this species are only elongate specimens of *bengalensis* this species has not been included in the identification key.

Polymesoda (Geloina) coaxans (GMELIN, 1791).

pl. 27 fig. 71.

- 1782 *Venus ceylonica* CHEMNITZ, Conch. Cab., (I) 6: 333, pl. 32 fig. 336 [invalid].
1791 *Venus coaxans* GMELIN, Syst. Nat., ed. 13: 3278 (habitat in Zeylonae fluviiis).
1806 *Cyclas zeylanica* LAMARCK, Ann. Mus. Hist. nat. Paris, 7: 420 (Ile de Ceylan).
1831 *Cyrena papua* LESSON, Voy Coquille, Zool. 2: 428 (Eaux douces des petits ruisseaux de la Nouvelle Guinee et de l'île de Waigiou).
1834 *Cyrena cyprinoides* QUOY & GAIMARD, Voy. Astrolabe, Zool. 2: 513, pl. 82 fig. 1-3 (Port Dorey, Nouvelle Guinee).
1850 *Cyrena ceylonica*, — PHILIPPI, Abb. & Besch., 3: 108, pl. 3 fig. 3 (Fluvii insulae Sumatri ?).
1866 *Cyrena ceylanica*, — MABILLE & LE MESLE, J. de Conch., 14: 121 (Poulo-Condor, dans les petits ruisseaux).
1897 *Cyrena moussoni* MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostind., 3: 94 (Java: Fuß Panimbang bei Pardana, Tjandor und Tji-Kalong, Preanger Regentschaften).
1950 *Cyrena cyprinoides*, — SUVATTI, Fauna Thailand: 110 (Kiew; Bandon).

1953 *Polymesoda erosa*, — VAN BENTHEM JUTTING, *Treubia*, 22: 50, fig. 11 (*Polymesoda eximia* err. typ.) (Various islands of the Malay Archipelago including the Philippines and New Guinea) [non SOLANDER, 1786].

Shell large, solid, thick, ovate or sub-rhomboidal, somewhat compressed, white, covered with a thick, rough, greenish-yellow periderm which turns brownish or even black with age. Young specimens are almost orbicular. — Dorsal margin short, regularly curved; anterior margin shorter than posterior margin, somewhat concave below, regularly curved above and nearly straight below the upper margin. — Ligament long and strong, but not greatly projecting. — The hinge does not show any peculiarities for the genus. A I triangular, thick, pad-like; A III small, thick, knob-like. P I elongate, ridge-like; P III longer and less prominent than A III. C I sharp or with a shallow furrow; C3 and C5 deeply furrowed, inclined backwards. In the left valve, A II is short, thick and blunt; P II elongate-triangular. C2 inclined forwards, C4 and C6 backwards. C6 is simple, C2 and C4 are bifid. — Sinus of the pallial line shallow; cicatrices very shallow.

Size A 50-90 mm; L 80-105 mm; D 35-53 mm. The largest specimens from Thailand are about 5 mm smaller than above dimensions.

Type locality: Ceylon.

Distribution Coasts of the eastern part of the Indian Ocean; South China Sea from Indonesia to New Guinea and the Philippines. In Thailand this species was found at the following localities: Chantaburi, Grabi, Kantang, Lang Suan, Trad, Bandon and Narativat.

Biology: This species lives in the estuaries and larger rivers and the drainage trenches of mud flats and nipa palm forests.

Parasitology: As this species like other *Geloina* is eaten in Thailand, a large number of specimens was checked for metacercariae. No metacercariae have been found.

***Polymesoda (Geloina) bengalensis* (LAMARCK, 1818).**

pl. 28 fig. 83.

- 1818 *Cyrena bengalensis* LAMARCK, *Hist. nat. anim. s. vert.*, 5: 554 (Bengal).
1821 *Cyrena sumatrensis* SOWERBY *Genera Shells*, 1: pl. 65 (Sumatra).
1832 *Cyrena turgida* LEA, *Trans. amer. phil. Soc.*, 5: 109, pl. 18 fig. 51 (Bengal).
1849 *Cyrena zeylanica*, — MOUSSON, *Moll. Java*: 89, pl. 12 [non LAMARCK, 1806] (Java).
1852 *Cyrena eximia* DUNKER, *Z. Malak.*, 9: 51 (Java).
1854 *Cyrena impressa* DESHAYES, *Proc. zool. Soc. London*, 22: 18 (Java).
1854 *Cyrena sinuosa* DESHAYES, *Proc. zool. Soc. London*, 22: 18 (Java).
1861 *Cyrena siamica* PRIME, *Proc. Acad. nat. Sci. Philad.*, 9: 162 (Siam).
1876 *Cyrena sumatrensis* var., — CROSSE & FISCHER, *J. de Conch.*, 24: 333 (Cambodge).
1889 *Cyrena sumatrensis*, — MORLET, *J. de Conch.*, 37: 170 (Golfe de Siam, près de Ragong = Rayong).
1915 *Cyrena impressa, sinuosa and bengalensis*, — PRESTON, *Fauna Brit. India, Moll.*: 202, 205 (Java, Philippine Islands, Australia, Ceylon, Bengal).
1921 *Cyrena bengalensis, siamica, impressa, ceylonica*, — PRASHAD, *Rec. Ind. Mus.*, 22: 138, 139, 140, 142, pl. 20 figs. 1-7, 11-13 (Bengal, Gangetic Delta; Cochin-China, Cambodia, Nicobars, Rangoon, Siam; Philippines, Java, Australia; Ratnagiri, Bombay; Dutch East Indies; Ceylon, Peninsular India).
1932 *Cyrena decipiens*, — TOMLIN, *J. nat. Hist. Siam Soc.*, 8: 317 [non DESHAYES] (Buang Bep, Surat).

Shell large, solid, thick, with greenish periderm which turns brownish or even blackish with age. Subtrigonal (*bengalensis*), suborbicular (*impressa*, *sumatrensis*) or even somewhat rhomboidal, inflated, with large, bent umbones. Dorsal margin in front of the umbones almost straight, curved posteriorly. Anterior margin truncate, posterior margin rounded. There is a shallow groove running from the umbones to the posterior angle. Hinge similar to that of *coaxans*, but more curved, laterals longer and more delicate, C2, C3, C4 and C5 bifid, but not so deeply furrowed as in *coaxans*.

Size: A 65-90 mm; L 65-95 mm; D 40-55 mm.

Type locality "Bengal"

Distribution: From the Ganges Delta to N-Australia and the Philippines. Common in the mud flats and estuaries in Thailand.

***Polymesoda (Geloina) proxima* (PRIME, 1864).**

pl. 29 fig. 98.

1863 *Cyrena proxima* PRIME, Cat. Corb.: 6 [nom. nud.] (Siam).

1864 *Cyrena proxima* PRIME, Ann. Lyc. nat. Hist. New York, 8: 85, fig. 34 (Siam).

1889 *Cyrena proxima*, — MARTENS, J. linn. Soc. London, 21: 165 (Sullivan Island, freshwater. Salang, Siam).

1915 *Cyrena proxima*, — PRESTON, Fauna Brit. India, Moll.: 206 (Siam; Sulinan Island, Mergui).

1921 *Cyrena proxima*, — PRASHAD, Rec. Ind. Mus., 22: 141 (Sullivan Island and Siam).

1950 *Cyrena proxima*, — SUVATTI, Fauna Thailand: 111 (Siam).

The distinguishing character of this species is the almost orbicular shape of the shell with the anterior and posterior margins regularly curved and with greatly arcuate ventral margin. The beaks are inclined inwardly and somewhat approximated. The cardinal teeth are narrow and divergent, C2-C5 are bifid as typical in the genus. The ligament is long and narrow; it is not prominent.

Size A 50-80 mm; L 53-84 mm; D 32-47 mm.

Type locality "Siam" No exact locality given.

Distribution: Known from Burma and Thailand only. In Thailand this species has only been found in the coastal areas of the peninsula, on the Gulf as well as on the Indian Ocean.

Note In a later publication PRIME considered this species to be synonymous with *bernardiana* PRIME 1861, a species reported from New Caledonia.

***Polymesoda (Geloina) galathea* (MÖRCH, 1850).**

pl. 29 fig. 99.

1850 *Cyrena (Corneocyclas) galathea* MÖRCH, Cat. Conch. Kierulf: 32, pl. 2 (in Insulis Nicobar, Fl. Galathea).

1915 *Cyrena galathea*, — PRESTON, Fauna Brit. India, Moll.: 207 (Galatea River, Nicobar Islands).

1921 *Cyrena galathea*, — PRASHAD, Rec. Ind. Mus., 22: 144, pl. 20 fig. 14-17 (Andaman and Nicobar Islands).

Shell large, thick, inflated, subtrigonal or rhomboidal, longer than high, inequilateral, the umbones being placed near to the anterior end of the dorsal

margin. Periderm yellowish-brown, turning blackish with age. Anterior margin much shorter than posterior. Hinge as in the genus but greatly curved and rather forwardly placed. Laterals solid, the upper laterals in the right valve (A I and P I) reduced knot or tubercles only. Cardinals very strong, slanting, C2-C5 bifid.

Size A 80-106 mm; L 94-120 mm; D 55-75 mm.

Type locality: Galathea River, Nicobar Islands.

Distribution Nicobar Islands, Andaman Islands, Thai coast of the Indian Ocean. With some hesitation specimens collected in the estuary of a small river near Takua Pa, Pang Nga Province, are assigned to this species.

***Batissa* GRAY, 1853.**

Shell roundedly ovate or subtrigonal, rather large and thick, without concentric sculpture except for the rough growth lines. Each valve with 3 divergent cardinals. Laterals long, curved, striate, the anterior laterals being shorter than the posterior, double in the right valve, single in the left. Ligament large, thick, projecting. Mantle edges simple or fringed; the two siphons are united at their bases.

Type species *Batissa tenebrosa* HINDS.

Distribution: From the Nicobar and Andaman Islands to N-Australia and the Micronesian Islands.

There is only one species known from Thailand.

***Batissa similis* PRIME, 1860.**

pl. 28 fig. 84.

1860 *Batissa similis* PRIME, Ann. Lyc. nat. Hist. New York, 7: 112 (Nicobar Islands).

1866 *Batissa similis*, — PRIME, Ann. Lyc. nat. Hist. New York, 8: 229, fig. 60 (Nicobar Islands).

Shell suborbicular, thick, with blackish-brown periderm and very strong, irregular growth lines, the intervals of which may appear as concentric sulci. Ligament short, dark brown, very protruding. Umbones curved forwards, always deeply eroded. Interior of young shells dark bluish-violet, of adult shells of brighter colour. Each valve with 3 converging cardinals. Anterior lateral in the left valve short and stout, posterior much longer. A III sinuate. Muscle scars distinct, connected by the regularly rounded pallial line.

Size: L 55-80 mm; A 52-60 mm; D 30-35 mm.

Type locality Nicobar Islands. A population from the Mae Noi River between Grabu and Trang is tentatively assigned to this species. The specimens from S-Thailand are less ovate than the typical form.

***Corbicula* MÜHLFELD, 1811.**

Shell of the shape of the superfamily, of medium size for the superfamily and of small size for the family. Sculptured with concentric ribs or striae of different strength which are regularly placed. Periderm greenish, more rarely brownish, yellowish or blackish. Interior of the shell bluish-violet, rarely whitish or of another colour. There are 3 diverging cardinals in each valve. A II, A III, P II

and P III serrated, right valve with 2 laterals at each side, left valve with 1. — Mantle edge fringed; siphons very short, united at their bases, opening papillate. Foot tongue-shaped, rather large; gills joint posteriorly; labial palps large, triangular.

Type species *C. fluminalis* (O. F. MÜLLER).

Distribution Africa, Asia, Australia, introduced into the United States of America.

Corbicula arata (SOWERBY, 1877).

pl. 27 fig. 73.

1876 *Corbicula arata* THEOBALD, Cat. Land Freshw. Shells Brit. India: 44 [nom. nud.] (Tenasserim).

1877 *Cyrena arata* SOWERBY, Conch. Icon., 20: pl. 7 fig. 93 (Tenasserim).

1915 *Corbicula arata*, — PRESTON, Fauna Brit. India, Moll.: 222 (Tenasserim).

1928 *Corbicula arata*, — PRASHAD, Mem. Ind. Mus., 9: 26, pl. 4 fig. 17-20 (Tenasserim, Lower Burma).

Shell moderately thick, rounded-trigonal, inflated, obliquely truncate and compressed posteriorly, extended and rounded anteriorly. Beaks high, inflated, placed in the anterior half, pointing forwards and inwards. Posterior ridge narrow but sharp, anterior ridge not prominent. The sculpture consists of relatively few, raised, regular, distantly placed ribs which are somewhat angulate in the posterior half of the shell. Colour greenish-yellow, in older specimens darker, somewhat glossy. Interior of adult shells creamy-white or purple, young shells whitish with two purple rays running from the umbones to the ventral margin. Pallial line and muscle scars not impressed but distinct. The 3 cardinals in each valve are not divided. P I and A I weakly developed. Ligament short and not very prominent. Nymphs finely roughened.

Size: L 16-19 mm; A 12-15 mm; D 9-12 mm.

Type locality: Tenasserim River in Lower Burma.

Distribution In Thailand in the Moei River, Ping River and Nan River. Extralimarily only known from the type locality. The only specimen in the British Museum (Nat. Hist.) is considered to be the holotype of this species.

Corbicula blandiana PRIME, 1864.

pl. 27 fig. 72.

1864 *Corbicula blandiana* PRIME, Ann. Lyc. nat. Hist. New York, 8: 71, fig. 18 (Montes Laos, Cambodia).

1929 *Corbicula blandiana*, — PRASHAD, Mem. Ind. Mus., 9: 45, pl. 6 fig. 26-27 (Laos).

Young shells equilateral, trigonal, greenish, with darker umbones and a brown zone parallel to the slopes. In adult shells the anterior side is longer than the posterior and almost straight, while the posterior slope is curved. The posterior margin is also more obtuse than the anterior margin and more distinctly rounded. The sculpture consists of regular, sharp, and distantly placed ribs; the interspaces between the ribs are about three times as broad as the ribs themselves. The periderm of adult specimens is of dirty-brownish olive colour. The inside of the shell is whitish in the umbonal depressions and bluish between the

pallial line and outer margin. Hinge well developed, C5 in the right valve separated by a deep groove from the serrate part of the hinge plate below the ligament. C1 connected with A III. The long laterals of the right valve nearly attain the middle of the anterior and posterior margin, those of the left valve are little shorter.

Size A 13-20 mm; L 14-21 mm; D 9-14 mm.

Type locality Montes Laos, Cambodia.

Distribution: Mekong and several of its tributaries on the Laotian and Thai side. In Thailand also in some small rivers in the N (Provinces of Nan and Pitsanuloke).

Corbicula bocourti (MORELET, 1865).

pl. 27 fig. 80.

- 1865 *Cyrena (Corbicula) bocourti* MORELET, J. de Conch., 13: 228 (Cochinchina).
1875 *Corbicula bocourti*, — MORELET, Sér. Conch., 4: 361, pl. 16 fig. 2 (Cochinchina).
1886 *Corbicula annamitica* WATTEBLE, J. de Conch., 34: 69, pl. 5 fig. 3 (juv.) (Les cours d'eau et lagunes des environs de Hue).
1886 *Corbicula bilineata* and *C. variegata*, — MORLET, J. de Conch., 34: 267 [non HEUDE] (Etangs et arroyos des environs de Chu et Locnam).
1886 *Corbicula sandai*, — MORLET, J. de Conch., 34: 267 [non REINHARDT] (Etangs et arroyos des environs de Chu et Locnam).
1889 *Corbicula gravisi* (sic!), — MORLET, J. de Conch., 37: 171 [non *C. gravis* HEUDE] (Haut Pursac, Cambodge).
1891 *Corbicula vespertina* FISCHER, Bull. Soc. nat. Hist. Autun, 4: 240 [partim].
1891 *Corbicula insularis*, — MORLET, J. de Conch., 37: 238 [non PRIME] (Les ruisseaux qui se jettent dans Menam-Pinh et ceux du plateau de Xieng-Moi).
1891 *Corbicula primeana*, — MORLET, J. de Conch., 37: 253 [non MORELET] (Nghia-Yen, province de Ha-Tinh).
1905 *Corbicula fluminea* var. *bocourti*, — DAUTZENBERG & FISCHER, J. de Conch., 53: 229 (Tonkin. Song Luc-Nam, Van-Ien).
1929 *Corbicula bocourti*, — PRASHAD, Mem. Ind. Mus., 9: 36, pl. 5 fig. 20 (Loc Nam and Annam).

Shell comparatively large, thick, inflated anteriorly and in the umbonal region, very much compressed in the posterior and lower half of the valves; young shells subtrigonal, subequilateral; adults with the anterior side greatly shortened and posterior drawn out into a beak. Young shells lemon-coloured, adults brownish to black, glossy. Upper margin very short and greatly curved, anterior side short, somewhat concave, compressed in the upper third, evenly rounded below; posterior side elongated, almost straight, truncate posteriorly; ventral margin moderately arched; lunule distinct in young shells, less marked in adults, heart-shaped; escutcheon not marked; umbones very prominent, large, greatly inflated, in some shells very much compressed anteriorly, greatly curved forwards and inwards, almost meeting in the middle line. Surface sculptured with very regular, concentric, slightly raised ridges in young and half-grown shells; in adults the ridges on the beaks and at the margin are finer and more closely placed and somewhat irregular; nymphs elongate, broad, somewhat roughened; ligament thick, prominent. Hinge teeth well developed; C5 and C6 rather long and straight, C1 and C2 short and almost vertical. Pallial line very

distinctly marked; muscle scars not greatly impressed. Nacre bluish-violet, in adults whitish in the umbonal depressions.

Size L 16-46 mm; A 16-45 mm; D 12-27 mm.

Type locality Cochinchina (Saigon).

Distribution Endemic in the Mekong, Red River and Black River and several of their tributaries. In Thailand this species was found in the provinces of Nong Kai (a small Klong near the provincial town), in the Mekong near Nakon Panom, in the Pao River near Kalasin and in the Kaek River in Pitsanuloke Province.

Remarks FISCHER & DAUTZENBERG (1906: 229) considered this species a form of *fluminea* O. F. MÜLLER and later placed it in the synonymy of *C. moreletiana* PRIME. In the collections in Paris and Brussels several different species are stored under this name. The species is here understood as PRASHAD described and figured it. He included only some small forms which may better be placed to *larnaudieri* PRIME. The holotype has disappeared from the Paris Museum, and the paratypes in that collection are of doubtful origin.

Corbicula javanica (MOUSSON, 1849).

pl. 27 fig. 82.

1849 *Cyrena orientalis* var. *javanica* MOUSSON, Land & Süßw. Moll. Java: 86, Taf. 15 Fig. 2 (Tjikojia, Java).

1854 *Corbicula moussoni* DESHAYES, Cat. Vener. Brit. Mus., 2: 227 (Tjikojia in Insula Javanica).

1860 *Corbicula gracilis* PRIME, Proc. Acad. nat. Sci. Philad., 12: 270 [nom. nud.] (Java).

1862 *Corbicula ducalis* PRIME, Proc. Boston Soc. nat. Hist., 8: 274 (Java).

1862 *Corbicula gracilis* PRIME, J. de Conch., 10: 389, pl. 14 fig. 7 (Java).

1867 *Corbicula colonialis* PRIME, Ann. Lyc. nat. Hist. New York, 8: 416 (Java).

1869 *Corbicula ovalina*, — FRAUENFELD, Verh. zool. bot. Ges. Wien, 19: 883 [non DESHAYES] (Java).

1879 *Corbicula sulcata* CLESSIN, Conch. Cab., 9 (3): 188, pl. 32 fig. 17-18 (Java).

1890 *Corbicula fluminea*, — BOETTGER, Ber. senckenb. naturf. Ges., 1890: 163 [non O. F. MÜLLER] (Java).

1904 *Corbicula subrostrata* BULLEN, Proc. malac. Soc. London, 6: 109, pl. 6 fig. 7-9 (Java).

1953 *Corbicula javanica*, — VAN BENTHEM JUTTING, Treubia, 22: 59, fig. 14 (Sumatra, Java, various satellite islands of Java, Bali, Lombok, Sumbawa, Celebes). [Here see for full synonymy until 1953].

Shell oval when young, but trigonal with extended posterior end when adult. The thick periderm is olive- or yellowish-green, but turns to black in old specimens. The concentric ribs are widely placed at a distance of about 1 mm. Umbones high and placed nearer to the rounded anterior end. — Inside glossy; umbonal cavities creamy, the marginal area below the pallial line with slightly bluish tint. The lateral teeth deep-blue. — Hinge typical for the genus. C1 connected with AI.

Size: A 40-45 mm; L 40-50 mm; D 24-28 mm.

Type locality: W-Java.

Distribution Thailand (? Malaysia), Sumatra, Java with satellite islands, Bali, Lombok, Sumbawa, Celebes. In Thailand this species is found in abundance in the Petchburi River in almost the same form which has been called *C. ducalis* by PRIME.

The species is collected by the local population as food and sometimes offered for sale on the markets of Petburi.

Corbicula lamarckiana PRIME, 1864.

pl. 27 fig. 76-77.

- 1864 *Corbicula lamarckiana* PRIME, Ann. Lyc. nat. Hist. New York, 8: 68, fig. 16 (Montes Laos, Cambodia).
1864 *Corbicula linneana* PRIME, Ann. Lyc. nat. Hist. New York, 8: 70, fig. 17 (Montes Laos, Cambodia). [Fide PRASHAD].
1891 *Corbicula lamarckiana*, — MORLET, J. de Conch., 39: 239 (Les ruisseaux qui se jettent dans le Menam-Pinh et ceux du plateau de Xieng-Moi).

Shell of medium size, not very thick, oval, of yellowish, olive or brownish colour. Upper anterior slope either regularly curved or somewhat truncate with almost straight, slanting anterior dorsal line; upper posterior line straight, sloping; after forming an angle it suddenly turns downwards to the podium. Ventral margin regularly curved anteriorly but almost straight posteriorly. The truncate posterior end of the shell appears longer than the regularly rounded anterior end. Umbones small, almost centrally placed, not inflated. The sculpture consists of fine riblets which grow obsolete at the umbones and the posterior beak. — Ligament short but prominent. Hinge well developed for the thin shell. Cardinals typical for the genus. Laterals strong, A III thickened in the middle. — Nacre of the interior dark blue. Specimens with a yellow periderm generally show a paler blue interior. Pallial line rather distant from the margin. Very dark specimens show two white patches in the umbonal cavities. Escutcheon and lunule are not marked.

Size L 20-27 mm; A 15-20.5 mm; D 9-12 mm.

Type locality "Laos mountains", Cambodia.

Distribution Yunnan (Lake Tali), Tonkin, Annam, Laos, Thailand. Not known from Cambodia in spite of above type locality. In Thailand this species has been found sporadically at many localities: between Chieng Mai and Petburi River.

Corbicula lydigiana PRIME, 1861.

pl. 27 fig. 74-75.

- 1861 *Corbicula lydigiana* PRIME, J. de Conch., 9: 355 (Habitat in regno Siamensi).
1862 *Corbicula lydigiana*, — PRIME, J. de Conch., 10: 388, pl. 14 fig. 8 (Habitat in regno Siamensi).
1862 *Corbicula larnaudieri* PRIME, Ann. Lyc. nat. Hist. New York, 7: 480 textfig. (Siam).
1875 *Corbicula larnaudieri*, — MORELET, Sér. Conch., 5: 132 (Siam).
1891 *Corbicula larnaudiei* (sic!), — MORLET, J. de Conch., 39: 238 (Les ruisseaux qui se jettent dans le Menam-Pinh).
1929 *Corbicula lydigiana*, — PRASHAD, Mem. Ind. Mus., 9: 31, pl. 5 fig. 4, ?5 (Upper Siam, ? Malacca).
1929 *Corbicula larnaudieri*, — PRASHAD, Mem. Ind. Mus., 9: 32, pl. 5 fig. 6-7 (Siam).
1950 *Corbicula lydigiana*, — SUVATTI, Fauna Thailand: 111 (Bangkok, Chantaburi River, Bang Sorn).
1964 *Corbicula ligidiana* (sic!), — HABE, Nature & Life SE-Asia, 3: 65, pl. 1 fig. 5-6 (Vietnam).

Shell of medium size for the genus, oval-trigonal, subequilateral, somewhat inflated; young specimens with yellowish-green periderm, adults olive-coloured. Upper slopes short, moderately arched; anterior side slightly longer than poste-

rior, both almost straight. Rounded anteriorly, truncate posteriorly; ventral margin regularly arched; lunule heart-shaped, escutcheon not marked. Umbones small, little inflated, curved inwards. Surface with strong, regular, distantly placed ribs, but populations with finer, narrower ribs are not rare. Nymphs narrow and smooth. — Ligament small, not very prominent; hinge rather weak in comparison to the thick shell. Cardinals with exception of C1 and C2 often bifid in adult specimens. Anterior laterals almost straight, posterior laterals only slightly curved. Nacre deeply bluish-violet.

Size L 18-33 mm; A 15-30 mm; D 8-18 mm. — There are populations known (Lopburi River) with adults which may not reach above given sizes.

Type locality "Siam" As no exact locality was given, the Klong Premprachakon in Bangkok is herewith designated as type locality, as it is highly probable that the type material (leg. Abbé LARNAUDIER) originated from Bangkok and most specimens from this locality are almost identical with the holotype in the MCZ.

Distribution Thailand, Laos, Cambodia. In Thailand found in the Chao Praya and all its tributaries, in the Petburi River, the Maeklong and in many tributaries to the Mekong and in the Bang Prakon River.

PRASHAD (1929: 33) provisionally assigned *C. pisidiformis* PRIME to this species, considering the type to be a young specimen of this species only. The present author has studied and compared the holotypes of both species and came to the conclusion that *pisidiformis* is a small, separate species and that its holotype is adult or almost so.

***Corbicula pisidiformis* PRIME, 1866.**

1866 *Corbicula pisidiformis* PRIME, Ann. Lyc. nat. Hist. New York, 8: 215, fig. 42 (Siam).

This is the smallest species of the genus in Thailand. PRIME himself considered it in a later publication to be synonymous with *C. lydigiana*. The type specimen in MCZ, however, looks different from a young *lydigiana*. However, it remains a doubtful species, as our collecting team never found it in Thailand.

Size L 5 mm; A 5 mm; D 3 mm.

Type locality: Siam. Its distribution is unknown.

***Corbicula castanea* (MORELET, 1865).**

pl. 27 fig. 79.

1865 *Cyrena (Corbicula) castanea* MORELET, J. de Conch., 13: 228 (Cochinchine).

1875 *Corbicula castanea*, — MORELET, Sér. Conch., 4: 362, pl. 15 fig. 4 (Cochinchine).

1881 *Corbicula striatella*, — ROCHEBRUNE, Bull. Soc. philom. Paris, (7) 6: 47 [non DESHAYES] (Cambodge).

1891 *Corbicula crosseana*, — MORLET, J. de Conch., 39: 239 [non PRIME] (les ruisseaux qui se jettent dans le Menam Pinh).

1891 *Corbicula subnitens*, — MORLET, J. de Conch., 39: 253 [non CLESSIN] (Nghiah-Yen, province de Ha-Tinh).

1929 *Corbicula castanea*, — PRASHAD, Mem. Ind. Mus., 9: 41, pl. 6 fig. 11-13 (Cochinchina, Annam, Cambodia, Laos).

Shell rather small, thin but solid, compressed or only slightly inflated, almost equilateral, oval; of a lemon yellow to chestnut brown colour. Upper margin slightly arched, ventral margin greatly arched; anterior side slightly shorter

than posterior, both ends evenly rounded. Lunule dark, heart-shaped, escutcheon not marked; umbones small, not prominent. Sculptured with regular, distinct ribs; nymphs short, narrow, almost smooth. — Ligament prominent. Hinge typical. Nacre purple with dark-blue teeth.

Size: L 14-21 mm; A 12-17 mm; D 6.7-11 mm.

Type locality Cochinchine.

Distribution: S-Vietnam, Cambodia, Laos, Thailand. In Thailand found in the Mekong and in several of its tributaries; in the Menam Yam at Prae and in the Petburi River.

Corbicula cyreniformis PRIME, 1860.

pl. 27 fig. 78.

1860 *Corbicula cyreniformis* PRIME, Proc. zool. Soc. London, 28: 321 (Hab.?).

1861 *Corbicula cyreniformis*, — PRIME, J. de Conch., 9: 41, pl. 2 fig. 5 (Hab.?).

1875 *Corbicula insularis*, — MORELET, Sér. Conch., 4: 364, pl. 16 fig. 4 [non PRIME] (Siam).

1881 *Corbicula insularis*, — ROCHEBRUNE, Bull. Soc. philom. Paris, (7) 6: 47 [non PRIME] (Mekong, Cambodge).

1886 *Corbicula gryphaea*, — MORLET, J. de Conch., 34: 268 [non HEUDE] (Chu et Loc-Nam).

1887 *Corbicula jullieniana* CLESSIN, Malak. Bl., (NF) 9: 73, pl. 3 fig. 1 (Vaterland?).

1889 *Corbicula gryphaea*, — MORLET, J. de Conch., 37: 171 [non HEUDE] (Haut Pursac, Cambodge).

1929 *Corbicula cyreniformis*, — PRASHAD, Mem. Ind. Mus., 9: 39, pl. 6 fig. 6-9 (Tonkin, Cambodia).

Shell subtrigonal, almost equilateral, heart-shaped, inflated, ventricose, thick, covered with a brownish or olive periderm; violet within. — Ligament short, thick, hinge teeth typical. The sculpture of the surface is of medium strength.

Size L 25-35 mm; A 24-34 mm; D 12-17 mm.

Type locality: not given in the original description. The original material was later supposed (MORELET 1875: 364) to have come from Thailand.

Distribution Tonkin; Mekong and tributaries; Maenam Ping and tributaries. Petburi River in Thailand.

Corbicula tenuis CLESSIN, 1887.

pl. 28 fig. 85.

1887 *Corbicula tenuis* CLESSIN, Malak. Bl., (NF) 9: 72, pl. 2 fig. 7 (Cochinchina).

1887 *Corbicula cochinchinensis* CLESSIN, Malak. Bl., (NF) 9: 73, pl. 2 fig. 8 (Cochinchina).

1891 *Corbicula lemoinei* MORLET, J. de Conch., 39: 253, pl. 7 fig. 5 (Nghia-Yen, Province de Ha-Tinh).

1929 *Corbicula tenuis*, — PRASHAD, Mem. Ind. Mus., 9: 44, pl. 6 fig. 22-25 (Cochinchina and Annam).

Shell rather large (CLESSIN's specimens on which he based his description were all young), almost circular when young and moderately subovate when adult. Young shells are covered with a yellowish periderm which turns brown or even blackish with age. The shells are thin or moderately thick and compressed. The umbones are small but prominent. Lunule narrow, escutcheon not

marked. Umbones small and somewhat prominent. The sculpture consists of narrow, low and irregularly placed concentric striae which are almost obsolete at the lower and posterior part of the shell. The nacre is bluish, the muscle scars are shallow. The hinge is feebly developed with weak and small cardinals and rather short, almost straight laterals. The ligament, however, is rather prominent.

Size: L 18-34 mm; A 15-30 mm; D 8-16 mm.

Type locality Cochinchina.

Distribution: Reported from Cochinchina and Annam. This species was found in abundance by our team in the Mekong between Nakon Panom in Thailand and Kratie in Cambodia.

Corbicula fluminea (O. F. MÜLLER, 1774).

pl. 28 fig. 97

1774 *Tellina fluminea* and *Tellina fluviatilis* O. F. MÜLLER, Hist. verm. terr. fluv., 2: 206 (China).

1929 *Corbicula fluminea*, — PRASHAD, Mem. Ind. Mus., 9: 51, pl. 7 fig. 1-10 (SE-China, Korea, Ussuri Bassin). [See here for complete synonymy until 1929].

Several populations from the Chao Praya system in Thailand have to be assigned to this species as they are hardly different from populations from South China.

The shells are rather large, ovate with extended posterior part or trigonal. The strong ribs are regularly placed, the periostracum is brownish or greenish grey, dull or moderately shining. The nacre is dull, not bluish. The hinge is well developed, the ligament moderately thick.

Size: Thai populations rarely exceed a size of 30 : 27 18 mm.

Distribution: In Thailand known from the Chao Praya River and several tributaries. Extralimitarily known from E-Asia.

Corbicula noetlingi MARTENS, 1899.

pl. 28 fig. 88.

1899 *Corbicula regularis*, — MARTENS, Arch. Naturgesch., 65: 1, 46 [non PRIME] (N. Shan States).

1899 *Corbicula nötlingi* MARTENS, Arch. Naturgesch., 65: 47, pl. 4 fig. 7-9 (Hpaung, N. Shan States).

1918 *Corbicula noetlingi*, — ANNANDALE, Rec. Ind. Mus., 14: 141, pl. 19 fig. 12 (Shan States).

1929 *Corbicula noetlingi*, — PRASHAD, Mem. Ind. Mus., 9: 24, pl. 4 fig. 21-25 (Shan States, Burma).

Shell elongately ovate, moderately inflated, narrowly truncate and compressed posteriorly, broadly rounded anteriorly; upper margin distinctly arched anteriorly, almost straight posteriorly and only slightly sloping; umbones prominent but not very much inflated, placed in the anterior half of the shell and pointing forwards. The sculpture consists of rather distantly placed concentric ribs; these become weaker on the posterior half. The interspaces between these ribs are about 2-3 times as broad as the ribs. Young specimens are of yellowish or olive colour, old specimens are dark brown or even blackish.

Interior of the shell purple to violet, the hinge area is of much lighter colour. Pallial line and adductor muscle scars only feebly impressed. Hinge like those of the genus, only the anterior lateral of the right valve is greatly compressed and curved. Nymphs finely roughened, lunule and escutcheon not marked.

Size: A 18-27 mm; L 23-34 mm; D 11-17 mm.

Type locality Hpaung, Northern Shan States, Burma.

Distribution N- and S- Shan States; Thailand. In Thailand it has been found in the Moei River at the Burmese border and some of its eastern tributaries. Furthermore it is known from the Fang River N of Chieng Mai.

Corbicula regia CLESSIN, 1879.

pl. 28 fig. 86.

1879 *Corbicula regia* CLESSIN, Conch. Cab., 3, 9: 267, pl. 43 fig. 5 (Wahrscheinlich Indien).

1929 *Corbicula regia*, — PRASHAD, Mem. Ind. Mus., 9: 34, pl. 3 fig. 10-12 (Penang; Perak).

This is one of the smallest species of the genus and only somewhat larger than *C. pisidiformis* PRIME.

Shell small, ovate, inflated, very inequilateral, yellowish-brown, young specimens yellowish-green. Sculptured with rather strong, distantly placed concentric ribs. Elongated and rounded anteriorly, short and obtuse posteriorly. Umbones very inflated, prominent, pointing forwards and inwards. Ligament short, prominent; interior dull, whitish or cream-coloured, with narrow brown rays in young specimens, running from the umbones to the ventral side and to the hinge-margin. Hinge margin fairly broad; cardinals small, not bifid; laterals long, depressed, the anterior being longer.

Size: L 11 mm; A 10 mm; D 7 mm.

Type locality: "Wahrscheinlich Indien" (probably India).

Distribution: Only known from Perak and the Malayan Island of Penang and from the province of Trang in S-Thailand. This species has not been found by our collecting team.

Corbicula gustaviana MARTENS, 1900.

pl. 28 fig. 87.

1900 *Corbicula gustaviana* MARTENS, Nachr. Bl. dtsh. malak. Ges., 32: 16 (Danau Baru, Sumatra).

1929 *Corbicula gustaviana*, — PRASHAD, Mem. Ind. Mus., 9: 199, pl. 25 fig. 11-12 (Sumatra).

The specimens of the two populations of this species in Thailand agree with the specimen figured by PRASHAD (1929).

The shell is trigonal, thick, covered with a blackish-brown periderm, glossy, sculptured with concentric riblets placed at distances of about 0.9 mm. The umbones are very high and inflated. They are turned inwards and are always somewhat eroded. Anterior and posterior upper margins almost straight, forming an angle at the umbones of about 80°. Anterior end somewhat longer than posterior, slightly truncate. Ventral margin not greatly arched. — Ligament very thick, brown, prominent. Hinge teeth strong, cardinals converging, C5 with a shallow groove. Anterior laterals straight, long, almost reaching the beak.

End of the posterior laterals somewhat sinuate. The interior of the shell is blue or bluish-violet, the part within the pallial line and the hinge are of lighter colour than the marginal part.

Size A 26-34 mm; L 25-33 mm; D 16-22 mm.

Type locality: Danau Baru, Sumatra.

Distribution: Sumatra; S-Thailand. Not yet reported from Malaysia. In Thailand this species was found in the estuarine area of the Tapi River near Bandon and in the Tale Luang in the province of Pattalung.

***Corbicula moreletiana* PRIME, 1867.**

pl. 28 fig. 89-90.

1867 *Corbicula moreletiana* PRIME, Ann. Lyc. nat. Hist. New York, 8: 416 (Cambodia).

1875 *Corbicula moreletiana*, — MORELET, Sér. Conch., 4: 360, pl. 17 fig. 4 (Cambodge).

1886 *Corbicula petiti* MORLET, J. de Conch., 34: 268, 294 (Tonkin. — Grand Lac de Cambodge).

1887 *Corbicula tongkingensis* CLESSIN, Malak. Bl., (NF) 9: 67, pl. 2 fig. 1 (Hué in Tongking).

1887 *Corbicula flava* CLESSIN, Malak. Bl., (NF) 9: 68, pl. 2 fig. 2 (without locality).

1887 *Corbicula petiti* CLESSIN, Malak. Bl., (NF) 9: 71, pl. 2 fig. 6 (Cochinchina).

1891 *Corbicula trajecta* P. FISCHER, Bull. Soc. Hist. nat. Autun, 4: 240 (Hué, Annam).

1905 *Corbicula fluminea* var. *petiti* and *moreletiana*, — FISCHER & DAUTZENBERG, J. de Conch., 53: 227, 228 (Tonkin, Song Luc-Nam, Van-Ien).

1929 *Corbicula moreletiana*, — PRASHAD, Mem. Ind. Mus., 9: 38, pl. 6 fig. 1-5 (Cambodia, Tonkin, Annam, Cochinchina).

Shell large for the genus, very thick and inflated, with high, curved, inflated umbones; greenish or yellowish when young, turning black with age. Young shells oblique with the posterior end shortened and curving forwards anteriorly thereby pear-shaped or cordiform in outline; adult shells more triangular with the umbones placed centrally and with the posterior side only slightly shorter than the anterior. Upper margin very short and almost concealed by the large umbones. Posterior and anterior ends of the upper margin sloping, almost straight, forming an angle at the gonium and podium. Ventral margin evenly rounded. The sculpture consists of strong, concentric ribs which are placed at a distance of about 1.1 mm. — Ligament rather short but prominent. The inner side is deep-blue, the part within the pallial line being dull, that between margin and pallial line glossy. Muscle scars well marked. Hinge teeth well developed, cardinals strong, converging, C3, C4 and C6 with a groove. The laterals are forming an angle of 90°, the posterior laterals are straight, the anterior somewhat curved.

Size A 22-39 mm; L 22-38 mm; D 14-26 mm.

Type locality: Cambodia, probably Tonle Sap.

Distribution: Mekong from Nakon Panom to S-Vietnam and several of its tributaries; Tonle Sap River and Tonle Sap Lake in Cambodia. Extralimitarily it is known from several rivers in Annam and Tonkin (C- and N-Vietnam).

PRIME, in a later publication, synonymized his *Corbicula lydigiana* with this species. A careful comparison of the holotypes of these species, however, clearly proved that *lydigiana* is a different species closely related to *larnaudieri* PRIME and probably only a small, trigonal race or local form of this species. *C. tonkiniana* MORLET is probably *moreletiana* PRIME, *tongkingensis* CLESSIN is surely synonymous with the species. The holotypes of *petiti* and *tonkiniana* MORLET are said to be purchased by FULTON for the

British Museum but have not yet been located in their collection. *C. flava* CLESSIN is placed by HABE and PRASHAD in the synonymy of *moreletiana*. The present author has not studied authentic material of this species to form an own opinion. This species is closely related to *C. cor* LAMARCK from China and to *C. recurvata* EYDOUX from the Philippines.

Corbicula siamensis PRASHAD, 1929.

- 1875 *Corbicula episcopalis*, — MORELET, Sér. Conch., 4: 364, pl. 16 fig. 3 [non PRIME] (Siam).
1889 *Corbicula erosa*, — MORLET, J. de Conch., 37: 170 [non DESHAYES nec PRIME] (Rivière de Srakéo).
1929 *Corbicula siamensis* PRASHAD, Mem. Mus. Ind., 9: 34, pl. 5 fig. 13-14 (Siam).

Original description: Species of a fair size, thick-shelled, trigonal, inequilateral, of a lemon-yellow to brownish colour. Upper slope narrowly arched, anterior side longer than posterior, somewhat arched, posterior nearly straight; narrowly rounded anteriorly, subtruncate posteriorly; ventral margin regularly arched; no distinctly marked lunule or escutcheon; umbones large, prominent, greatly inflated, curved inwards and somewhat forwards, eroded in full-grown shells. Shell surface with concentric, regular, somewhat distinctly placed, rather sharp, low ridges, equally developed over the whole surface of the shell; nymphs rather broad, almost smooth; ligament strong, prominent. Hinge moderately strong, normal; laterals subequal, somewhat curved; muscle scars not greatly impressed. Nacre dirty violet.

Size: L 20-28 mm; A 16-25 mm; D 11-20 mm.

Type locality: "Siam"

Distribution Thailand, many localities. An exactly defined distribution can not yet be given as the validity of this species is still doubtful.

HABE gave for his figured specimen a length of 44.5 mm and a height of 26 mm. Specimens of such dimension have not been found of this species, and it seems that HABE made a mistake in the measurements as among several millions of specimens of *Corbicula* in Thailand only specimens of *moreletiana* almost attained a length of 40 mm. HABE placed *erosa* and *nevilli* apud MORLET in the synonymy of this species; *nevilli* is definitely conspecific with *larnaudieri* PRIME as typical material in Paris showed.

Paratypes of *C. siamensis* PRASHAD, studied by this author in Paris and London, have to be assigned to *C. solidula* or *C. lydigiana* respectively. As the holotype in the Museum of Zoology in Calcutta could not be found — the two valves are said to be lost in an inundation — this author has no comment on the validity of this species as description and figure are not sufficient to form a judgment.

? ***Corbicula erosa*** PRIME, 1861.

pl. 27 fig. 81.

1861 *Corbicula erosa* PRIME, Proc. Acad. nat. Sci. Philad., 13: 127 (Cambodia).

1864 *Corbicula erosa*, — Ann. Lyc. nat. Hist. New York, 8: 213, fig. 40 (Cambodia).

Shell of medium size for the genus, solid, inflated, glossy, yellowish or greyish-green. The sculpture consists of regularly placed sharp ribs, the distances between the ribs being broader than the ribs. The shape is ovate-trigonal with

beaked posterior and rounded anterior end. Umbones not prominent. Ligament not very prominent, of greyish colour. Nacre bluish-violet. Hinge rather strong, with well developed cardinals and long, somewhat bent laterals.

Size: L 19-25 mm; A 17-22 mm; D 12-17 mm.

Type locality: Cambodia.

Distribution: Cambodia and Thailand. — With great hesitation I assign a population from Glaeng District (Province of Rayong) to this doubtful species. The specimens are almost identical with the unique shell (considered by PRASHAD to represent the holotype) in the BM (NH).

Corbicula iravadica HANLEY & THEOBALD, 1876.

pl. 28 fig. 91.

1876 *Corbicula iravadica* HANLEY & THEOBALD, Conch. Ind.: V, 62 (nomen), pl. 155 fig. 8 (Iravadi).

1880 *Corbicula iravadica*, — BLANFORD, J. asiat. Soc. Bengal, 49: 221 (Iravadi).

1929 *Corbicula iravadica*, — PRASHAD, Mem. Ind. Mus., 9: 25, pl. 4 fig. 7-10 (Ava, Pegu, Bhamo, Thyetmyo).

With some hesitation we assign populations from the Ping River in North Thailand to this Burmese species.

The shell is rather small, thin, inflated, greenish, with very weak or almost obsolete sculpture. The nacre is bluish, the hinge is weakly developed.

Size: L 10-14 mm; A 8-10 mm; D 5-8 mm.

Type locality: Iravady River.

Distribution: Iravady River and tributaries in Burma and Maenam Ping and tributaries in North Thailand.

Corbicula baudoni MORLET, 1886.

pl. 29 fig. 102.

1863 *Corbicula largillierti*, — CROSSE & FISCHER, J. de Conch., 11: 345 [non PHILIPPI] (Cochinchine).

1866 *Corbicula largillierti*, — MABILLE & LE MESLE, J. de Conch., 14: 121 (Grand Lac du Cambodge).

1886 *Corbicula baudoni* MORLET, Diagn. Moll. Terr. fluv. Tonkin: 6 (Tonkin: les étangs et arroyos de Loc-Nam et de Chu).

1886 *Corbicula baudoni*, — MORLET, J. de Conch., 34: 268, 293, pl. 14 fig. 6-6a (Tonkin: étangs et arroyos de Loc-Nam et de Chu).

1887 *Corbicula baudoni*, — DAUTZENBERG & HAMONVILLE, J. de Conch., 35: 224 (Étangs près d'Hanoi).

1889 *Corbicula vericunda* MABILLE, Contr. Faune malac. Tonkin: 17 (Tonkin: Chobo).

1905 *Corbicula fluminea* var. *baudoni*, — DAUTZENBERG & FISCHER, J. de Conch., 53: 232 (Tonkin).

1929 *Corbicula baudoni*, — PRASHAD, Mem. Ind. Mus., 9: 35, pl. 5 fig. 15-18 (Loc Nam; Annam; Cambodia).

Shell subtrigonal, subequilateral, thick, covered with a brownish, glossy periderm and sculptured with weak riblets, about 7-9 on 5 mm. Lunule weakly marked, escutcheon not marked. Nymphs narrow, smooth. Inner surface pale-violet, the outer zone glossy, the zone within the pallial line generally dull in adult specimens. Muscle scars well marked. Hinge typical for the genus, laterals

darker coloured than the rest of the inner surface. Hinge teeth moderately strong; laterals long, almost reaching podium and gonium. Posterior laterals straight, anterior somewhat curved at the distant end. Ligament short, strong, blackish-brown.

Size L 24-40 mm; A 22-33 mm; D 15-22.4 mm.

Type locality Loc Nam, Tonkin.

Distribution: Vietnam, Laos, Cambodia and Thailand. In Thailand this species is restricted to few localities only: Nam Suei near Nong Kai; Maenam Kuang at Lam-poon; Maenam Kaek, Pitsanulok. Mekong River and tributaries.

If this species is synonymous with *C. bocourti* MORELET, MORELET's Name has to replace that of MORLET.

***Corbicula virescens* n. sp.**

pl. 29 fig. 101.

Diagnosis: A species of *Corbicula* which differs from all other species of this genus from Thailand by its yellowish-green periderm.

Description: Shell broadly ovate, nearly equilateral, longer than high, with light green periderm which is paler at the umbonal area than at the margin and brownish at the extremities and at the escutcheon and lunule. The sculpture consists of obtuse riblets which are stronger at the margin than at the umbonal area. There are 2-3 riblets on 1 mm. Juvenile specimens may show 1 or 2 darker posterior rays. The umbones are moderately inflated and curved inwards; they are almost smooth. The posterior upper margin is almost straight, so is the anterior dorsal margin. Podium and gonium regularly rounded, podium sometimes moderately truncate or rostrate. Ventral margin regularly arched; the posterior end is only slightly longer than the anterior. Lunule narrow, smooth, escutcheon not marked. Ligament external, short, rather thick, dirty-brown. Muscle scars shallow, pallial line barely sinuous. Interior bright, the area within the pallial line milky-blue, marginal area mauve-coloured. Laterals bluish-violet, with a small violet patch at their ends. Hinge plate narrow; there are 3 diverging cardinals in each valve; right valve with 1 lateral at each extremity, left valve with 2. C1 connected with A III, C3 triangular, somewhat curved. C5 long and obliquely triangular, with a sharp crest, but not divided. A I almost straight, narrow and sharp above, broader and obtuse at the lower end. A I and P I smooth, the other laterals serrated. P I and P III originate together below the ligamental groove. They are separated by a deep groove. C2 very oblique, almost in the same line with P II. C4 vertical, high, with sharp crest.

Size L 20-28 mm; A 17-21 mm; D 12-14 mm.

Type locality Maenam Chao Praya at Nakon Sawan.

Distribution: Maenam Chao Praya and Ping River.

Material: Holotype SMRL 2751/A; paratypes 2751/50. — SMRL 5723-Ping River at Wutikon bridge near Tak.

***Corbicula pingensis* n. sp.**

pl. 28 fig. 93.

Diagnosis: A species of *Corbicula* MÜHLFELD which differs from *C. lamarckiana* PRIME with which it has been found together, by its milky-white nacre and more curved lateral teeth.

Description: Shell medium-sized, ovate, inequilateral, compressed, solid but not thick, with elongate and truncate anterior end and short, rounded posterior. Periderm yellowish (never brownish-green or olive-coloured like in *C. lamarckiana*), somewhat glossy. Sculptured with fine, sharp and regular riblets which are separated by sulci of about twice their breadth. These riblets are obsolete near the beaks and fade away at the anterior end. Ligament short and strong. Lunule and escutcheon not marked. Hinge rather long, with distinctly curved laterals. C₂, C₄, C₆ rather long, C₃ short and triangular, C₁ only a minute tubercle, C₅ thin and sharp. AI and AIII of almost equal strength, PIII like PI (contrary to *C. lamarckiana* and others). Nacre milky-white, no bluish patches at the teeth. Pallial line and muscle scars not distinct in fresh specimens.

Size L 23-25 mm; A 17-19 mm; D 11-13 mm.

Type locality: Maenam Ping near Chieng Mai.

Distribution Upper reaches of the Maenam Ping, N-Thailand.

Material: Holotype SMF 234287, Paratypes SMF 234388/2; — SMF 234389/14 Maenam Ping, 60 km N of Chieng Mai.

Corbicula gubernatoria PRIME, 1869.
pl. 28 fig. 92.

1869 *Corbicula gubernatoria* PRIME, Amer. J. Conch., 5: 132 (Saigon).

1870 *Corbicula gubernatoria*, — PRIME, Ann. Lyc. nat. Hist. New York, 9: 298, fig. 71 (Saigon).

This species has been reported by MORLET (1891: 239) from the Ping River near Chieng Mai. As no material from this locality was found in the Museum of Paris and as our team never found a population of *Corbicula* identical with that from Saigon, the occurrence of *C. gubernatoria* in Thailand is doubtful.

Corbicula occidentiformis n. sp.
pl. 28 fig. 94.

Diagnosis: A species of *Corbicula* MÜHLFELD which differs from its closest relatives, *C. leviuscula* PRIME by its coarser striation and *C. lamarckiana* PRIME by its more circulate shape and smaller ligament.

Description: Shell ovate, with short, rounded anterior end and somewhat elongate posterior. Somewhat inflated but umbones not prominent. Sculptured with irregular, coarse striae which are obsolete on the beaks. Periderm moderately glossy, greenish with darker dots, ligament comparatively small, brown, not prominent. Hinge long, rather broad; nymphs roughened; teeth strong, C₁ very feeble, C₂ thin and sharp, C₃ and C₄ short and strong. C₅ minute, C₆ thin and sharp, only a delicate tubercle. AII long and curved, PII longer and straight, both serrate. AI thicker than AIII, AI somewhat S-shaped. PIII thinner than PI. Interior nacre deep bluish-violet. The part within the pallial line dull, outer part glossy. Muscle scars only distinct in old shells.

Size L 22-28 mm; A 20-25 mm; D 13-15 mm.

Type locality Maenam Loei near Loei, N-Thailand.

Distribution Known from the Loei River, Huai Lam Lai, a tributary to the Loei River and from the Mekong at Phnom Penh.

Material: Holotype SMF 197431. — SMF 197430/12 Huai Lam Lai near Loei; SMF 234398/1 Mekong at Phnom Penh.

***Corbicula leviuscula* PRIME, 1864.**

pl. 28 fig. 95.

1864 *Corbicula leviuscula* PRIME, Ann. Lyc. nat. Hist. New York, 8: 64, fig. 9 (Cochinchina).

1876 *Corbicula laeviuscula* (sic!), — CROSSE & FISCHER, J. de Conch., 24: 334 (Cambodge).

Shell rounded-trigonal, almost equilateral, with slightly produced anterior end and short posterior. The shell is thin and moderately inflated. The glossy periderm is yellowish-green, in very old specimens brownish. The sculpture consists of very narrowly placed striae which are separated by sulci of about the same breadth. The brown ligament is short and prominent. Nymphs narrow and almost smooth. Nacre bluish-violet. Hinge plate very narrow, greatly curved. Teeth small, delicate.

Size: L 16-19 mm; A 11-15 mm; D 7-8 mm.

Type locality Cochinchina.

Distribution Mekong River between Ban Khum and South Vietnam and numerous tributaries. Also reported from Annam.

***Corbicula solidula* PRIME, 1861.**

pl. 28 fig. 96.

1861 *Corbicula solidula* PRIME, Proc. Acad. nat. Sci. Philad., 13: 127 (no locality).

1864 *Corbicula solidula*, — PRIME, Ann. Lyc. nat. Hist. New York, 8: 81, fig. 31 (no locality).

1869 *Corbicula episcopalis* PRIME, Amer. J. Conch., 5: 131 (Cambodia) [fide PRASHAD].

1886 *Corbicula souverbiana* WATTEBLÉ, J. de Conch., 34: 70, pl. 5 fig. 4 (Annam) [fide PRASHAD].

1887 *Corbicula solidula*, — CLESSIN, Malak. Bl., (NF) 9: 69, pl. 2 fig. 4 (Cochinchina).

1929 *Corbicula solidula*, — PRASHAD, Mem. Ind. Mus., 9: 42, pl. 6 fig. 14-15 (Cambodia, Cochinchina, Annam).

Shell subtrigonal or ovate, thick, rather inflated, with brownish or yellowish-green periderm. Sculptured with regularly placed obtuse ribs. Lunule distinctly marked; ligament small, not very prominent. Hinge long, almost rectangular. C1 obsolete, all other teeth more or less typical for the genus. Nacre bluish-white with violet hinge and teeth. The darker coloured hinge is typical for a limited number of species only.

Size: L 12-25 mm; A 12-22 mm; D 11-14 mm.

Type locality: Cochinchina (designated by CLESSIN 1887).

Distribution Mekong and Chao Praya basin.

Note: PRIME's description was based on young specimens. A rather large number of populations from Thailand and Laos proved *C. solidula* to be a widely distributed species with great variability. The many different variations, however, are all connected by intermediate forms.

Corbicula messengeri BAVAY & DAUTZENBERG, 1901.

pl. 29 fig. 100.

1901 *Corbicula messengeri* BAVAY & DAUTZENBERG, J. de Conch., 49: 9, pl. 1 fig. 5-7 (Entre Lang-Son et That-Khé).

Shell rather compressed, subequilateral, ovate, with rounded anterior end and slightly elongate and truncate posterior. Periderm reddish to blackish-brown, slightly glossy; sculptured with irregular and sharp riblets which are separated by somewhat broader sulci. These riblets fade away at the posterior end and tape to the anterior. Umbones not prominent, always eroded. Lunule and escutcheon not marked. Ligament small, brown. Hinge long, narrow, teeth typical.

Size L 14-25 mm; A 12-20 mm; D 9-12 mm.

Type locality Between Lang-Son and That-Khé, North Vietnam.

Distribution: NE-Thailand, N-Laos, N-Vietnam.

PRASHAD (1929: 43) placed this species in the synonymy of *C. lamarckiana* PRIME. I studied the type of *C. messengeri* and found it to be a completely different species. It is generally smaller but thicker, brownish, not greenish or yellowish like *C. lamarckiana*. The costulation is stronger.

Corbicula vokesi n. sp.

pl. 29 fig. 103.

Diagnosis: A species of *Corbicula* MÜHLFELD which differs from all other Thai species of this genus but *C. arata* and *C. blandiana* by its strong, regular ribs. It differs from *C. arata* and *C. blandiana* by its milky-blue nacre with darker tinted hinge, and by its dull, greyish periderm.

Description: Shell of medium size for the genus, ovate, solid, with anterior margin well rounded, posterior tapering and truncate. Slightly inflated; the strongly eroded beaks not prominent. Sculptured with strong but obtuse ribs, the intervals of about twice the breadth of the ribs. Colour of the periderm yellowish, turning black with age. — Ligament short but prominent. Lunule and escutcheon not marked. Nymphs narrow, roughened. Hinge long and strong. C1 minute, C3 strong and triangular, C5 thin and sharp. C2 stronger than C4, C6 sharp. Laterals long, A1 somewhat stronger than AIII, PI connected with the weaker PIII at their proximal ends. AII and PII almost strongly; PI, PII and AII delicately serrate. — Nacre white in the beak cavity, bluish-white at the margin with more or less distinctly tinted hinge. Cicatrices weak.

Size L 17-24 mm; A 15-20 mm; D 9-12.5 mm.

Type locality Mekong at Nakon Panom.

Distribution Known from parts of the Mekong, from the Mae Lao River near Chieng Rai, Kaek River near Pitsanulok.

Material Holotype SMF 234461, paratypes SMF 234462/5; — SMF 197383/6-Mae Lao River at Ban Rim Lao, Chieng Rai Prov.; SMF 234463/6-Gaeng Song Falls, Kaek River, Pitsanulok.

Etiology: I dedicate this species to HAROLD E. VOKES in recognition of his valuable contribution to our knowledge of the systematics of Bivalves.

Note This species lives together with *C. blandiana*, *C. leviuscula*, *C. tenuis*, *C. solidula* and the following new species.

***Corbicula heardi* n. sp.**

pl. 29 fig. 104.

Diagnosis: A species of *Corbicula* MÜHLFELD which differs from its compatriots *C. vokesi* and *C. solidula* by its thinner texture, yellow periderm and salmon coloured nacre. From *C. solidula* it also differs by its ovate shape and smaller size.

Description: Shell rather small, subequilateral, ovate, thin but rather solid, moderately inflated; anterior and posterior part of dorsal margin regularly slanting, ventral margin regularly rounded. Periderm yellow, eroded at the beaks. Sculptured with obtuse, regular concentric ribs which are obsolete at the umbones. — Ligament short, not prominent. Lunule and escutcheon not marked. Hinge long, curved. Nymphs small, almost smooth. C1 very delicate, C3 short, triangular. C5 thin, long, connected with the posterior laterals. Laterals of equal strength and length but PIII sometimes obsolete. C2 and C4 small but distinct, C6 connected with PII. Nacre cream- to salmon-coloured in the beak-cavities but milky-white at the margin. With a bluish-violet dot on the posterior laterals.

Size L 15-19 mm; A 13-16 mm; D 8-10 mm.

Type locality Mekong at Nakon Panom.

Distribution Known from the type locality and from the Mae Lao River near Chiang Rai only.

Material: Holotype SMF 197413, paratypes SMF 234464/6. — SMF 234465/5-Mae Lao River near Chiang Rai.

Etiology: I dedicate this species to WILLIAM H. HEARD for his valuable contributions to our knowledge of Bivalvia.

Pisidiidae GRAY, 1857.

Shell small to very small (1.5-5.5 mm long), generally rather thin, covered with a thin periderm; smooth or with concentric ribs. Ligament narrow, with 2 cardinals and 1 lateral on each side of them in the left valve and 1 cardinal and 2 laterals on each side of it in the right valve. The shell is porous; these pores contain tiny processes of the mantle epithelium. Mantle edge smooth with 1 or 2 smooth siphons. Foot tongue-shaped; the demibranchs are connected with the mantle lobe without and with the digestive sac within. They are united with each other posteriorly. The inner demibranchs form the marsupia, but only anteriorly. The embryonic shells are released from the marsupia after having reached a rather large size. The animals are hermaphroditic.

Distribution: Cosmopolitan.

Habitat: Freshwater of all kinds.

There is only one genus represented in Thailand.

***Pisidium* C. PFEIFFER, 1821.**

Shell very small, round or ovate, translucent, with thin periderm, almost smooth or with concentric ribs. Ligament external, internal or between the hinge plates. This genus is represented by three subgenera in Thailand.

Type species *Pisidium amnicum* (O. F. MÜLLER).

Distribution: Cosmopolitan.

Key to the Thai subgenera:

- | | | |
|--|----|-------------------------|
| 1. Animal with anterior pair of demibranchs, 1 lobe on each side; ligament either internally or externally visible | .. | 2 |
| — Animal with 2 pairs of demibranchs, 1 pair on either side; ligament placed between the margins of the valves, not visible internally or externally | . | <i>Pisidium.</i> |
| 2. Shell with internal ligament | | <i>Odhneripisidium.</i> |
| — Shell with external ligament | | <i>Afropisidium.</i> |

Pisidium (Pisidium) s. str.

The ligament of the hinge is placed between the margins of the valves, beside the hinge plate. The animals have 2 pairs of demibranchs; the mantle forms 2 openings..

Distribution Cosmopolitan.

There is only one species known from Thailand.

Pisidium (Pisidium) casertanum (POLI, 1791).

pl. 30 fig. 4.

1791 *Cardium casertanum* POLI, Test. utr. Sicil., 1: 65, pl. 16 fig. 1 (Sicily).

1878 *Pisidium hydaspicola* THEOBALD, J. Asiat. Soc. Bengal, 47: 147 (Kashmir, near Shypion).

1915 *Pisidium hydaspicola*, — PRESTON, Fauna Brit. Ind., Freshw. Moll.: 225, fig. 27 (Shypion, Kashmir).

Shell oval to triangular, with fine, irregular concentric striae and with densely placed shell pores which are comparatively large. C2 hooked; C4 short and straight, behind C2.

Size L 5.5 mm; A 4.5 mm; D 3.4 mm.

Type locality Sicily.

Distribution Almost cosmopolitan. — In Thailand known only from an irrigation trench in the Agricultural Station N of Ban Wiang Kok in the valley of the Nam Mae Chai, about 12 km NW of Fang, Chiang Mai Province. This species is known from India (Kashmir) and Burma in SE-Asia. It is known from Japan and China in E-Asia and has been reported as *P. floresiana* RENSCH from several Indonesian Islands. It has not yet been reported from Indo-China and Malaysia.

Pisidium (Afropisidium) KUIPER, 1962.

Ligament externally visible; the distal part of the ligament pit is turned outward. Animal with 1 pair of demibranchs, with 1 lobe on either side and with 1 (anal) siphon only.

Type species *Pisidium lepus* KUIPER.

Distribution Africa; S- and SE-Asia.

Key to the Thai species:

- | | | |
|---------------------------------------|----|---------------------|
| 1. Shell more or less obliquely ovate | .. | 2 |
| — Shell trigonal | | <i>nevillianum.</i> |
| 2. Nepionic shell striated, dull | | <i>javanum.</i> |
| — Nepionic shell smooth, glossy | | <i>clarkeanum.</i> |

Pisidium (Afropisidium) clarkeanum G. & H. NEVILL, 1871.

pl. 30 fig. 2.

- 1871 *Pisidium clarkeanum* G. & H. NEVILL, J. Asiat. Soc. Bengal, 40: 9, pl. 1 fig. 4, 4a-d (Tanks etc. close to the Damuda at Moirakha).
1876 *Pisidium bombayana* THEOBALD, J. Asiat. Soc. Bengal, 45: 188 (Western Ghats).
1918 *Pisidium casertanum*, — ANNANDALE, Rec. Ind. Mus., 14: 142, pl. 19 fig. 13-14 [non POLI] (Inlé Lake; He-Ho plain).
1921 *Pisidium clarkeanum* and *P. hydaspicola* [non THEOBALD], — PRASHAD in ANNANDALE & al., Rec. Ind. Mus., 22: 618 (Manipur: Loktak Lake; road from Wai-khong to Shugui; stream near Yaribuk Bungalow).
1925 *Pisidium clarckeanum*, — PRASHAD, Rec. Ind. Mus., 27: 408, pl. 7 fig. 1-2, pl. 8 fig. 1-3 (many localities in India and Maymyo and Inle Lake, Burma).
1928 *Pisidium clarckeanum*, — RAO, Rec. Ind. Mus., 30: 465 (Northern Shan States: at Mongyu, Kutkai, Hsenwi, Hsipaw and Mongyai).

Shell of medium size for the genus, moderately thick, obliquely ovate, greatly inflated. Beaks smooth and glossy, the remainder of the shell with more or less strong striae (river form) or fine riblets (pond form). These striae are more narrowly placed near the margins than near the umbones. Posterior end somewhat truncate, anterior end (in the original description of the NEVILL brothers anterior and posterior were confused) sloped and curved. Hinge about $\frac{3}{4}$ of the length of the shell, rather broad, somewhat arched. Hinge teeth: A I about $\frac{1}{3}$ of the length of the hinge line, strong, curved, with blunt ridges. A III parallel to the distal ridge of A I and about $\frac{1}{3}$ of its length, very close and parallel to it. C2 separated from the hinge plate by a shallow impression. Ligament heavy, external.

Size L 3.2-5.6 mm; A 2.7-4.7 mm; D 2.1-3.6 mm.

Anatomy see PRASHAD (1925: 410).

Type locality: Moirakha, India.

Distribution India, Burma, Thailand, Laos. In Thailand this species is common in the mountain areas of N- and W-Thailand, but it is also found in C-Thailand (Klong Premprachakon in Bangkok), E-Thailand (Nakon Panom Province) and SE-Thailand (Chantaburi Province). In N-Thailand the species was found in the following provinces: Nan, Mae Hongson, Tak, Chiang Mai, Lampang, Kon Kaen, Prae, Chiang Rai and Loei. It was also collected in the Moei River E of Mae Sot. It has not yet been found on the Malayan peninsula nor in S-Thailand.

Pisidium (Afropisidium) nevilleianum THEOBALD, 1876.

pl. 30 fig. 3.

- 1876 *Pisidium nevilleianum* THEOBALD, J. Asiat. Soc. Bengal, 45: 188 (Rurki).
1925 *Pisidium nevilleianum*, — PRASHAD, Rec. Ind. Mus., 27: 412, pl. 7 fig. 3-4, pl. 8 fig. 4 (Rurki).

This species differs from the preceding, and the following species, by its trigonal shape and by its more strongly developed hinge. The shell is regularly striated, the striae being stronger near the umbonal area. Hinge about $\frac{4}{5}$ of the length of the shell. A III differs from that of *P. clarkeanum* by measuring more than half the length of A I.

Size L 3.0-4.2 mm; A 2.5-4.0 mm; D 1.6-2.8 mm.

Type locality: Rurki, India.

Distribution Before the species was found in Thailand it has been known from India only. Beside the type locality it is known from the Nerbudda River in India and from Bolagunj in E-Pakistan (personal communication by J. G. J. KUIPER, who also identified our material). In Thailand this species has been collected near Mae Sot (Tak Prov.), Klong Wad (Songkla), Nam Mae Sao near Fang (Chieng Mai Prov.). As it was found near the Burmese border, it has to be expected in Burma also.

***Pisidium (Afropisidium) javanum* VAN BENTHEM JUTTING, 1931.**

pl. 30 fig. 1

- 1931 *Pisidium (Neopisidium) javanum* VAN BENTHEM JUTTING, Treubia, 13: 12, fig. 14a-c (Lake Djigombong, Java).
1940 *Pisidium (Neopisidium) javanum*, — ODHNER, Nova Guinea, (NS) 4: 116, 127, pl. 12 fig. 11, textfig. 12-13 (Java, Sumba).
1953 *Pisidium (Neopisidium) javanum*, — VAN BENTHEM JUTTING, Treubia, 22: 70, fig. 19, 21 (Java).
1965 *Pisidium javanum*, — KUIPER, Basteria, 29: 26, fig. 1-2 (Western part of the island of Java).

The shell resembles that of *P. clarkeanum*, but it may be easily distinguished from the latter by its less oblique shape in which the beaks take a more perpendicular position, by the fine concentric striation of the nepionic shell (which is generally surrounded ventrally by 3-5 more marked striae) and by the position and shape of P III which converges proximally with P I. The shell is thickened at the proximal end similar to that of the African *P. giraudi* BOURGUIGNAT. The regular striation of the shell (9-12 striae on 1/2 mm per the middle of the valve) is often whitish caused by corrosion of the periderm. The external ligament does not project so far outwards as in *P. clarkeanum*.

Size L 3.5-4.5 mm; A 2.9-4.0 mm; D 2.2-2.7 mm.

Type locality: Lake Djigombong in W-Java.

Distribution: Before this species was found by our collecting team in Thailand and Laos, it was only known from Java and Sumba. It is the most common species of *Pisidium* in Thailand and has been found in almost all Thai provinces. When this fauna was compiled, 87 localities of *javanum* were known in Thailand. The distribution in Thailand extends from Fang in the N to Satun in the S of Thailand; and from the Moei River at the Burmese border in the W to Bandan in the E of Thailand. It has also been found in Laos, and as it was collected in the border river (Maenam Moei) between Thailand and Burma, it also belongs to the Burmese fauna.

***Pisidium (Odhneripisidium)* KUIPER, 1962.**

This subgenus is characterized by its generally short ligamental pit being turned inwards. The ligament is visible inside the shell at ventro-dorsal view. The animal has 1 gill on either side and 1 siphonal (anal) opening only.

Type species: *Pisidium stewarti* PRESTON.

Distribution: Europe, Asia, Bismarck Archipelago. Not known from Africa and Australia. Several of the still unexamined Japanese species may belong to this subgenus.

Key to the Thai species:

- | | |
|---|--------------------|
| 1. Shell elongate with distinct, fine striation | 2 |
| Shell rounded, almost smooth | <i>sumatrana.</i> |
| 2. Shell subtrigonal, without radial striae | <i>annandalei.</i> |
| — Shell almost oval, with radial striae | <i>prasongi.</i> |

Pisidium (Odhneripisidium) sumatranum MARTENS, 1897

pl. 30 fig. 6.

- 1897 *Pisidium sumatranum* MARTENS in WEBER, Zool. Ergebn. Reise Niederl.-Ostind., 4: 121, pl. 9 fig. 16-18 (Sumatra: Ajer Tengenang bei Fort Kock, in einer Höhe von 1150 Met.).
- 1928 *Pisidium sumatranum*, — DEGNER, Treubia, 10: 390 (Sumatra).
- 1940 *Pisidium sumatranum*, — ODHNER, Nova Guinea, (2) 4: 128, pl. 13 fig. 23-24, textfig. 16-17 (Balege; Ajer Tengenang, near Fort de Kock, 1150 m).
- 1959 *Pisidium sumatranum*, — VAN BENTHEM JUTTING, Beaufortia, 7 (83): 180 (Am-balutu Estate, near Kisaran; Ajer Tengenang, near Fort de Kock, 1150 m alt.).

Shell thin, whitish, translucent, with almost round outlines, surface dull with almost imperceptible striae. Beaks glossy, smooth. Anterior end shorter than posterior end. Cardinals in the right valve bicuspid.

Size L 2.0-2.5 mm; A 1.75-2.3 mm; D 1.1-1.8 mm.

Type locality Ajer-Tengenang near Fort de Kock, at about 1150 m altitude, Sumatra.

Distribution This species was known from only two localities in Sumatra. We found specimens at 12 localities in Thailand, from the extreme N (Fang in Chiang Mai Prov.) to the S (Grabi; Satun). Other provinces in which this species was found are: Pattalung, Loei and Petchabun. We also found *sumatranum* in Malaya, about 6 km E of Ipoh, and in Laos, about 24 km S of Pakse. The species is nowhere as common as *clarkeanum* and *javanum*.

Pisidium (Odhneripisidium) annandalei PRASHAD, 1925.

pl. 30 fig. 7.

- 1925 *Pisidium annandalei* PRASHAD, Rec. Ind. Mus., 27: 420, pl. 7 fig. 12-12a, pl. 8 fig. 11 (Parehnath Hill, Bihar, at an altitude of 4000 ft.).
- 1940 *Pisidium dammermani* ODHNER, Nova Guinea, (2) 4: 130 (Sumba).
- 1963 *P. (Odhneripisidium) annandalei*, — KUIPER, Arch. Moll., 92: 248 (mediterr. Zone), 250 (südlich des Himalayagebirges).
- 1965 *Pisidium dammermani*, — KUIPER, Basteria, 29: 28, fig. 3-4 (no loc.).
- 1966 *Pisidium annandalei*, — KUIPER, Ann. zool. Wetensch., 151: 10 (Ceylan à la Sicile; Israel).

Shell small, subtrigonal, thin, porcellaneous, moderately tumid, umbones barely prominent, almost smooth, the remaining shell with fine, concentric striae; striae close-set and regular. Dorsal margin short, slightly arched, with well marked shoulders on both anterior and posterior slopes; anterior margin regularly curved, posterior margin broadly arched, subtruncate. Shell of bright corneous colour, surface somewhat glossy. Hinge about $\frac{3}{4}$ of the length of the shell, rather strong, arched, projecting inwards. AI about $\frac{1}{2}$ the length of the hinge line, A III about $\frac{1}{2}$ the length of AI. C3 very prominent, upper part almost straight, posterior end knob-like. PI about $\frac{1}{2}$ the length of the hinge

line, broad, strong, with swollen base and obtuse apex. P III somewhat more than $\frac{1}{3}$ of the length of P I, parallel to the margin of the shell. A II a little longer than $\frac{1}{3}$ of the length of the hinge line, with sharp ridge. C2 with obtuse, trigonal apex, base continuous with the umbonal ridge. P II smaller than A II. Ligament pit placed rather posterior.

Size: L 2.0-3.2 mm; A 1.7-2.8 mm; D 1.2-2.1 mm.

Type locality: Parashnat Hill, Bihar, India, 1200 m.

Distribution: From Sicily through Greece and Israel to SE-Asia and Indonesia (Sumba). There are 30 localities of this species known from Thailand. The distribution extends from Fang in the N to Trang and Yala in the S of Thailand. No populations are known from E-Thailand, nor has this species been found in Malaysia or Indo-China.

***Pisidium (Odhneripisidium) prasongi* KUIPER n. sp.**

pl. 30 fig. 5.

“Diagnosis: A small species of *Pisidium (Odhneripisidium)* which differs from its closest relative, *P. annandalei* PRASHAD, by its more oval outline, its relatively long dorsal margin and its fine, regular striation crossed by radial microgrooves.

Description: Shell small, moderately tumid, subpentagonal to oval, slightly inequilateral, with rather prominent, almost central, somewhat prosogyrous beaks. Dorsal margin relatively long, $\frac{3}{5}$ of the shell length, slightly curved, joined by the anterior and posterior margins by distinctly rounded edges. Anterior margin more strongly curved than posterior, which forms one regular curve with the ventral margin. Surface dullish between the somewhat silky, glossy, concentric striae, about 5-7 on $\frac{1}{2}$ mm in the midst of the shell. On and around the beaks the striation is very fine and dense and crossed by short, radial microscopic grooves. The translucent shell is densely porous. Hinge moderately solid, rather long, the distance between A II and P II being $\frac{3}{5}$ of the shell length. Lateral teeth relatively well developed, inner slopes rather short. Base of anterior laterals stronger than that of posterior laterals (seen in a ventral-dorsal view). C3 curved, posterior end thickened, and short. C4 nearly straight, somewhat shorter than C2; C2 very short and triangular. Ligament pit turned inwards, short, 0.25 mm.

Size: L 2.10-2.25 mm; A 1.7-2.0 mm; D 1.3-1.55 mm.

Soft parts not examined as only desiccated animals were available for description.

Type locality: Side-branch of the Mae Sarieng River at Mae Sarieng, Mae Hongson Province.

Material: Holotype SMRL 2835/A; paratypes 2835/4. — SMRL 2833/5-Trench in the town of Mae Sarieng; 11266/10-Huai Mae Hang, N of Fang, Prov. Chiang Mai; 11274/10-Chayapum Falls, 23 km N of Chayapum; 11288/4-Huai Pasong at Ban Pasong, 17 km N of Fang; 11289/5-Huai Mae Raeng at Ban Mae Raeng, 14 km N of Fang.

Discussion: Originally this species was overlooked and labelled as immature *P. javanum*. It can be distinguished from juvenile specimens of *javanum* by its more swollen appearance and its internal position of the ligament which is not visible externally. The radial microsculpture of the nepionic shell is variable and not of distinctive

character. The species lives together with *P. javanum*, *nevillianum* and *annandalei*. It has never been collected in abundance.

Etiology: This species is dedicated to the Thai collector Mr. PRASONG TEMCHAROEN who detected this species on the 19th of March 1966 at the type locality."

Veneracea RAFINESQUE, 1815.

The family Glauconomyidae was originally understood to belong to the Veneracea. Later authors (THIELE 1934: 920) placed this family in the Sole-nacea, a superfamily which formed together with Saxicavacea, Gastrochaenacea and Adesmacea (= Pholadacea) the suborder Adapedonta. Recent authors, however, (VOKES 1967: 318) replaced this family into its old position.

Glauconomyidae CHENU, 1862.

(Glauconomidae GRAY, 1853).

Shell rather solid, *Unio*-shaped, somewhat gaping at the ends. Ligament external. Hinge plate with 3 cardinals in each valve, but without laterals. Pallial line deeply sinuate. Animal with long, retractable siphons. Mantle edges ventrally united, open anteriorly.

Distribution: S- and SE-Asia.

Habitat: Estuarine areas of rivers and mud-flats.

Of the two recognized genera of this family only one is found in Thailand.

Glauconomya BRONN, 1838.

Shell solid, ovate conoidal, with greenish periderm and often with a delicate microsculpture which may give the shell a silky lustre. Laterals missing, with 3 cardinals in each valve. Siphons long, almost completely united, fringed at the tips. Foot rather thick, tongue-shaped.

Type species: *G. chinensis* (GRAY).

Distribution and habitat like those of the family.

Three species were found in mangrove forests and nipa palm swamps which may be mentioned here although they do not belong to the inland fauna. A small species with corrugated surface and truncate posterior end is *G. corrugata* (LAMARCK) which was found in Chonburi Province. *G. virens* (LINNAEUS) with silky lustre of the periderm and large, *Unio pictorum*-like shape is not rare in S-Thailand. *G. cumingi* (GOULD), distinguished by its radial wrinkles, is barely different from *G. rugosa* (HANLEY).

Va. Appendix. Beside several misidentifications of Thai species with those of other Asian countries, three freshwater species were erroneously reported from Thailand: The genus *Bocourtia* ROCHEBRUNE 1886 with *B. lymnaeiformis* and *fasciata* was supposed to be a freshwater genus closely related to *Lymnaea*. In reality the species are representatives of the Southamerican genus of Bulimulidae *Scutalus* ALBERS. — *Mycetopus emarginatus* LEA 1860, later placed in the Asian genus *Solenaia* CONRAD which has representatives in India and China, is a species of the American genus *Mycetopoda* ORBIGNY.

VI. Bibliography.

- ABBOTT, R. T. (1948a): Handbook of medically important mollusks of the Orient and Western Pacific. — Bull. Mus. comp. Zool. Cambridge, 100 (3): 245-328, with 5 pls. and textfigs.
- — — (1948b): A new genus and species of Philippine Amnicolidae. — Nautilus, 61: 75-80, with 9 figs.
- — — (1949a): An Indian species of *Clenchiella*. — Nautilus, 63: 62.
- — — (1949b): New syncerid mollusks from the Marianas Islands. — Occ. Pap. B. P. Bishop Mus., 19: 261-274, 9 figs.
- — — (1951): New stenothyrid gastropods from the Philippines. — J. Wash. Acad. Sci., 44: 14-16, 7 figs.
- — — (1952): A study of an intermediate snail host (*Thiara granifera*) of the Oriental lung fluke (*Paragonimus*). — Proc. U. S. nat. Mus., 102: 71-116, fig. 32-45, pl. 8-9.
- — — (1958): The gastropod genus *Assimineia* in the Philippines. — Proc. Acad. nat. Sci. Philad., 110: 213-278, pl. 15-25.
- ADAMS, C. B. (1850): Monograph of *Vitrinella*, a new genus and new species of Turbinidae. 10 pp. Amherst, Mass.
- ANCEY, C. F. (1898): Observations on Papuan land and freshwater shells from New Guinea and Western Australia. — Proc. linn. Soc. New South Wales, 22: 771-778, 1 pl.
- ANNANDALE, N. (1916): Preliminary report on the fauna of the Tale Sap or Inland Sea of Singora. — J. nat. Hist. Siam Soc., 2 (2): 90-102.
- — — (1918): Aquatic molluscs of the Inlé Lake and connected waters. — Rec. Ind. Mus., 14: 103-182, pl. 10-19.
- — — (1919): The gastropod fauna of Old Lake Beds in Upper Burma. — Rec. geol. Surv. India, 50: 209-240.
- — — (1920a): The apple-snail of Siam. — J. nat. Hist. Siam Soc., 4: 1-24, pl. 1-2, Addendum: 45.
- — — (1920b): Indian freshwater molluscs assigned to the genus *Bithynia*. — Rec. Ind. Mus., 19: 41-46.
- — — (1920c): Materials for a generic revision of the freshwater gastropod molluscs of the Indian Empire. I. The Indian genera of Melaniidae. II. The Indian genera of Viviparidae. — Rec. Ind. Mus., 19: 107-115.
- — — (1922): Materials for a generic revision of the freshwater gastropod molluscs of the Indian Empire. V. The Indian Planorbidae. — Rec. Ind. Mus., 24 (3): 357-362.
- — — (1924a): The evolution of the shell-sculpture in freshwater snails of Viviparidae. — Proc. roy. Soc. London, (B) 96: 60-76.
- — — (1924b): The molluscan hosts of the Human Blood Fluke in China and Japan and species liable to be confused with them. — In: FAUST & MALENEY, Studies on *Schistosomiasis japonica*, App. A, Amer. J. Hyg. (Monogr. Ser.) 3: 269-294, pl. 36.
- — — (1924c): Fauna of the Chilka Lake. Mollusca, Gastropoda. — Mem. Ind. Mus., 5: 853-873.
- — — (1924d): Aquatic gastropod molluscs. Zoological results of the Percy Sladen Trust Expedition to Yunnan. — J. asiat. Soc. Bengal, (NS) 19: 399-422, pl. 17.
- ANNANDALE, N. & KEMP, S. (1916): Fauna of the Chilka Lake. Mollusca, Gastropoda and Lamellibranchiata. — Mem. Ind. Mus., 5: 327-366, pl. 14-16.

- ANNANDALE, N. & PRASHAD, B. (1918): Note on the taxonomic position of the genus *Camptoceras* BENSON and of *Lithotis japonica* PRESTON. — J. asiat. Soc. Bengal, (NS) 14: 457-462, pl. 12.
- — — (1919): Contribution to the fauna of Yunnan based on a collection made by J. COGGIN BROWN. 9. Two remarkable genera of freshwater gastropod molluscs from the Lake Erb-Hai. — Rec. Ind. Mus., 16: 413-423.
- — — (1921a): Materials for a generic revision of the freshwater gastropod molluscs of the Indian Empire. 3. The freshwater genera of the Hydrobiidae. — Rec. Ind. Mus., 22: 1-6.
- — — (1921b): Materials for a generic revision of the freshwater gastropod molluscs of the Indian Empire. 4. The Indian Ampullariidae. — Rec. Ind. Mus., 22 (1,2): 7-12.
- — — (1921c): The Indian molluscs of the estuarine subfamily Stenothyridae. — Rec. Ind. Mus., 22: 121-136, pl. 16.
- — — (1921d): The aquatic and amphibious mollusca of Manipur. — Rec. Ind. Mus., 22: 530-563, pl. 4-8.
- ANNANDALE, N. & RAO, H. S. (1925a): Further observations on the aquatic gastropods of the Inlé Watershed. — Rec. Ind. Mus., 27: 101-127.
- — — (1925b): Materials for a revision of the recent Indian Limnaeidae. — Rec. Ind. Mus., 27: 137-189.
- BAKER, F. C. (1945): The molluscan family Planorbidae. — The University of Illinois Press Urbana. 530 pgs., 141 pls.
- BAKER, H. B. (1923): Notes on the radula of Neritidae. — Proc. Acad. nat. Sci. Philad., 75: 117-178.
- BASCH, P. F. (1963): A review of the recent freshwater limpet snails of North America. — Bull. Mus. comp. Zool., 129: 401-453, 19 figs.
- BARTSCH, P. (1927): New species of ship-worms from Siam. — J. nat. Hist. Soc. Siam, 7: 59-64.
- BAVAY, A. (1895): Coquilles nouvelles, provenant des récoltes de M. L. LEVAY, dans les rapides du Haut-Mékong, pendant la campagne du Massie, 1893-1894-1895. — J. de Conch., 43: 82-94, pl. 5-6.
- — — (1898): Coquilles nouvelles, provenant des récoltes de M. L. LEVAY, dans les rapides du Haut-Mékong, pendant la campagne du Massie. (Supplément). — J. de Conch., 46: 15-19, pl. 2.
- BAVAY, A. & DAUTZENBERG, P. (1899): Description de coquilles nouvelles de l'Indo-Chine.
1. J. de Conch., 47: 28-55, 275-296, pls. 1, 2, 3, 12.
- — — (1900): 2. J. de Conch., 48: 108-122, 435-461, pl. 9-11.
- — — (1903): 3. J. de Conch., 51: 201-236.
- — — (1912): 7. J. de Conch., 60: 1-54, pl. 1-6.
- — — (1915): 8. J. de Conch., 62: 147-160, pl. 5.
- BENSON, W. H. (1836): Description of the shell and animal of *Nematura*, a new genus of Mollusca inhabiting situations subject to alternations of fresh and brackish water. — J. asiat. Soc. Bengal, 5: 781-783.
- — — (1843): Description of *Camptoceras*, a new genus of Lymnaeidae, allied to *Ancylus*, and of *Tricula*, a new type of form, allied to *Melania*. — Calcutta J. nat. Hist., 3: 465-468.
- — — (1856): Description of three new species of *Paludomus* from Burmah, and of some forms of *Stenothyra* (*Nematura*) from Penang, Mergui etc. — Ann. Mag. nat. Hist., (2) 17: 201-211.

- BENTHEM JUTTING, W. S. S. VAN (1928): Non-marine Mollusca of Sumba. — *Treubia*, 10: 153-162.
- -- (1929): A list of the land and freshwater Mollusca from Java. — *Treubia*, 11: 76-88.
- -- (1931): Notes on freshwater Mollusca from the Malay Archipelago. — *Treubia*, 13: 5-14, 15 figs.
- -- (1934): Über den Bau der Radula und ihre Bedeutung für die Nahrungsaufnahme bei einigen javanischen Süßwasser-Gastropoden. — *Verh. intern. Ver. theor. & angew. Limnologie*, 6: 325-330.
- -- (1946): Enkele beschouwingen over de Corbiculidae. — *Corr. Bl. ned. mal. Ver.*, 25: 148-150.
- -- (1952): Systematic studies on the non-marine Mollusca of the Indo-Australian Archipelago. III. Critical revision of the Javanese pulmonate land-snails of the families Ellobiidae etc. — *Treubia*, 21: 291-435, 90 figs.
- -- (1953): IV. Critical revision of the freshwater bivalves of Java. — *Treubia*, 22: 19-73, 22 figs.
- -- (1956): Systematic studies on the non-marine Mollusca of the Indo-Australian Archipelago. V. Critical revision of the Javanese freshwater Gastropoda. — *Treubia*, 23: 259-477, 135 figs.
- -- (1959a): Catalogue of the non-marine Mollusca of Sumatra and of its satellite islands. — *Beaufortia*, 7 (83): 41-191, 2 pls., 11 figs. and map.
- -- (1959b): Non-marine Mollusca of the North Moluccan islands Halmahera, Ternate, Batjan and Obi. — *Treubia*, 25: 25-87, 3 figs.
- -- (1960): Some notes on land and freshwater Mollusca of Malaya. — *Basteria*, 24: 10-20, 1 fig.
- -- (1962): Selection of lectotypes of non-marine Mollusca of New Guinea, described by TAPPARONE-CANEFRI, and now preserved in the Museo Civico di Storia Naturale "Giacomo Doria" in Genova. — *Ann. Mus. civ. Stor. nat. Genova*, 73: 1-18, 10 figs.
- -- (1963): Non-marine Mollusca of West Guinea. 1. Mollusca from fresh and brackish waters. — *Nova Guinea (Zool.)*, 20: 409-521, 56 figs., 1 pl.
- BERGH, R. (1870-1904): Malakologische Untersuchungen. — In: C. SEMPER, *Reisen im Archipel der Philippinen. Wissenschaftliche Resultate.*
- BLANFORD, H. F. & W. T. (1860-1861): Contributions to Indian Malacology. — *J. asiat. Soc. Bengal*, 29: 117-127; 30: 247-367.
- BLANFORD, W. T. (1867): Contribution to Indian Malacology. 8. List of estuary shells collected in the delta of the Irawadi in Pegu, with descriptions of new species. — *J. asiat. Soc. Bengal*, 36: 51-72.
- -- (1868): Description of *Fairbankia*, a new genus and species of Rissoidae from Western India. — *Ann. Mag. nat. Hist.*, (4) 3: 173-179.
- -- (1869): Descriptions of new land and freshwater molluscan species collected by Dr. JOHN ANDERSON in Upper Burmah and Yunnan. — *Proc. zool. Soc. London*, 37: 444-450.
- -- (1903): Notes on Mr. W. H. DALY's collection of land and freshwater Mollusca from Siam. — *Proc. malac. Soc. London*, 5: 274-284, pl. 8.
- BOETTGER, O. (1886): Zur Kenntnis der Melanien Chinas und Japans. — *Jb. dtsh. malak. Ges.*, 13: 1-16.
- -- (1887): Aufzählung der zur Gattung *Assimineae* FLEMING gehörigen Arten. — *Jb. dtsh. malak. Ges.*, 14: 147-234.
- -- (1891): AD. STRUBELL's Konchylien aus Java II und von den Molukken. — *Ber. senckenb. naturf. Ges.*, 1891: 241-318, pl. 3, 4.

- BRANDT, R. A. M. (1968): Description of new non-marine mollusks from Asia. — Arch. Moll., 98: 213-289, pl. 8-10.
- — — (1970): New freshwater gastropods from the Mekong. — Arch. Moll., 100: 183-205, pl. 13.
- BRANDT, R. A. M. & TEMCHAROEN, P. (1971): The molluscan fauna of the Mekong at the foci of schistosomiasis in South Laos and Cambodia. — Arch. Moll., 101: 111-140, textfigs. 1-20.
- BROT, A. (1870): Catalogue of the recent species of the family Melanidae. — Amer. J. Conch., 6 (app.): 271-325.
- — — (1874-1879): Die Melaniaceen (Melanidae). — Syst. Conch. Cab., 1, 24: 1-144 (1874), 145-372 (1877), 374-488 (1879), pl. 1-44.
- — — (1876): Note sur les genres *Canidia* et *Clea*, avec la description de deux espèces nouvelles. — J. de Conch., 24: 343-353, pl. 12.
- — — (1877a): Catalog der Gattung *Canidia* H. ADAMS. — Jb. dtsh. malak. Ges., 4: 299-300.
- — — (1877b): Catalog der Gattung *Clea* A. ADAMS. — Jb. dtsh. malak Ges., 4: 300.
- — — (1880): Die Gattung *Paludomus* auct., Melaniaceen. — Syst. Conch. Cab., 1, 25: 1-52, pl. 1-9.
- — — (1886): Mélanies nouvelles. — Rec. zool. Suisse, 4: 87-109, pl. 5-7.
- CALL, R. E. (1886): On the genus *Campeloma*. — Bull. Washburne Coll. Lab. nat. Hist., 1 (5).
- CLENCH, W. J. (1927): A new subgenus and species from Japan. — Nautilus, 40: 121-122.
- COLLINGS, W. E. (1902): On the non-operculate land and freshwater molluscs collected by members of the "Skeat Expedition" in the Malay Peninsula. — J. of Malac., 9: 71-94, pl. 4-6.
- COTTON, B. C. (1942): Some Australian freshwater Gastropoda. — Trans. roy. Soc. S. Austr., 66 (1): 75-82, pl. 1-2.
- — — (1943): More Australian freshwater shells. — Trans. roy. Soc. S. Austr., 67 (1): 143-148, pl. 14-19.
- CLESSIN, S. (1877-1879): Die Familie der Cycladeen. — Syst. Conch. Cab., 9 (3): 1-282, pl. 1-46.
- — — (1880): Studie über die Familie der Paludinen. — Malak. Bl., (NF) 2: 161-196.
- CROSSE, H. (1886): Note sur le nouveau genre *Wattebledia*. — J. de Conch., 34: 78.
- CROSSE, H. & FISCHER, P. (1863): Note sur la faune malacologique de Cochinchine, comprenant la description des espèces nouvelles ou peu connues. — J. de Conch., 11: 343-379, pl. 13-14.
- — — (1864): Faune malacologique de Cochinchine, 1er suppl. — J. de Conch., 12: 322-338, pl. 12-13.
- — — (1867): Description d'espèces nouvelles de Cochinchine. — J. de Conch., 15: 204.
- — — (1876): Mollusques fluviatiles recueillis au Cambodge par la mission scientifique française de 1873. — J. de Conch., 24: 313-342, pl. 10-11.
- DALL, W. H. & BARTSCH, P. (1904): Synopsis of the genera, subgenera and sections of the family Pyramidellidae. — Proc. biol. Soc. Washington, 17: 1-16.
- — — (1906): Notes on Japanese, Indopacific and American Pyramidellidae. — Proc. U. S. nat. Mus., 30: 320-369, 1 pl.

- DAUTZENBERG, P. & FISCHER, H. (1905): Liste des mollusques récoltés par M. BLAISE au Tonkin. — J. de Conch., 53: 85-234.
- — — (1906a): Contribution à la faune malacologique de l'Indo-Chine. — J. de Conch., 54: 145-226, pl. 5-7.
- — — (1906b): Liste des mollusques récoltés par M. H. MANSUY en Indo-Chine et au Yunnan. — J. de Conch., 54: 343-471, pl. 8-10.
- — — (1908): II. — J. de Conch., 56: 169-251, pl. 4-8.
- DAUTZENBERG, P. & HAMONVILLE, L. D' (1887): Description d'espèces nouvelles du Tonkin et observations sur quelques autres mollusques de la même région. — J. de Conch., 35: 213-225, pl. 8 part.
- DEMANGE, V. (1912): Notes d'excursions malacologiques au Tonkin. — Ann. Ass. Natural. Levallois-Perret.
- DESHAYES, P. G. & JULLIEN, J. (1876): Mémoire sur les mollusques nouveaux du Cambodge envoyés au Muséum par le Docteur JULLIEN. — Nouv. Arch. Mus. Hist. nat. Paris., 10: 115-162, pl. 5-8 (published 1876 not 1874!)
- EHRMANN, P. (1922): Land- und Süßwasserschnecken aus den südlichen Shan-Staaten. — SB. naturf. Ges. Leipzig, 45/48: 1-28.
- EYDOUX, F. & SOULEYET (1852): Voyage autour du monde exécuté pendant les années 1836 et 1837 sur la corvette "La Bonite". — Zoologie, 2: 1-664.
- FISCHER, H. & DAUTZENBERG, P. (1904): Mission Pavie Indo-Chine. — Études divers, 3: 332-450, pl. 19-22.
- FISCHER-PIETTE, E. (1950): Liste des types décrits dans le Journal de Conchyliologie et conservés dans la collection de ce Journal. — J. de Conch., 90: 8-82, 149-180, 310-333, pl. 1-5.
- FRAUENFELD, G. VON (1862): Versuch einer Aufzählung der Arten der Gattung *Bithinia* LEACH and *Nematura* BENSON. — Verh. k. k. zool.-bot. Ges. Wien, 12: 1145-1170.
- — — (1864): Verzeichnis der Namen der fossilen und lebenden Arten der Gattung *Paludina* LAM. nebst jenen der nächststehenden und Einreihung derselben in die verschiedenen neueren Gattungen. — Verh. k. k. zool.-bot. Ges. Wien, 14: 561-672.
- — — (1865): Zoologische Miscellen, 5, 7. — Verh. k. k. zool.-bot. Ges. Wien, 15: 525-536, pl. 8-11, 22.
- GARRET, H. B. (1935): A fresh-water mussel. — J. nat. Hist. Soc. Siam, 10 (1): 61.
- GASSIES, J. B. (1863): Faune conchyliologique terrestre et fluvio-lacustre de la Nouvelle-Caledonie. I. — Act. Soc. linn. Bordeaux, 23: 211-330, pl. 1-8.
- — — (1871): II. — Act. Soc. linn. Bordeaux, 28: 1-212, pl. 1-8.
- — — (1880): III. — Act. Soc. linn. Bordeaux, 34: 5-107, pl. 1-4.
- GERMAIN, L. (1921): Catalogue of the Planorbidae in the Indian Museum (Natural History), I. — Rec. Ind. Mus., 21: 8-80.
- — — (1922): II. — Rec. Ind. Mus., 21: 81-128.
- — — (1923): III. — Rec. Ind. Mus., 21: 129-194.
- — — (1924): IV. — Rec. Ind. Mus., 21: 195-210, pl. 1-4.
- GODWIN-AUSTEN, H. H. (1882-1920): Land and freshwater Mollusca of India, I. 257 pgs. (1882-1888); II. 442 pgs. (1897-1914); III. 65 pgs. (1920), 165 pls.
- — — (1917): Zoological results of the ARBOR Expedition 1911-1912, Mollusca VII. — Rec. Ind. Mus., 8: 560-580, pl. 49-50.

- GRATELOUP, J. P. S. DE (1840): Mémoire descriptif sur plusieurs espèces de coquilles nouvelles ou peu connues de mollusques exotiques vivants, terrestres, fluviales et marins. — Act. Soc. linn. Bordeaux, **11**: 389-455.
- GREDLER, V. (1881): Zur Conchylienfauna von China. III. Stück. — Jb. dtsh. malak. Ges., **8**: 110-132, pl. 6.
- HAAS, F. (1910-1920): Die Unioniden. — Syst. Conch. Cab., **9** (2, II): 1-344, pl. 1-73.
 — — — (1912): New land and freshwater shells collected by Dr. J. ELBERT in the Malay Archipelago. — Ann. Mag. nat. Hist., (8) **10**: 412-420.
 — — — (1929): Beitrag zur Kenntnis ostasiatischer Binnenmollusken. — Senckenbergiana, **11**: 211-218, 6 figs.
 — — — (1930): Beiträge zur Kenntnis ostasiatischer Najaden. — Senckenbergiana, **12**: 1-13, 8 figs.
 — — — (1952): Some non-marine mollusks from Northwest and Southwest Siam. — Bull. nat. Hist. Siam Soc., **15**: 19-25.
- HABE, T. (1964): Freshwater molluscan fauna of Thailand. — Nature & Life Southeast Asia, **3**: 45-66, 2 pls.
- HANLEY, S. & THEOBALD, W. (1870-1876): Conchologia Indica. — Illustrations of the land and freshwater shells of British India, : I-XVII, 1-65, 160 pls., London.
- HOFFMANN, H. (1928): Zur Kenntnis der Oncidiiden (Gastr., Pulm.). I. Untersuchungen neuen Materials und Revision der Familie. — Zool. Jb. (Syst.), **55**: 28-118, pl. 2-4.
 — — — (1929): II. Phylogenie und Verbreitung. — Zool. Jb. (Syst.), **57**: 253-302, 17 figs.
- HUBENDICK, B. (1951): Recent Lymnaeidae, their variation, morphologie, taxonomy, nomenclature and distribution. — Kungl. Sv. Vet. Akad. Handl., **3**: 1-63, pl. 1-2.
 — — — (1955): Phylogenie in the Planorbidae. — Trans. zool. Soc. London, **28**: 453-542.
 — — — (1964): Studies on Ancyliidae. — Göteborgs kungl. vet. Vitt. Handl., **9** (6): 1-77, 207 figs.
 — — — (1967): On the genus *Camptoceras*. — Ark. Zool., (2) **20**: 165-173, 20 figs.
- ITO, JIRO & al. (1962): Studies on Cercariae from freshwater snails in Thailand. — Jap. J. med. Sci. Biol., **15**: 249-268, 16 figs.
- ISSEL, A. (1874): Molluschi Borneensi. Illustrazione delle specie terrestri e d'acqua dolce raccolte nell'isola di Borneo dai Signori G. DORIA e O. BECCARI. — Ann. Mus. Civ. Stor. nat. Genova, **6**: 366-486, pl. 4-7.
- KOBELT, W. (1904): Die systematische Stellung der chinesischen Fauna. — Nachr. Bl. dtsh. malak. Ges., **36**: 26-30.
 — — — (1906-1909): Die Gattung *Paludina* LAM. Neue Folge. — Syst. Conch. Cab., **1**, **21a**: 97-128 (1906), 129-200 (1907), 201-312 (1908), 313-430 (1909); pl. 15-77.
 — — — (1908a): Diagnosen neuer *Vivipara*-Formen. — Nachr. Bl. dtsh. malak. Ges., **40**: 35-38, 59-63, 161-162.
 — — — (1908b): Synopsis der Mollusca *Pneumonopoma Opisthoptalmia*. — Jb. nassau. Ver. Naturk. Wiesbaden, **61**: 156-220.
- KURODA, T. (1963): A catalogue of the non-marine mollusks of Japan. — Malac. Soc. Japan, Tokyo. 71 pgs.

- LAIDLAW, W. F. (1933): A list of land and freshwater Mollusca of the Malay Peninsula. — J. Malay Branch roy. asiat. Soc., 11: 211-234.
- — (1940): A note on the occurrence of *Parafossarulus striatulus* (BENS.) in the Malay Peninsula. — Bull. Raffles Mus. Singapore, 16: 133.
- LEA, I. (1852): A synopsis of the family of najades. — Philadelphia, 88 pgs.
- — — (1856): Description of thirteen new species of exotic peristomata. — Proc. Acad. nat. Sci. Philad., 8: 109-111.
- — — (1866-1869): New Unionidae, Melanidae etc. — J. Acad. nat. Sci. Philad., (2) 6: 5-66 (1866); 113-187 (1867); 249-302 (1869), 303-344 (1869), 3 pls.
- LESCHKE, M. (1914): Zur Molluskenfauna von Java und Celebes. — Mitt. naturh. Mus. Hamburg, 31: 205-284, 1 pl.
- LESSON, R. P. (1828-1830): Zoologie, in: L. J. DUPERRY, Voyage autour du monde, exécuté sur la corvette de S. M. La Coquille, pendant les années 1822-1825. Paris.
- MABILLE, J. (1872): Sur quelques mollusques rares ou peu connus. — Rev. Mag. Zool., (2) 23: 48-51.
- — — (1887): Sur quelques mollusques du Tonkin. — Bull. Soc. malac. France, 4: 73-164.
- — — (1889): Description du nouveau genre *Chlorostracia*. — Bull. Soc. malac. France, 6: 309-314, pl. 8.
- MABILLE, J. & LE MESLE, G. (1866): Observations sur la faune malacologique de la Conchinchine et du Cambodge. — J. de Conch., 14: 117-138, pl. 7.
- MARTENS, E. VON (1860): On the Mollusca of Siam. — Proc. zool. Soc. London, 28: 6-18.
- — — (1863a): Überblick der Najaden des Indischen Archipels. — Malak. Bl., 10: 10-17.
- — — (1863b): Über die ostasiatischen Limnaeaceen. — Malak. Bl., 10: 211-227.
- — — (1881): Über die Süßwassermollusken des malayischen Archipels. — SB. Ges. naturf. Freunde Berlin, 1881: 109-111.
- — — (1887): List of the shells of Mergui and its Archipelago, collected by Dr. JOHN ANDERSON — J. linn. Soc., 21: 155-222, pl. 14-16.
- — — (1894): Mollusken. — In: SEMON, Zoologische Forschungsreisen in Australien und dem malayischen Archipel, vol. 5. — Jenaer Denkschr., 4: 83-96, pl. 4.
- — — (1897): Süß- und Brackwasser-Mollusken des Indischen Archipels. — In: M. WEBER, Zoologische Ergebnisse einer Reise in Niederländisch Ostindien, 4: 1-331, pl. 1-12.
- MICHELSON, E. H. (1961): On the generic limits in the family Pilidae. — Breviora, 133: 1-7.
- MODELL, H. (1942): Das natürliche System der Najaden. — Arch. Moll., 74: 161-191.
- — — (1949): Das natürliche System der Najaden, II. — Arch. Moll., 78: 29-48.
- — — (1964): Das natürliche System der Najaden, III. — Arch. Moll., 93: 71-126.
- MOELLENDORFF, O. F. VON (1902): Binnenmollusken aus Hinterindien. — Nachr. Bl. dtsh. malak. Ges., 34: 135-149.
- MORELET, A. (1865a): Rectifications et additions à la faune malacologique de l'Indo-Chine. — J. de Conch., 13: 19-23.
- — — (1865b): Addition à la faune malacologique de l'Indo-Chine. — J. de Conch., 13: 225-228.
- — — (1869): Observations critiques sur quelques Paludines de l'Indo-Chine. — J. de Conch., 17: 192-292.
- — — (1875): Séries conchyliologiques. 4e livraison, Indo-Chine.

- MORGAN, J. DE (1885): Mollusques terrestres et fluviatiles du Royaume de Pérag et de pays voisine. — Bull. Soc. zool. France, 10: 353-428, pl. 5-9.
- MORLET, L. (1883): Description d'espèces nouvelles de coquilles recueillies, par M. PAVIE, au Cambodge. — J. de Conch., 31: 104-110, pl. 4.
- — — (1884): 2e article. — J. de Conch., 32: 386-402, pl. 11-13.
- — — (1886a): Diagnoses molluscorum novorum Cambodgiae. — J. de Conch., 34: 74-75.
- — — (1886b): Liste des coquilles recueillies, au Tonkin, par M. JOURDY, et description d'espèces nouvelles. — J. de Conch., 34: 257-295, pl. 12-15.
- — — (1889): Catalogue des coquilles recueillies, par. M. PAVIE, dans le Cambodge et le Royaume de Siam, et description d'espèces nouvelles. — J. de Conch., 37: 121-199, pl. 6-9.
- — — (1891): Contributions à la faune malacologique de l'Indo-Chine. — J. de Conch., 39: 230-254, pl. 6-7.
- — — (1892): Diagnoses molluscorum novorum, in Indo-China collectorum. — J. de Conch., 40: 82-86.
- — — (1904): Descriptions de mollusques nouveaux recueillies par M. A. PAVIE en Indo-Chine. — In: Mission PAVIE Indo-Chine, Études diverses, 3: 351-389, pl. 19-22 (posthumous).
- MORRISON, J. P. E. (1952): World relations of the melanians (an abstract). — Amer. malac. Union News Bull. and Ann. Rep., 1951: 6-9.
- — — (1954a): The relationships of Old and New World melanians. — Proc. U. S. nat. Mus., 103: 357-394, pl. 11.
- — — (1954b): Some zoogeographic problems among brackish water mollusks. — Ann. Rep. amer. malac. Soc., 1954: 7-10.
- NEVILL, G. (1877): List of the Mollusca brought back by Dr. J. ANDERSON from Yunnan and Upper Burma, with description of new species. — J. asiat. Soc. Bengal, 46: 14-41.
- — — (1878): Handlist of Mollusca in the Indian Museum, pt. 1, xv + 338 pgs.
- — — (1881): New or little-known Mollusca of the Indo-Malayan fauna. — J. asiat. Soc. Bengal, 50: 125-167, pl. 5-7.
- — — (1885): Handlist of Mollusca in the Indian Museum, pt. 2, x + 306 pgs. (dated 1884 but appeared 1885).
- PAGE, G. L. (1973): The freshwater snails of Taiwan (Formosa). — Malacological Review, Suppl. 1: 1-118, 19 pl. and 17 textfigs.
- PAETEL, F.: Die bisher veröffentlichten Familien- und Gattungsnamen der Mollusken. 229 pgs., Berlin.
- PETIT DE LA SAUSSAYE, S. (1865): Note sur le genre *Monocondylea* de D'ORBIGNY, et description d'une espèce nouvelle. — J. de Conch., 13: 13-19, pl. 4.
- PFEIFFER, L. (1862): Diagnoses de neuf espèces nouvelles provenant de Siam. — J. de Conch., 10: 39-46, pl. 5-6.
- PHILIPPI, R. A. (1851-1852): Die Gattung *Ampullaria*. — Syst. Conch. Cab., I, 20: 1-74.
- PILSBRY, H. A. (1901): New species of mollusks from South Africa and Burma. — Proc. Acad. nat. Sci. Philad., 53: 188-190.
- — — (1924): On some Japanese fresh water mollusks. — Proc. Acad. nat. Sci. Philad., 76: 11-13, 3 figs.
- PRASHAD, B. (1921a): Notes on the lamellibranchs in the Indian Museum. 4. Indian species of the genus *Cyrena*. — Rec. Ind. Mus., 22: 137-149, 2 figs.
- — — (1921b): The Indian species of the genus *Tricula*. — Rec. Ind. Mus., 22: 67-69, 1 textfig.

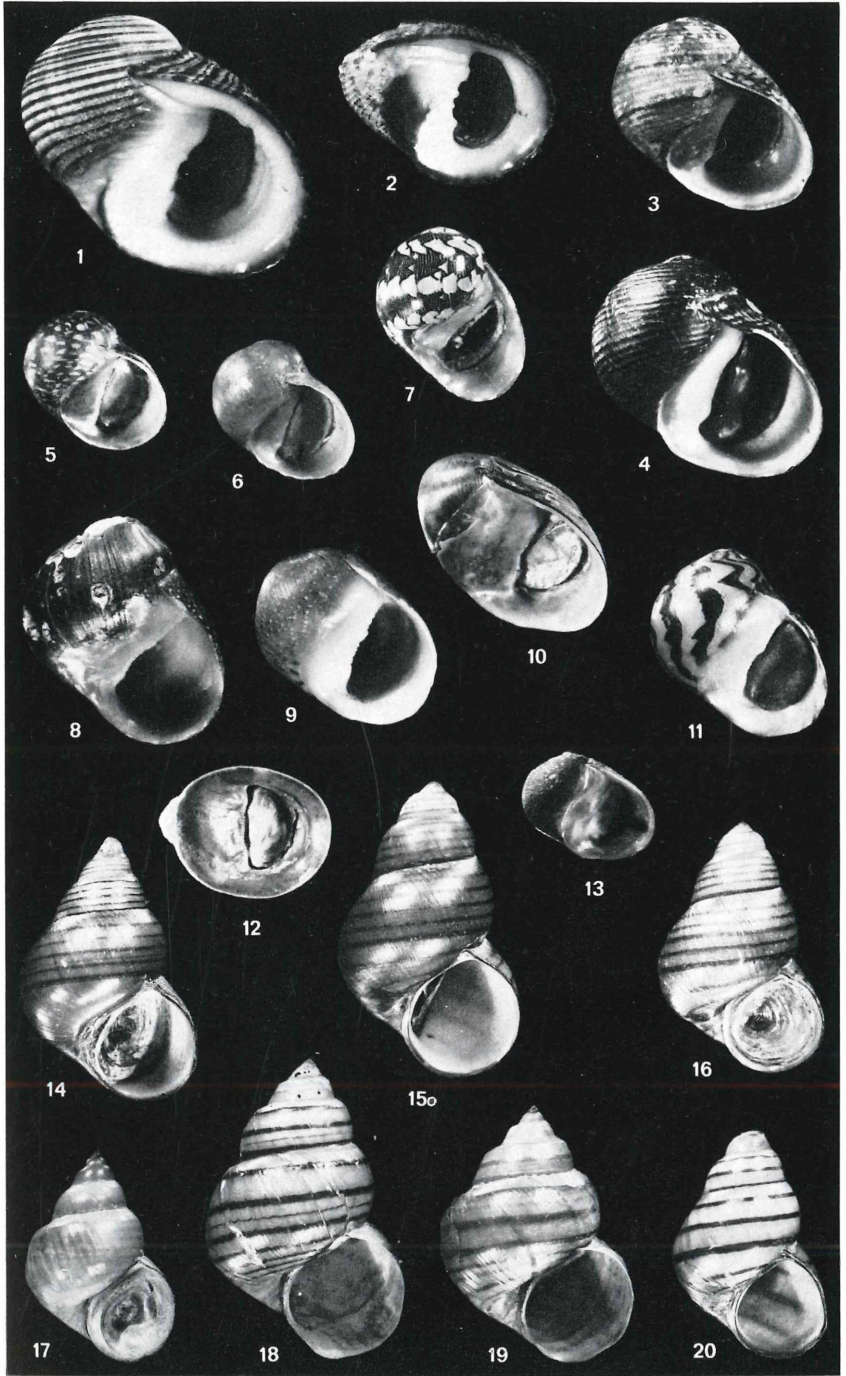
- — — (1921c): Report on a collection of Sumatran molluscs from fresh and brackish water. — *Rec. Ind. Mus.*, 22: 461-507, pl. 14.
- — — (1925a): Notes on the lamellibranchs in the Indian Museum. 6. Indian species of the genus *Pisidium*. — *Rec. Ind. Mus.*, 27: 405-422.
- — — (1925b): Notes on WESTERLUND's species of freshwater molluscs from Ceylon. *Rec. Ind. Mus.*, 27: 345-350, 8 figs.
- — — (1928a): Revision of the asiatic species of the genus *Corbicula*. — *Mem. Ind. Mus.*, 9: 13-68, pl. 3-8.
- — — (1928b): Recent and fossil Viviparidae. — A study in distribution, evolution and palaeogeography. — *Mem. Ind. Mus.*, 8: 153-251, pl. 19.
- — — (1928c): The mantle and shell of the Viviparidae. — *Mem. Ind. Mus.*, 8: 253-319, pl. 20-24.
- — — (1930): On some undescribed freshwater molluscs from various parts of India and Burma. — *Rec. geol. Surv. India*, 63: 428-433, pl. 19.
- — — (1933): Notes on lamellibranchs in the Indian Museum. — *Rec. Ind. Mus.*, 35: 1-8, pl. 1.
- PRESTON, H. B. (1907): Description of four new species of *Melania* from New Ireland and Kelantan. — *Proc. malac. Soc. London*, 7: 266-268.
- — — (1915a): The fauna of British India, including Ceylon and Burma. Mollusca (Freshwater Gastropoda, Pelecypoda). — 244 pgs., 29 figs., London.
- — — (1915b): A further report on Mollusca from Lake Chilka on the East Coast of India. — *Rec. Ind. Mus.*, 11: 289-310.
- PRIME, T. (1861): Diagnose d'espèces nouvelles. — *J. de Conch.*, 9: 354-356.
- — — (1870): Catalogue of the family Corbiculidae.
- QUADRAS, J. F. & MOELLENDORFF, O. F. VON (1894-1895): Diagnoses specierum novarum ex insulis Philippinis. — *Nachr. Bl. dtsh. malak. Ges.*, 26: 81-104, 113-130 (1894); 27: 73-88, 105-121, 137-149 (1895).
- QUOY, J. R. & GAIMARD, J. P. (1824): Zoologie. — In: L. DE FREYCINET, Voyage autour du monde . sur les corvettes l'Urania et La Physicienne, pendant les années 1817-1820, 3: 1-712.
- — — (1826-1834): Zoologie. — In: M. J. DUMONT D'URVILLE, Voyage de la Corvette l'Astrolabe . pendant les années 1826-1829. Vol. 1-4.
- RAFINESQUE-SCHMALTZ, C. S. (1831): Enumeration and account of some remarkable natural objects in the cabinet of Prof. RAFINESQUE in Philadelphia. — Philadelphia.
- RAO, H. (1925a): Note on a collection of freshwater gastropods from Thazi. — *Rec. Ind. Mus.*, 27: 97-100, 4 figs.
- — — (1925b): On the comparative anatomy of oriental Viviparidae. — *Rec. Ind. Mus.*, 27: 129-135, 3 figs.
- — — (1928): The aquatic and amphibious mollusca of the Northern Shan States, Burma. — *Rec. Ind. Mus.*, 30: 399-468, pl. 12-14, 28 textfigs.
- — — (1929): The freshwater and amphibious gastropod molluscs of the Indawgyi Lake and of the connected freshwater areas in the Myitkyina District, Burma. — *Rec. Ind. Mus.*, 31: 273-299, 9 textfigs.
- — — (1931): *Angulyagra oxytropis* (BENSON) nom. nov. A correction. — *Rec. Ind. Mus.*, 33: 301.
- RECLUZ, C. A. (1850): Notice sur le genre Nérite et sur le S. g. *Neritina* avec le catalogue synonymique de Néritines. — *J. de Conch.*, 1: 131-169.

- ROCHEBRUNE, A. T. DE (1882): Supplément aux documents sur la faune malacologique de la Cochinchine et du Cambodge. — Bull. Soc. philom. Paris., (7) 7: 88-118.
- SMITH, E. A. (1899): Description of *Unio Pahangensis*, n. sp. from the river Pahang. — Proc. malac. Soc. London, 3: 315, c. fig.
- SOLEM, A. (1966): Some non-marine mollusks from Thailand, with notes on classification of the Helicarionidae. — Spolia zoll. Mus. Hauniensis, 24, 110 pgs., 3 pls. and 24 textfigs.
- STRUBELL, A. (1897): Neue Süßwasser-Conchylien aus Sumatra und Java. — Nachr. Bl. dtsh. malak. Ges., 29: 8-12.
- SUVATTI, C. (1938): Molluscs of Siam. — Bureau of Fishery, Bangkok. 91 pgs.
— — — (1950): Fauna of Thailand, Mollusca. — Department of Fisheries, Bangkok: 32-126.
- TAPPARONE-CANEFRI, C. (1883): Fauna malacologica della Nuova Guinea e delle isole adiacente. — Ann. Mus. civ. Stor. nat. Genova, 19: 1-313, 11 pls.
— — — (1887): Molluschi estramarini + Suppl. I. — Ann. Mus. civ. Stor. nat. Genova, 4: 113-199, 2 pls.
- TEMCHAROEN, P. (1971): New aquatic molluscs from Laos. — Arch. Moll., 101: 91-109, pl. 6-7.
- THEOBALD, W. (1857): Notes on the distribution of some of the land and freshwater shells of India. — J. asiat. Soc. Bengal, 26: 245-254.
— — — (1876): Descriptions of some new land- and freshwater shells from India and Burmah. — J. asiat. Soc. Bengal, 45: 184-189.
- THIELE, J. (1927): Über die Schneckenfamilie Assiminaeidae. — Zool. Jb. (Syst.), 53: 113-146.
— — — (1928): Revision des Systems der Hydrobiiden und Melaniiden. — Zool. Jb. (Syst.), 55: 351-402, pl. 8.
— — — (1929-1935): Handbuch der systematischen Weichtierkunde. — Jena. pgs. 1-376 (1929), 377-778 (1931), 779-1022 (1934), 1023-1134 (1935).
- TOMLIN, J. R. LE B. (1932): Shells from a cave at Buang Dep., Surat, Peninsula Siam. — J. nat. Hist. Soc. Siam, 8 (4): 319-320, pl. 27.
- WALKER, B. (1927): The molluscan hosts of *Clonorchis sinensis* (COBBOLD) in Japan, China and Southeastern Asia, and other species of molluscs closely related to them. — Amer. J. Hyg., (monogr. ser.) 8: 208-250, pl. 14.
- WATTEBLED, G. (1884): Description de mollusques inédits recueillis par M. le capitaine DORR, en Cochinchine. — J. de Conch., 32: 125-131, pl. 4.
— — — (1886): Description de mollusques inédits de l'Annam, récoltés du capitaine DORR aux environs de Hué. — J. de Conch., 34: 54-71, pl. 3-5.
- WESTERLUND, C. A. (1885): Land- och Sötvatten Mollusker. — In: Ur Vega Exp. Vet. Jakt., 4: 143-220, pl. 2-6.
- WOODWARD, F. R. (1964): The morphology of *Chamberlainia hainesiana* (LEA, 1856) (Unionidae, Bivalvia). — Vid. Medd. dansk naturh. Foren, 126: 337-345, pl. 31-33.
- WYKOFF, D. E. & al. (1965): *Opisthorchis viverrini* in Thailand. — The life cycle and comparison with *O. felineus*. — J. of Parasitol., 51: 207-214, 6 figs.

- WENZ, W. (1938-1944): Gastropoda, Prosobranchia. — In: SCHINDEWOLF, Handbuch der Palaeozoologie, 6: 1-1639, 4211 figs. (Fortsetzung Euthryneura, see ZILCH).
- YEN, T. CH. (1939): Die chinesischen Land- und Süßwassergastropoden des Natur-Museums Senckenberg. — Abh. senckenb. naturf. Ges., 444: 1-233, 16 pls.
- ZILCH, A. (1955): Die Typen und Typoide des Natur-Museums Senckenberg, 14: Mollusca, Viviparidae. — Arch. Moll., 84: 45-86, pl. 3-7.
- — — (1959): Gastropoda, Euthryneura. — In: SCHINDEWOLF, Handbuch der Palaeozoologie. 6 (2): 1-129, 427 figs.
- — — (1967a): Die Typen und Typoide des Natur-Museums Senckenberg, 36: Assimineidae. — Arch. Moll., 96: 67-99, pl. 1-6.
- — — (1967b): Die Typen und Typoide des Natur-Museums Senckenberg, 39: Mollusca, Unionacea. — Arch. Moll., 97: 45-154.

Plate 1.

- Fig. 1. *Nerita (Nerita) articulata* (GOULD), ¹/₁.
Chantaburi River Estuary (713) [SMF 219163].
- Fig. 2. *Nerita (Theliostyla) planospira* ANTON, ¹/₁.
Dja Bi Lang; Satun (4657) [SMF 219172].
- Fig. 3-4. *Neritodryas cornea* (LINNAEUS), ¹/₁.
Din Daeng Harbour at Ban Noi Sra; Grabi (3987) [SMF 219222].
- Fig. 5-6. *Neritodryas dubia* (GMELIN), ¹/₁.
Paknam Bandon; Surat Thani (4693) [SMF 219228].
- Fig. 7. *Clithon (Pictoneritina) oualaniensis* (LESSON), ²/₁.
Ban Bo Phut; Ko Samui (4685) [SMF 221332a].
- Fig. 8. *Clithon (Clithon) faba* (SOWERBY), ²/₁.
Klong Nachon Thian; Chonburi (4682) [SMF 221983].
- Fig. 9. *Clithon (Clithon) sowerbyana* (RECLUZ), ²/₁.
Klong Bang La Mung; Chonburi (715) [SMF 225489].
- Fig. 10. *Neritina (Neritina) pulligera* (LINNAEUS), ¹/₁.
Klong Glaeng Yai; Rayong (3981) [SMF 219216].
- Fig. 11. *Neritina (Vittoida) coromandeliana* SOWERBY, ¹/₁.
Brackish water canal at Narativat (4668) [SMF 219213].
- Fig. 12. *Neritina (Dostia) violacea* (GMELIN), ¹/₁.
Opposit Kantang; Trang (4702) [SMF 219205].
- Fig. 13. *Neritilia rubida* (PEASE), ⁵/₁.
Stream 3 km from Grabi to Khao Thong; Grabi (3996) [SMF 219159].
- Fig. 14. *Filopaludina (Filopaludina) sumatrensis speciosa* (DESHAYES), ¹/₁.
Ban Ta Gulad; Ubon (3118) [SMF 219244].
- Fig. 15-16. *Filopaludina (Filopaludina) sumatrensis polygramma* (MARTENS), ¹/₁.
Ban Huai Sapan; Angtong (85) [SMF 219245].
- Fig. 17. *Filopaludina (Filopaludina) sumatrensis peninsularis* n. subsp., ¹/₁.
Bok Kharani Fall; Pang Ngo (245A) [Holotype SMF 219251].
- Fig. 18-19. *Filopaludina (Filopaludina) doliaris* (GOULD), ¹/₁.
18) Town-moat Lamphoon (112) [SMF 219246].
19) Fishery station Mae Jo; Chiang Mai (113) [SMF 219247].
- Fig. 20. *Filopaludina (Filopaludina) filosa* (REEVE), ¹/₁.
Ban Muang at Nakon Sawan (224) [SMF 219250].

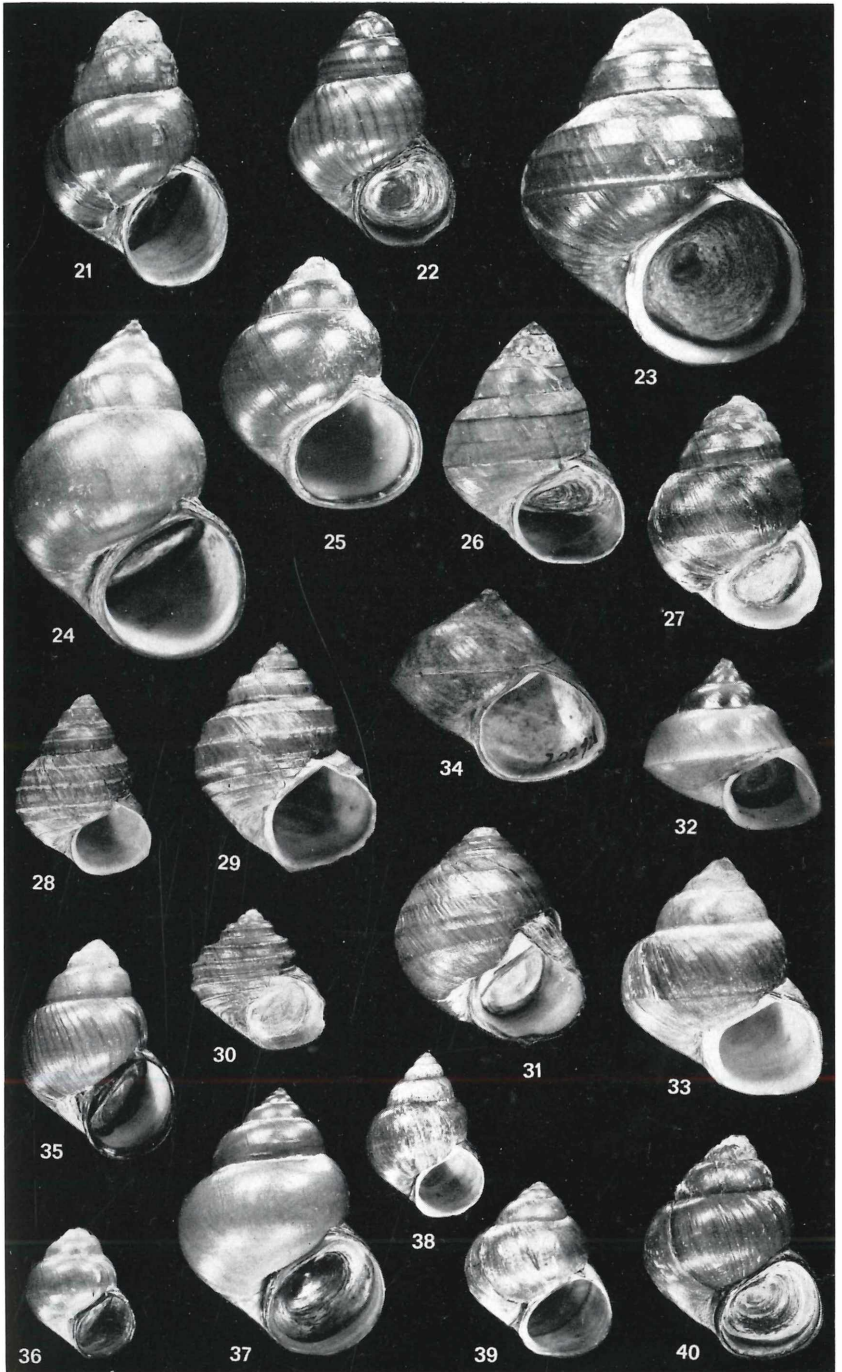


BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 2.

(All figs. in natural size).

- Fig. 21. *Filopaludina (Siamopaludina) j. javanica* (VON DEM BUSCH).
Java: Bogor (11882) [SMF 219255].
- Fig. 22. *Filopaludina (Siamopaludina) j. continentalis* n. subsp.
Bang Pra; Chonburi (3138A) [Holotype SMF 219253].
- Fig. 23. *Filopaludina (Siamopaludina) m. martensi* (FRAUENFELD).
Ban Mahad Thai; Angtong (2891) [SMF 219259].
- Fig. 24. *Filopaludina (Siamopaludina) m. cambodjensis* (MABILLE & LE MESLE).
Distr. Khlung near Chantaburi (003) [SMF 219258].
- Fig. 25. *Filopaludina (Siamopaludina) m. munensis* n. subsp.
Maenam Mun at Ban Tha Tum; Surin (50A) [Holotype SMF 219256].
- Fig. 26. *Filopaludina (Siamopaludina) maekoki* (BRANDT).
Ban Mae Chai; Chien Mai (2941A) [Holotype SMF 197570].
- Fig. 27. *Sinotaia mandahlbarthi* BRANDT.
Huai Mae Un, near Sri Songkram; Nakon Panom (2976A) [Holotype SMF 197371].
- Fig. 28. *Sinotaia arturrolli* BRANDT.
Maenam Kham; Nakon Panom (3125A) [Holotype SMF 197372].
- Fig. 29. *Anulotaia lagrandierei* (BAVAY).
Laos: Mekong River, 2 km S of Khone (15861) [SMF 219262].
- Fig. 30. *Anulotaia forcarti* BRANDT.
Mun River at Rasi Salai; Sri Sakat (3121A) [Holotype SMF 197269].
- Fig. 31. *Anulotaia mekongensis* BRANDT.
Laos: Mekong at Stung Treng (15866A) [Holotype SMF 198336].
- Fig. 32-33. *Trochotaia trochooides* (MARTENS).
32) Ban Ta Tom, N of Udon Tani (031) [SMF 219260].
33) Ban Chong Sarika; Lopburi (2953) [SMF 219261].
- Fig. 34. *Eyriesia eyriesi* (MORELET).
Ban Bunaham, Maenam Yom; Pitsanulok [SMF 202928].
- Fig. 35. *Idiopoma umbilicata* (LEA).
Ban Maha Thai; Angtong (223) [SMF 221991].
- Fig. 36. *Idiopoma ingallsiana* (LEA).
Chiang Mai (200) [SMF 219263].
- Fig. 37-39. *Idiopoma dissimilis* (MÜLLER).
37) Ban Pong Makam Pem, 38 km S of Fang (3015) [SMF 219280].
38) Ban Pa Sing, 16 km N of Nan (92) [SMF 225491a].
39) Mae Dao, Huai Mae Dao at Mae Sot (248) [SMF 225503a].
- Fig. 40. *Cipangopaludina amandalei* BRANDT.
Maekok River, E of Chieng Rai (231A) [Holotype SMF 197373].

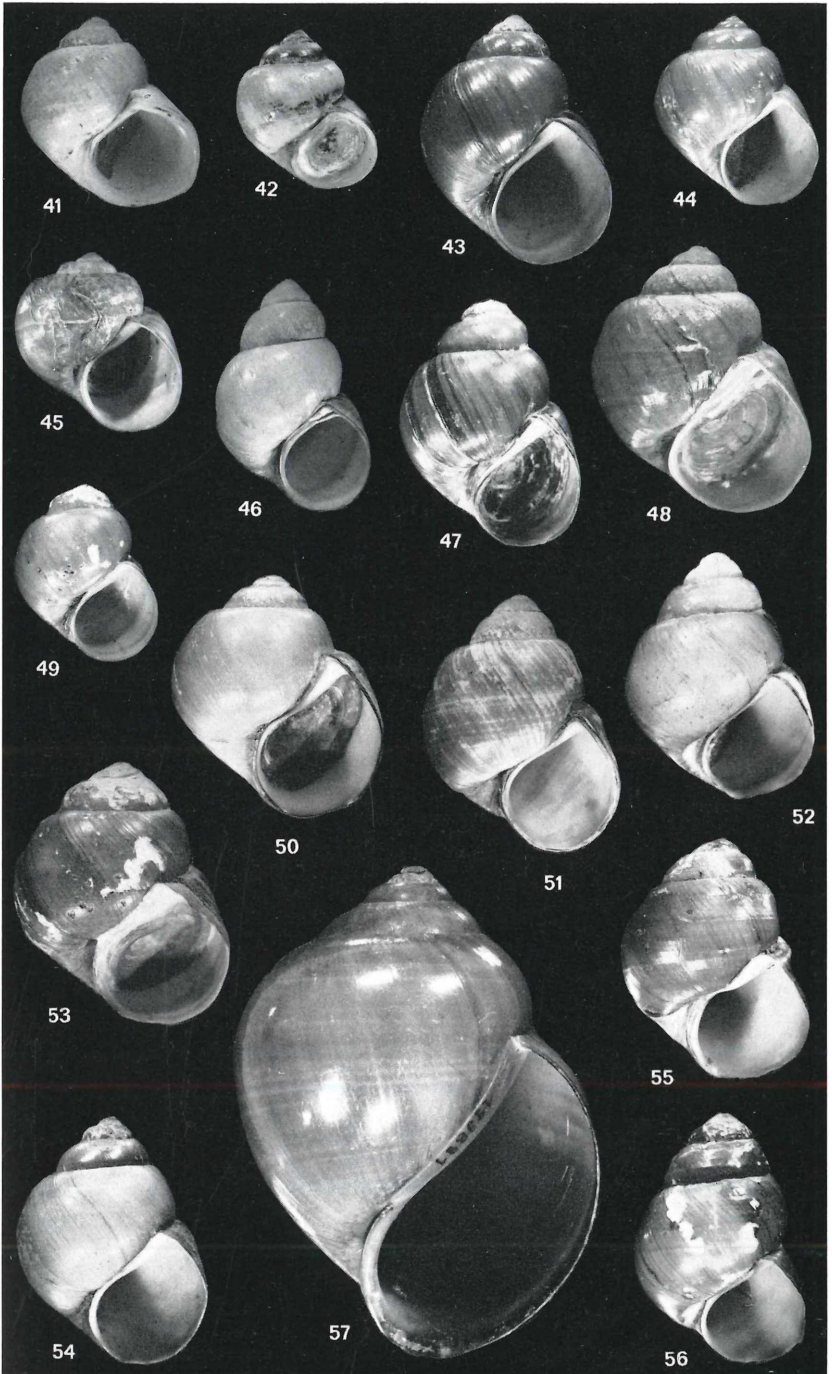


BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 3.

(All figs. in natural size).

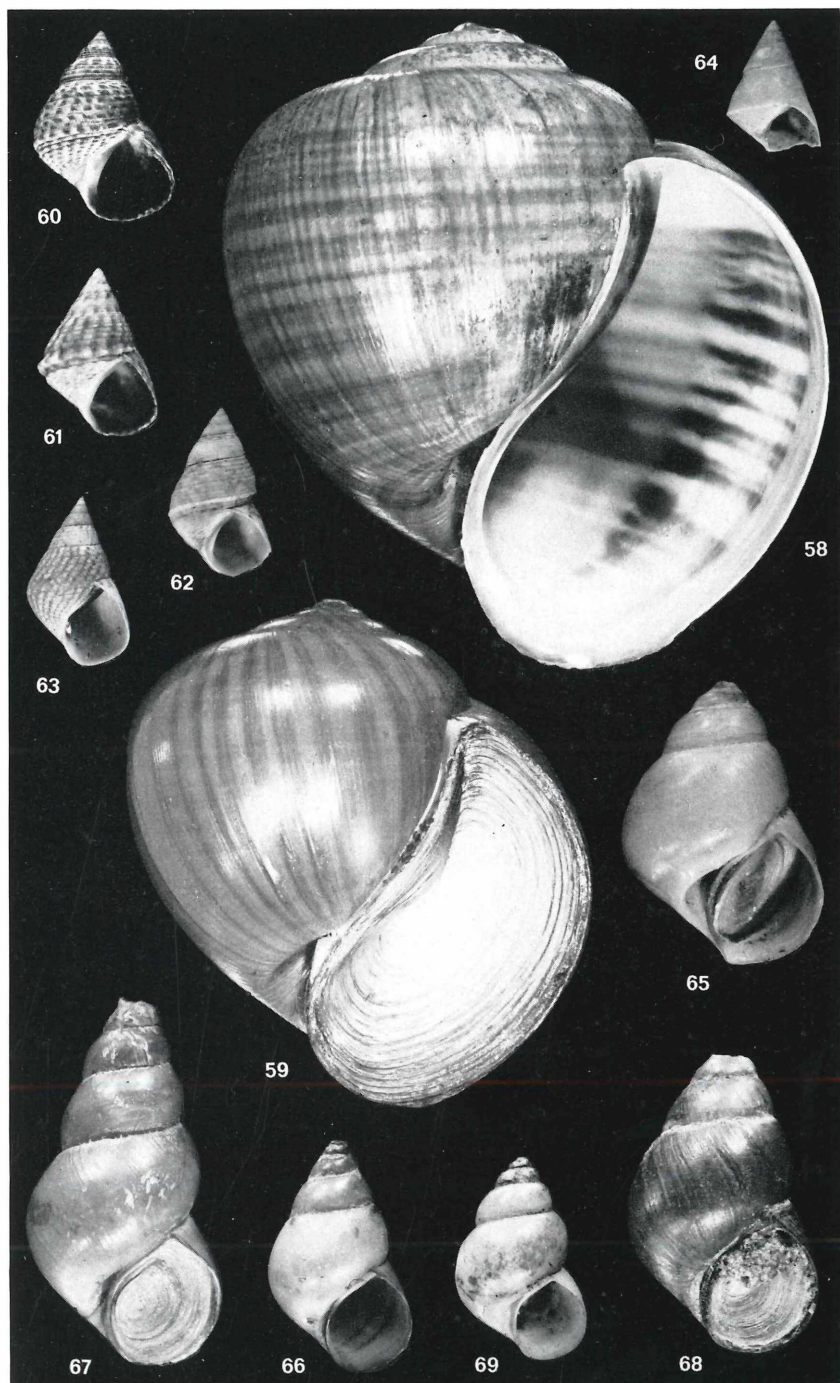
- Fig. 41. *Mekongia siamensis* (FRAUENFELD).
Maeklong River at Ban Tha Muang; Ratburi (0125) [SMF 219281].
- Fig. 42. *Mekongia pongensis* BRANDT.
Lam Than (Maenam Pao); Kalasin (3191A) [Holotype SMF 197368].
- Fig. 43. *Mekongia swainsoni braueri* (KOBELT).
Chao Praya River at Nakon Sawan (133) [SMF 219309a].
- Fig. 44-45. *Mekongia swainsoni swainsoni* (LEA).
44) Chao Praya River at Nakon Sawan (133) [SMF 219309b].
45) Pasak River, W of Saraburi; Ta Luang (136) [SMF 220943].
- Fig. 46. *Mekongia swainsoni* cf. *hainesisana* (LEA).
Mae Klong River at Chetsamien; Ratburi (129) [SMF 221992].
- Fig. 47-48. *Mekongia swainsoni braueri* (KOBELT).
47) Chao Praya River at Ayutthia (3189) [SMF 219310].
48) Nan River; Pitsanulok (176) [SMF 220942].
- Fig. 49. *Mekongia swainsoni kmeriana* (MORELET).
Prachin River near Kabinburi (0150) [SMF 193948a].
- Fig. 50. *Mekongia swainsoni flavida* n. subsp.
Mekong at Ban Nong Saeng; Nakon Panom (0151A) [Holotype SMF 198282].
- Fig. 51-52. *Mekongia rattei* (CROSSE & FISCHER).
51) Mekong at Magdahan (3168) [SMF 219311].
52) Stung River, Aranyapratet (179) [SMF 225512].
- Fig. 53-54. *Mekongia sph. sphaericula* (DESHAYES).
53) Mun River at Ubon Ratchasima (0153) [SMF 219312].
54) Stung River at Aranyapratet (3177) [SMF 219313].
- Fig. 55. *Mekongia sph. spiralis* n. subsp.
Lam Chi River at Selaphum (0141A) [Holotype SMF 219314].
- Fig. 56. *Mekongia sph. extensa* n. subsp.
Maenam Sri Songkram, 17 km NE of Ta Uthen; Nakon Panom (3213A) [Holotype SMF 219315].
- Fig. 57. *Pila polita* (DESHAYES).
Yang, Klong Kload; Korat (265) [SMF 193891a].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 4.

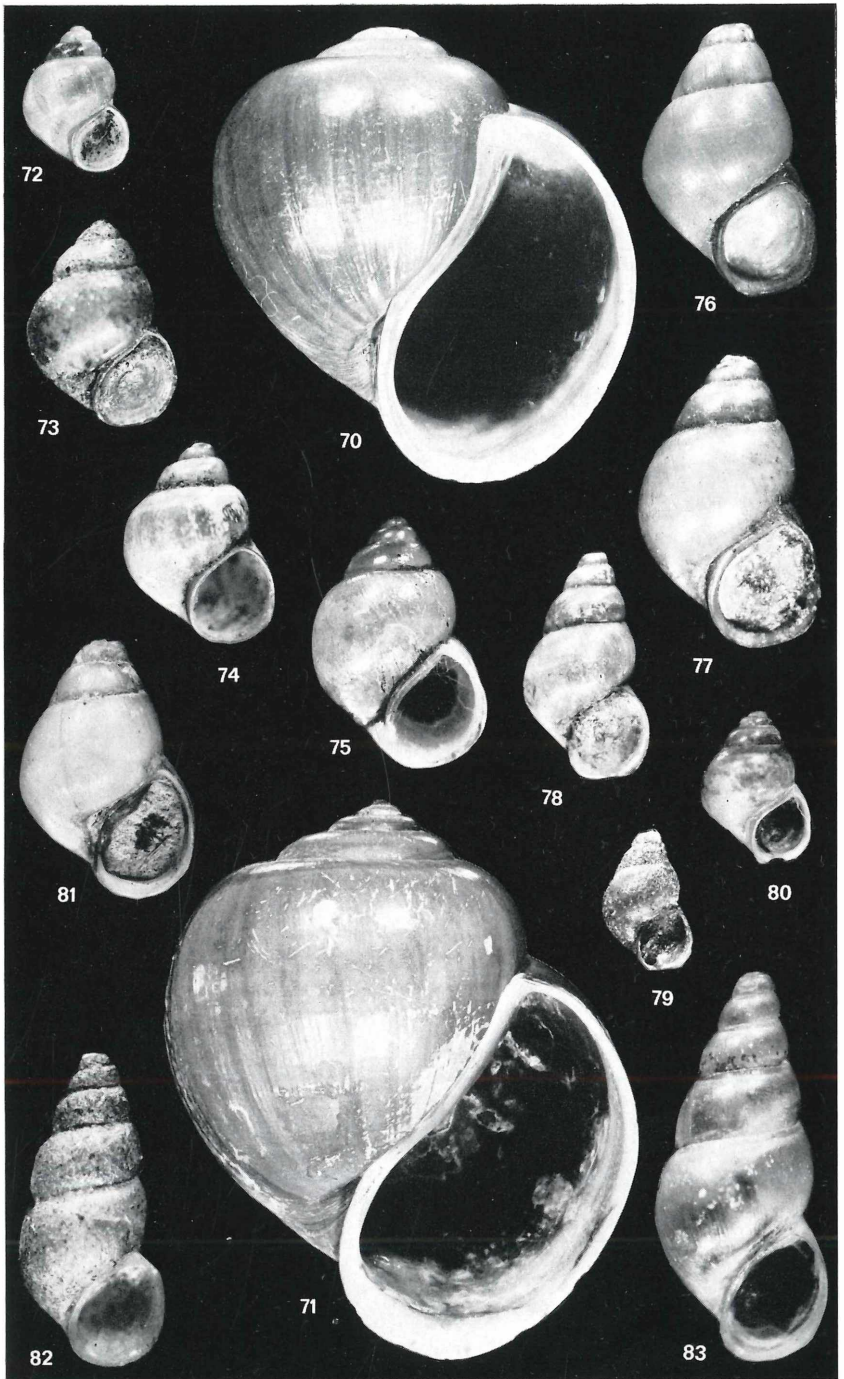
- Fig. 58-59. *Pila ampullacea* (LINNAEUS), ¹/₁.
58) Duson; Satun (3224 = *lacustris*) [SMF 219559].
59) Bangkok-Bankapi; Sri Juthamara (3226 = *turbinis*) [SMF 194264a].
- Fig. 60-61. *Littorinopsis scabra* (LINNAEUS), ¹/₁.
60) Klong Na Glua; Chonburi (10272) [SMF 219579].
61) Klong Na Glua; Chonburi (10270 = *angulifera*) [SMF 219578].
- Fig. 62. *Littorinopsis intermedia* (PHILIPPI), ¹/₁.
Klong Na Glua; Chonburi (10262) [SMF 219581].
- Fig. 63. *Littorinopsis melanostoma* (GRAY), ¹/₁.
Klong Na Glua; Chonburi (10257) [SMF 219573].
- Fig. 64. *Littorinopsis conica* (PHILIPPI), ¹/₁.
Katang (10281) [SMF 219576].
- Fig. 65. *Bithynia (Digoniostoma) funiculata* WALKER, ³/₁.
Mae Huai Han, Ban Mae Sob Han; Mae Sarieng (3611) [SMF 219148a].
- Fig. 66-67. *Bithynia (Digoniostoma) s. siamensis* (LEA), ³/₁.
66) Laem Sing; Chantaburi (3552) [SMF 219149a].
67) Ayurthia (363, gigantism) [SMF 219150].
- Fig. 68. *Bithynia (Digoniostoma) s. goniomphalos* (MORELET), ³/₁.
Nonivet near Udon Thani (310) [SMF 219151].
- Fig. 69. *Bithynia (Digoniostoma) pulchella* BENSON, ³/₁.
Chieng Mai (387) [SMF 219080].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 5.

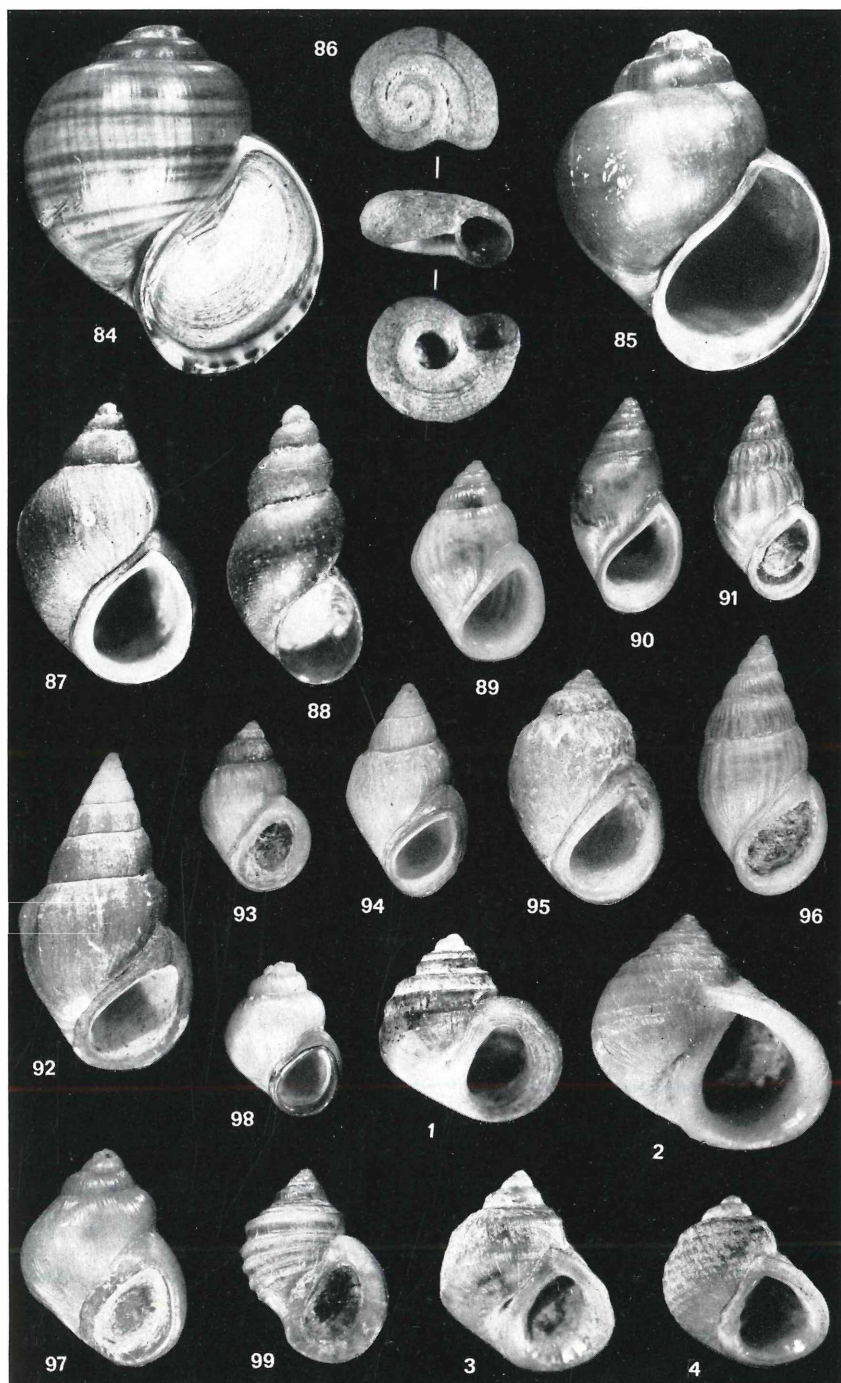
- Fig. 70-71. *Pila pesmei* (MORLET), ¹/₁.
70) Ban Glachong; Sukothai (3284) [SMF 223291].
71) Ban Kun Gaeo; Nakon Patum (3334 = *angelica*) [SMF 219560].
- Fig. 72. *Bithynia* (*Gabbia*) *wykoffi* BRANDT, ⁴/₁.
2 km N of Uthong; Supanburi (3708A) [Holotype SMF 197312].
- Fig. 73-74. *Bithynia* (*Gabbia*) *pygmaea* PRESTON, ⁸/₁.
73) Huai Mae Ka, Chieng Dao; Chieng Mai (3726) [SMF 219079a].
74) Num Pu Nong Pai; Petchabun (1311) [SMF 220907].
- Fig. 75. *Bithynia* (*Gabbia*) *walkeri* BRANDT, ⁴/₁.
Popraya tap-water supply station; Supanburi (3602A) [Holotype SMF 197313].
- Fig. 76-77. *Wattebledia crosseana* (WATTEBLED), ⁴/₁.
Nonivet; Udon Thani (370) [SMF 219146/2].
- Fig. 78-79. *Wattebledia siamensis* (MOELLENDORFF), ⁴/₁.
Klong Premprachakon, Bangkok-Dusit (376) [SMF 219145/2].
- Fig. 80. *Wattebledia baschi* BRANDT, ⁸/₁.
Malaya: Kampong Padang Malau (12026A) [Holotype SMF 197314].
- Fig. 81. *Hydrobioides nassa* (THEOBALD), ³/₁.
Ban Makok; Lampun (383) SMF 219147a].
- Fig. 82. *Tricula burchi* DAVIS, ¹⁵/₁.
Huai Mac Ka at Ban Tam; Chiang Dao (3481A) [Holotype SMF 197367].
- Fig. 83. *Tricula bollingi* DAVIS, ¹⁵/₁.
Swamp above Dang Makam Pom; Fang (3487A) [Holotype SMF 197366].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 6.

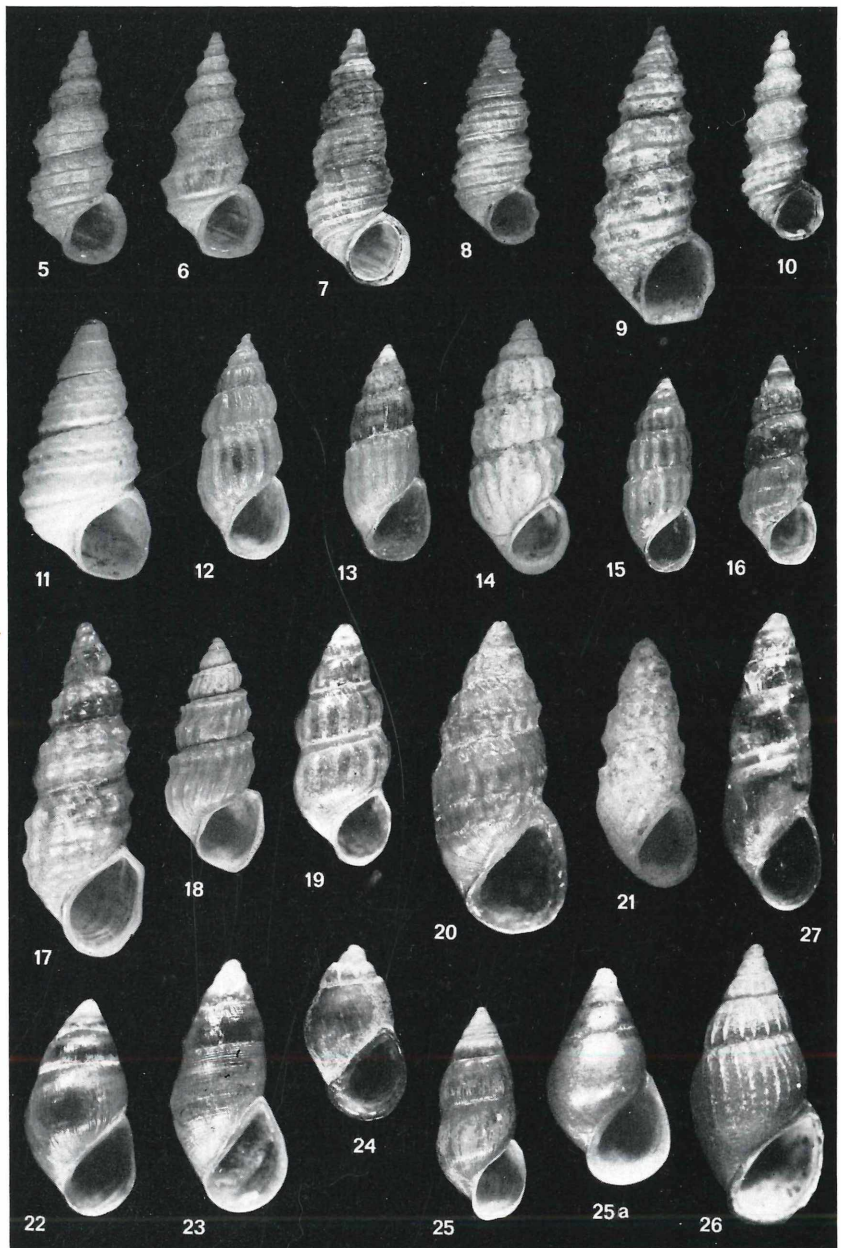
- Fig. 84. *Pila gracilis* (LEA), ¹/₁.
Near Khok Yai, 2.5 km S of Trat; Chantaburi (3283) [SMF 219558].
- Fig. 85. *Pila scutata* (MOUSSON), ¹/₁.
Malaya: Kuala Lumpur (288) [SMF 223292].
- Fig. 86. *Clenchiella microscopica* (NEVILL), ¹⁵/₁.
Paknam Bandon; Suratthani (4118) [SMF 193925a].
- Fig. 87. *Rebderiella parva* (LEA), ⁵/₁.
Maenam Chao Praya, Bangkok (484) [SMF 219141a].
- Fig. 88. *Rebderiella siamensis* n. sp., ¹⁰/₁.
Klong Bang O; Thonburi (3395A) [Holotype SMF 198283].
- Fig. 89. *Pachydrobia spinosa* POIRIER, ³/₁.
Mekong at Bandan (3476) [SMF 215897a].
- Fig. 90. *Pachydrobia bavayi* BRANDT, ⁴/₁.
Cambodia: Mekong at Kratie (16285A) [Holotype SMF 198338].
- Fig. 91. *Pachydrobia munensis* BRANDT, ³/₁.
Mun River near Ban Ta Tum; Surin (447A) [Holotype SMF 197185].
- Fig. 92. *Pachydrobia variabilis* (POIRIER), ³/₁.
Laos: Done Tane, opp. Séne; Sitandone (16141) [SMF 193619a].
- Fig. 93. *Pachydrobia siamensis* BRANDT, ³/₁.
Maenam Kwae Noi at Ban Kao Pun, N of Kanhanaburi (446A) [Holotype SMF 197190].
- Fig. 94. *Pachydrobia prasongi* n. sp., ³/₁.
Laos: Se Bang Fai River opp. Tat Panom (3432A) [Holotype SMF 198285].
- Fig. 95. *Pachydrobia wykoffi* BRANDT, ³/₁.
2 km S of Nakon Panom (3433A) [Holotype SMF 197191].
- Fig. 96. *Pachydrobia crooki* BRANDT, ³/₁.
Mekong at Bandan; Ubon (3435A) [Holotype SMF 197179].
- Fig. 97. *Pachydrobia zilchi zilchi* BRANDT, ³/₁.
Mun River at Ubon Ratchatani (460A) [Holotype SMF 197192].
- Fig. 98. *Pachydrobia zilchi reducta* n. subsp.
Lam Chi River at Gantaravichai; Mahasarakam (3441A) [Holotype SMF 198288].
- Fig. 99. *Jullienia acuta* POIRIER, ⁴/₁.
Mekong River at Bandan; Ubon (3462) [SMF 195124a].
- Fig. 1. *Jullienia munensis* n. sp., ⁴/₁.
Mun River at Pibun Mangsahan; Ubon (3461A) [Holotype SMF 219033a].
- Fig. 2. *Jullienia crooki* (BRANDT), ⁴/₁.
Mekong River at Bandan; Ubon (3463A) [Holotype SMF 197193].
- Fig. 3. *Jullienia harmandi* POIRIER, ⁴/₁.
Mekong River at Bandan; Ubon (3464) [SMF 193642a].
- Fig. 4. *Jullienia prasongi* n. sp., ⁴/₁.
Mun River at Tana Falls (5142A) [Holotype SMF 219039].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 7.

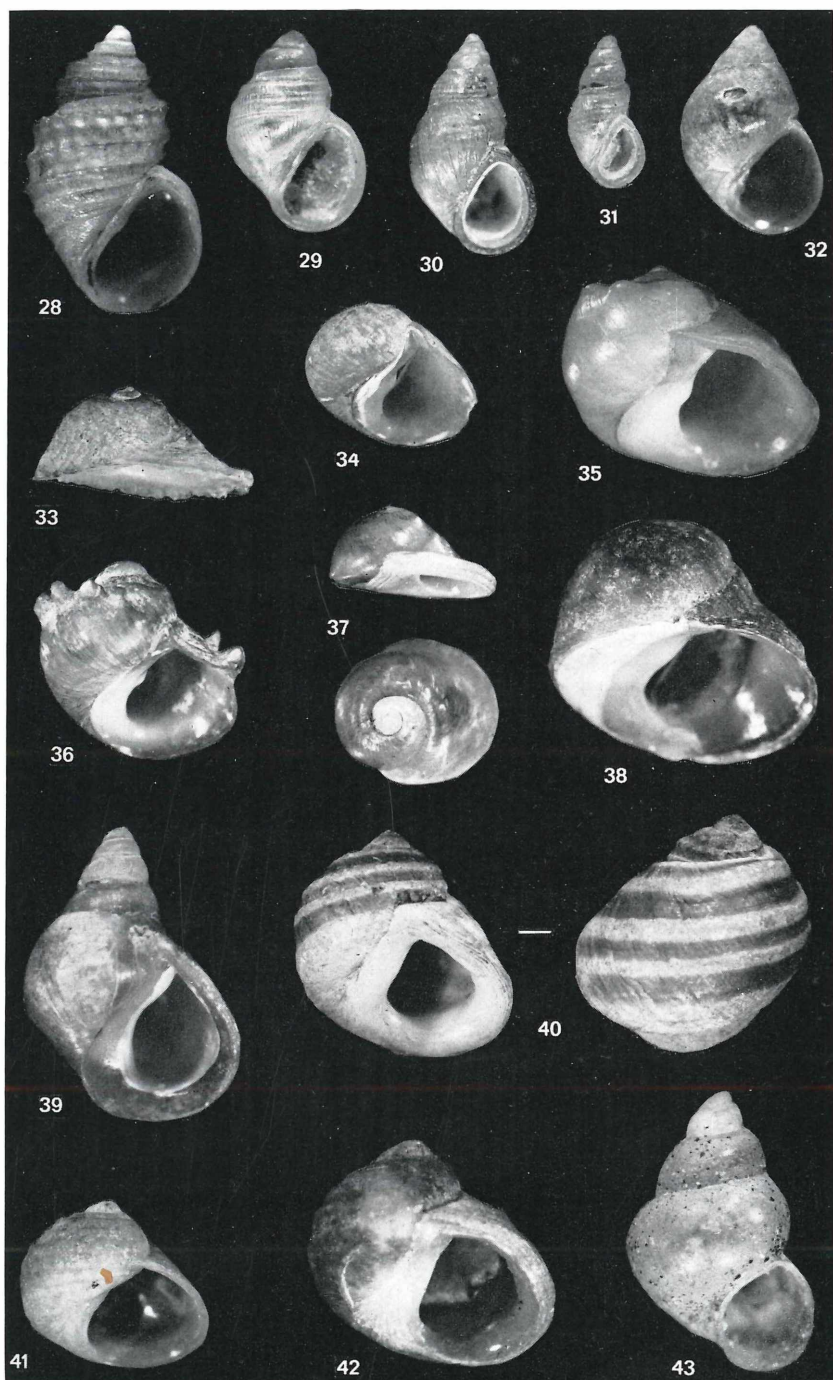
- Fig. 5-6. *Paraprososthenia levayi* (BAVAY), ⁵/₁.
Laos: Mekong at Muang Khong; Sithandone (16114) [SMF 219036/2].
- Fig. 7. *Paraprososthenia taylori* BRANDT, ⁵/₁.
Mekong River at Bandan; Ubon (3383A) [Holotype SMF 197158].
- Fig. 8. *Paraprososthenia davisi* BRANDT, ⁵/₁.
Mekong River at Bandan; Ubon (3384A) [Holotype SMF 197154].
- Fig. 9. *Paraprososthenia vivonai* BRANDT, ⁵/₁.
Mekong River at Bandan; Ubon (3443A) [Holotype SMF 197159].
- Fig. 10. *Paraprososthenia iijimai* BRANDT, ⁶/₁.
Mekong River at Bandan; Ubon (5119A) [Holotype SMF 198339].
- Fig. 11. *Paraprososthenia hanseni* BRANDT, ⁵/₁.
Mekong River at Bandan; Ubon (3475) [Paratype SMF 197139a].
- Fig. 12. *Hubendickia siamensis* BRANDT, ⁴/₁.
Mun River at Pibun Mangsahan; Ubon (3390A) [Holotype SMF 197168].
- Fig. 13. *Hubendickia spiralis* BRANDT, ⁴/₁.
Mekong River near Bandan; Ubon (3386A) [Holotype SMF 197172].
- Fig. 14. *Hubendickia tuberculata* BRANDT, ⁸/₁.
Mekong River at Ban Kum; Ubon (3389A) [Holotype SMF 197173].
- Fig. 15. *Hubendickia crooki* BRANDT, ⁴/₁.
Mekong River at Bandan; Ubon (3391A) [Holotype SMF 197160].
- Fig. 16. *Hubendickia gochenouri* BRANDT, ⁴/₁.
Mekong River at Ban Kum; Ubon (3394A) [Holotype SMF 197162].
- Fig. 17. *Hubendickia schuetti* (BRANDT), ⁵/₁.
Mekong River at Bandan; Ubon (3382A) [Holotype SMF 197157].
- Fig. 18. *Hubendickia coronata* BRANDT, ⁴/₁.
Mekong River at Ban Kum; Ubon (3442A) [Holotype SMF 197161].
- Fig. 19. *Hubendickia cylindrica* n. sp., ⁸/₁.
Mekong River at Bandan; Ubon (5099A) [Holotype SMF 198292].
- Fig. 20. *Hubendickia cingulata* n. sp., ⁸/₁.
Mekong River at Bandan; Ubon (5100A) [Holotype SMF 198289].
- Fig. 21. *Hubendickia schlickumi* (BRANDT), ¹⁰/₁.
Mun River at Pibun Mangsahan; Ubon (3381A) [Holotype SMF 197156].
- Fig. 22. *Manningiella polita* BRANDT, ⁶/₁.
Mekong River at Bandan; Ubon (3377A) [Holotype SMF 197216].
- Fig. 23. *Manningiella microsculpta* (BRANDT), ⁸/₁.
Mekong River at Bandan; Ubon (3378A) [Holotype SMF 197166].
- Fig. 24. *Manningiella expansa* BRANDT, ⁸/₁.
Laos: Mekong River at Muang Khong (16288A) [Holotype SMF 198322].
- Fig. 25. *Manningiella pellucida* (BAVAY), ⁶/₁.
Laos: Mekong branch at Sompamit Falls (16124) [SMF 219142].
- Fig. 25a. *Manningiella conica* TEMCHAROEN, ⁸/₁.
Laos: Mekong at Ban Na on Khong Island (16275A) [Holotype SMF 197204].
- Fig. 26. *Manningiella incerta* (TEMCHAROEN), ⁸/₁.
Laos: Mekong River at Ban Na on Khong Island (16388A) [Holotype SMF 197163].
- Fig. 27. *Manningiella subulata* BRANDT, ¹⁰/₁.
Mekong River about 20 km N of Bandan (5436A) [Holotype SMF 198354].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 8.

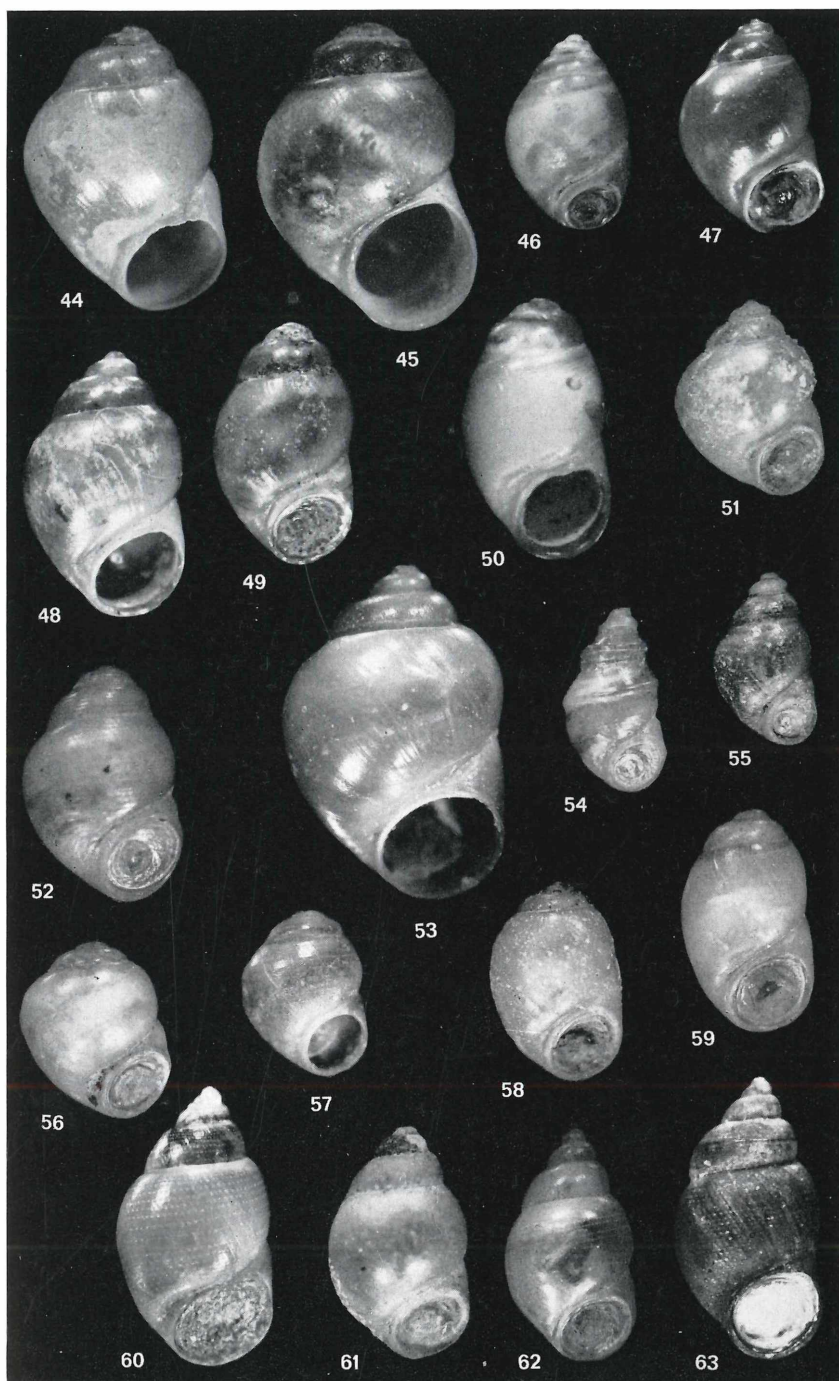
- Fig. 28. *Hydrorissoia elegans* BAVAY, ⁸/1.
Mekong River at Bandan; Ubon (3380) [SMF 194182a].
- Fig. 29. *Hydrorissoia trispiralis* BRANDT, ⁸/1.
Mekong River at Bandan; Ubon (3472A) [Holotype SMF 197178].
- Fig. 30. *Hydrorissoia muensis* BRANDT, ⁸/1.
Mun River at Pibun Mangsahan; Ubon (3471A) [Holotype SMF 197176].
- Fig. 31. *Hydrorissoia gracilis* BRANDT, ⁸/1.
Mekong River at Bandan; Ubon (3478A) [Holotype SMF 197174].
- Fig. 32. *Pachydrobiella brevis* (BAVAY), ⁸/1.
Laos: Mekong branch at Phaphaeng Falls (16281) [SMF 197298a].
- Fig. 33. *Lacunopsis fischerpiettei* BRANDT, ²/1.
Mekong River at Bandan; Ubon (3467A) [Holotype SMF 197310].
- Fig. 34. *Lacunopsis munensis* BRANDT, ⁴/1.
Mun River at Ubon Ratchatani (3371A) [Holotype SMF 197311].
- Fig. 35. *Lacunopsis levayi* BAVAY, ⁴/1.
Mekong River at Bandan; Ubon (3372) [SMF 193641a].
- Fig. 36. *Lacunopsis coronata* BAVAY, ⁴/1.
Laos: Sompamit Falls, Khone (16200) [SMF 198395].
- Fig. 37. *Lacunopsis massiei* BAVAY, ⁴/1.
Mekong River at Ban Kum [SMF 234238].
- Fig. 38. *Lacunopsis harmandi* POIRIER, ⁴/1.
Mun River at Tana Rapids, Bandan; Ubon (3470) [SMF 219130].
- Fig. 39. *Lithoglyphopsis aperta* TEMCHAROEN, ¹⁰/1.
Laos: Mekong River at Ban Na on Khong Isl. (16282) [Holotype SMF 198768].
- Fig. 40. *Wykoffia tricostata* (DESHAYES), ⁵/1.
Cambodia: Mekong River at Sambor (16187) [SMF 198396].
- Fig. 41. *Wykoffia costata* (POIRIER), ⁵/1.
Laos: Mekong River at Khong; Sithandone (16189) [SMF 205382a].
- Fig. 42. *Wykoffia minima* TEMCHAROEN, ¹⁰/1.
Laos: Mekong River at Muang Khong; Khong Isl. (16335A) [Holotype SMF 197194].
- Fig. 43. *Gangetia tigertti* BRANDT, ¹⁵/1.
Ban Don Makok; Rayong (4031A) [Holotype SMF 197315].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 9.

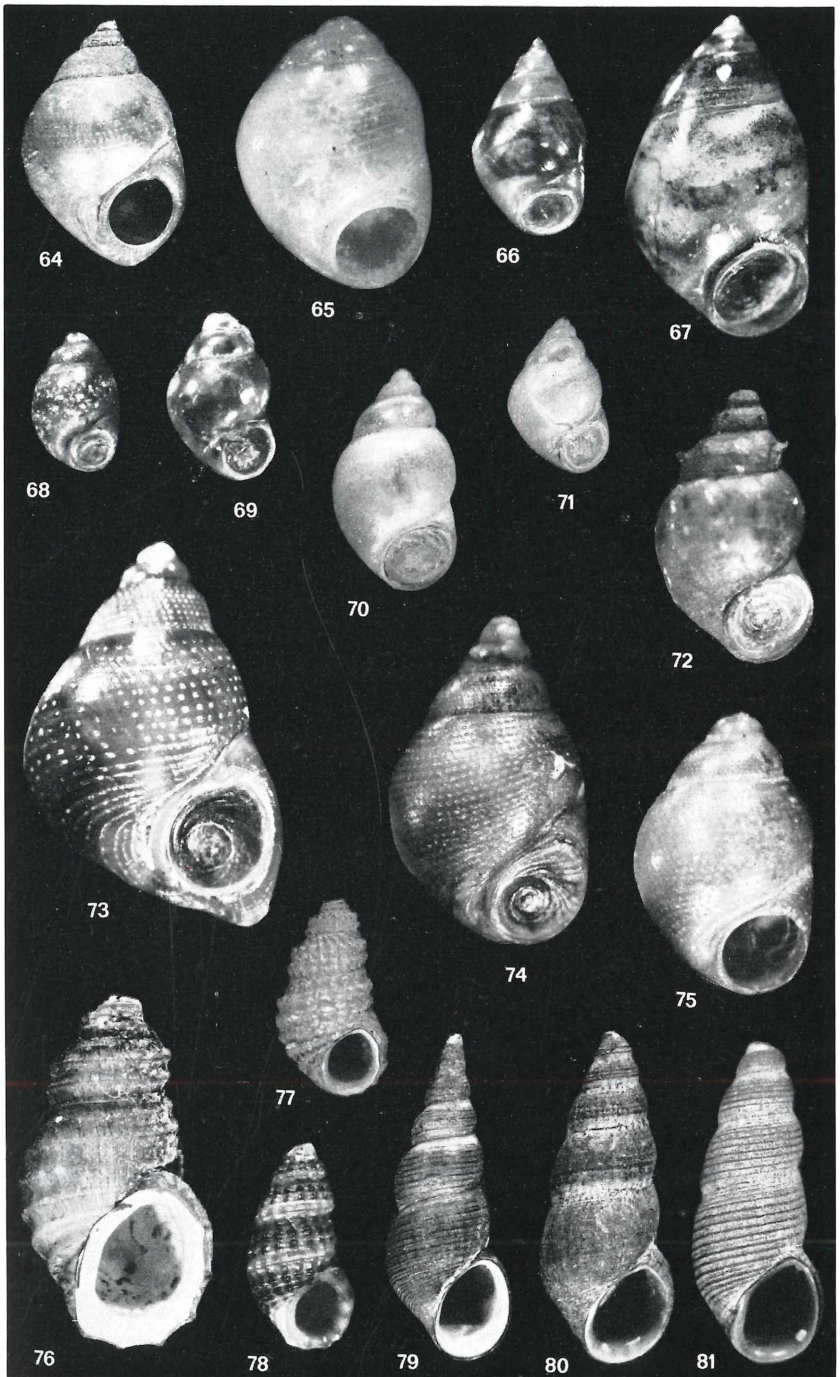
- Fig. 44. *Stenothyra microsculpta* n. sp., ¹⁰/1.
Huai Thuai; Tha Uthen (5037A) [Holotype SMF 198281].
- Fig. 45. *Stenothyra hybocystoides* BAVAY, ¹⁰/1.
Mekong River at Bandan; Ubon (4988) [SMF 219034].
- Fig. 46. *Stenothyra basisculpta* BRANDT, ¹⁰/1.
Mekong River at Bandan; Ubon (5045A) [Holotype SMF 197233].
- Fig. 47. *Stenothyra ovalis* BRANDT, ¹⁰/1.
Mun River at Rasi Salai (5146A) [Holotype SMF 198340].
- Fig. 48. *Stenothyra confinis* n. sp., ¹⁰/1.
Moei River 6 km W of Mae Sot (4966A) [Holotype SMF 198274].
- Fig. 49. *Stenothyra mcmulleni* BRANDT, ¹⁰/1.
Mekong at Bandan, Ubon (5003A) [Holotypus SMF 197254].
- Fig. 50. *Stenothyra cambodiensis* BRANDT, ²⁰/1.
Cambodia: Mekong River at Sambor; Kratie (16437A) [Holotype SMF 198904].
- Fig. 51. *Stenothyra k. koratensis* BRANDT, ¹⁰/1.
Takrong River at Korat (416A) [Holotype SMF 197247].
- Fig. 52. *Stenothyra k. holosculpta* BRANDT, ¹⁰/1.
Maenam Kham at Tat Panom (4054A) [Holotype SMF 215953].
- Fig. 53. *Stenothyra jiraponi* BRANDT, ¹⁰/1.
Maenam Songkram; Sakon Nakhon (3417A) [Holotype SMF 197246].
- Fig. 54. *Stenothyra spiralis* BRANDT, ¹⁰/1.
Maenam Mun at Rasi Salai; Sri Saket (3421A) [Holotype SMF 197267].
- Fig. 55. *Stenothyra schuetti* BRANDT, ¹⁰/1.
Maenam Songkram at Wanonivat; Sakon Nakhon (3416A) [Holotype SMF 197266].
- Fig. 56. *Stenothyra crooki* BRANDT, ¹⁰/1.
Huai Nam Un, Sri Songkram; Nakhon Panom (4991A) [Holotype SMF 197244].
- Fig. 57. *Stenothyra roseni* BRANDT, ¹⁰/1.
Songkram River N of Wanonivat; Nakhon Panom (4994A) [Holotype SMF 197265].
- Fig. 58. *Stenothyra fasciata* BRANDT, ¹⁰/1.
Maenam Songkram at Wanonivat; Sakon Nakhon (4046A) [Holotype SMF 197245].
- Fig. 59. *Stenothyra wykoffi* BRANDT, ¹⁰/1.
Maenam Mun at Rasi Salai; Sri Saket (4052A) [Holotype SMF 197268].
- Fig. 60. *Stenothyra monilifera* BENSON, ⁷/1.
Pak Takong, Bang Prakon; Chachoengsao (5158) [SMF 219037].
- Fig. 61. *Stenothyra moussoni* MARTENS, ¹⁰/1.
15 km N of Samut Songkram (3429) [SMF 219038a].
- Fig. 62. *Stenothyra mandahlbarthi* BRANDT, ¹⁰/1.
Bang Khon Kao, Nakhon Chai Sri (4061A) [Holotype SMF 197253].
- Fig. 63. *Stenothyra labiata* BRANDT, ¹⁰/1.
Creek 40 km N of Ranong (4990A) [Holotype SMF 197249].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 10.

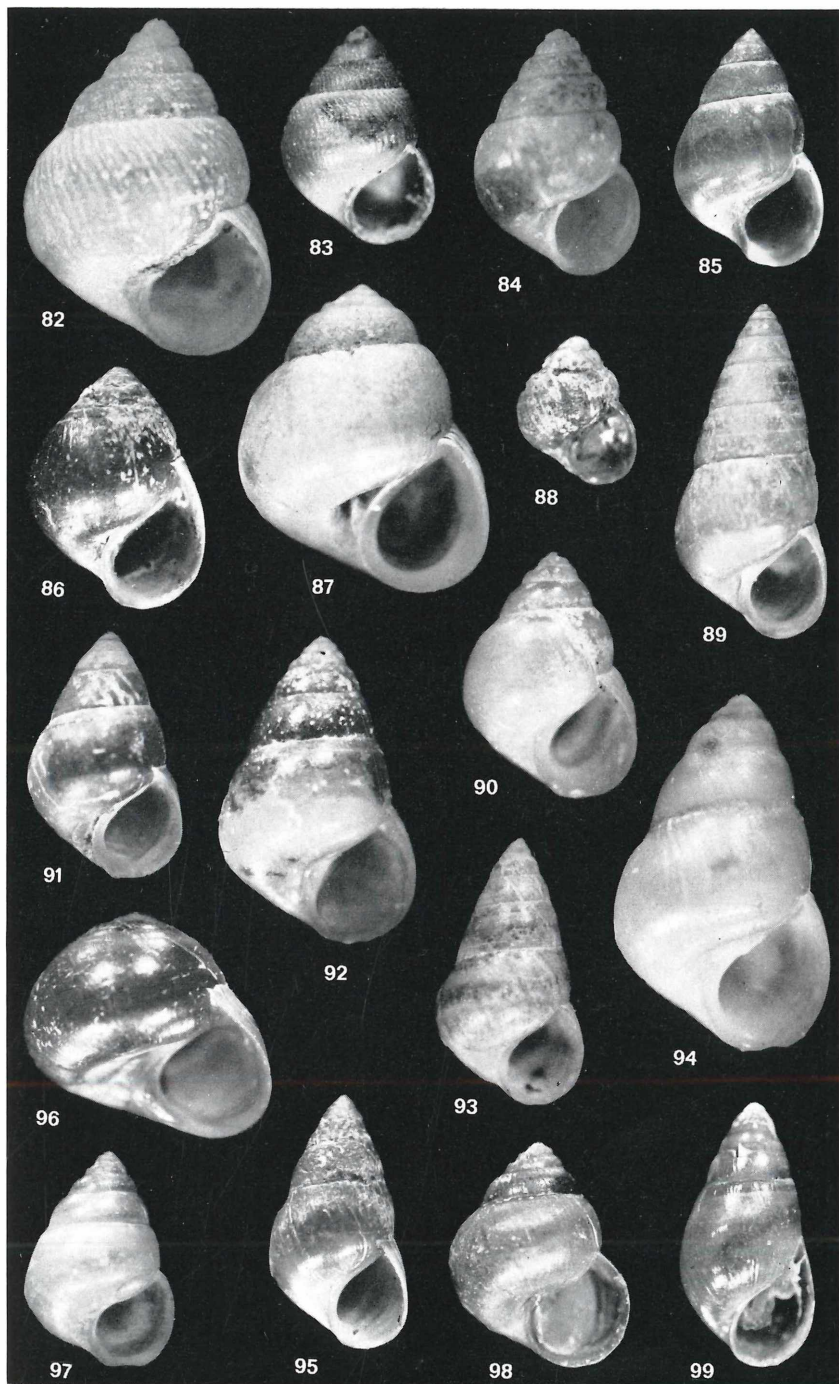
- Fig. 64. *Stenothyra polita* (A. ADAMS), ⁵/₁.
Swamp Bang Prakon bridge (5039) [SMF 215938].
- Fig. 65. *Stenothyra cyrtochila* VAN BENTHEM JUTTING, ²⁰/₁.
Yong Star, S of Palian (4968) [SMF 219032].
- Fig. 66. *Stenothyra acuta* n. sp., ¹⁰/₁.
Pak Takong, Bang Prakon; Chachoengsao (5157A) [Holotype SMF 198271].
- Fig. 67. *Stenothyra glabrata* A. ADAMS, ⁷/₁.
2 km from the Bang Prakon bridge (5444) [SMF 215922a].
- Fig. 68. *Stenothyra schlickumi* BRANDT, ¹⁰/₁.
2 km S of Palian; Trang (5018A) [Holotype SMF 198211].
- Fig. 69. *Stenothyra maculata* n. sp., ¹⁰/₁.
Khlung Harbour; Chantaburi (4965A) [Holotype SMF 198278].
- Fig. 70. *Stenothyra krungtepensis* BRANDT, ¹⁰/₁.
Klong Premprachakon, Bangkok-Dusit (417A) [Holotype SMF 197248].
- Fig. 71. *Stenothyra annandalei* BRANDT, ¹⁰/₁.
Creek near Ban Don Makok; Rayong (3424A) [Holotype SMF 197232].
- Fig. 72. *Stenothyra spinosa* n. sp., ¹⁰/₁.
Klong Wan 5 km S of Kraburi; Ranong (5145A) [Holotype SMF 219081].
- Fig. 73. *Stenothyra prasongi* n. sp., ¹⁰/₁.
2 km S of Palian; Trang (5155A) [Holotype SMF 219826].
- Fig. 74. *Stenothyra hardouini* MORGAN, ¹⁰/₁.
Klong Sapan Pun, 500 m E of Kraburi (5144) [SMF 226084].
- Fig. 75. *Stenothyra nana* PRASHAD, ²⁰/₁.
Fa Dan; Ranong (4970) [SMF 219035].
- Fig. 76. *Iravadia ornata* BLANFORD, ⁵/₁.
Pak Takong at Ban Ta Sa An; Chachoengsao (5173) [SMF 219158].
- Fig. 77. *Iravadia reticulata* BRANDT, ⁶/₁.
Tarua Khlung; Chantaburi (3454A) [Holotype SMF 197318].
- Fig. 78. *Iravadia tuberculata* n. sp., ⁸/₁.
Grabi, 1 km S of the town (3451A) [Holotype SMF 198295].
- Fig. 79. *Fairbankia cochinchinensis* BAVAY, ³/₁.
4 km before Paknam Bandan; Suratthani (4030) [SMF 219143].
- Fig. 80. *Fairbankia bombayana* BLANFORD, ⁵/₁.
Klong Yai Pin, Laem Ngob; Trad (5025) [SMF 219144].
- Fig. 81. *Fairbankia rohdei* BRANDT, ⁸/₁.
7 km from Chantaburi to Tachalaeb; Chantaburi (4011A) [Holotype SMF 197317].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 11.

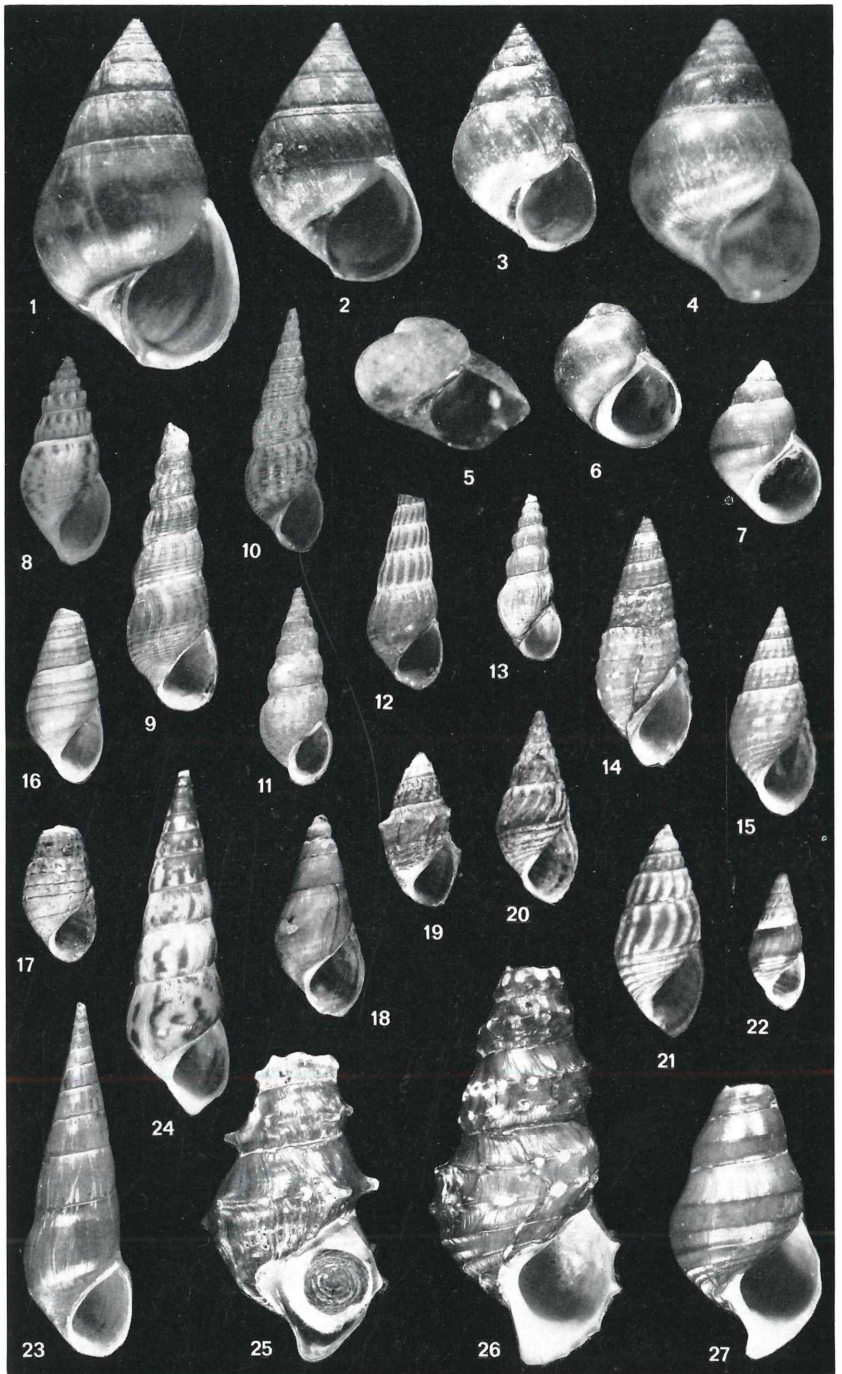
- Fig. 82. *Assimineea* (*Sculptassimineea*) *microsculpta* NEVILL, ¹⁵/₁.
Klong Yai Pin; Laem Ngob (3495) [SMF 220946].
- Fig. 83. *Assimineea* (*Sculptassimineea*) *abbotti* BRANDT, ¹⁵/₁.
Near Yong Star Custom House at Palian; Trang (4917A) [Holotype SMF 197306].
- Fig. 84. *Assimineea* (*Sculptassimineea*) *spiralis* n. sp., ¹⁵/₁.
Swamp 500 Yards W of Ban Pa In (4905A) [Holotype SMF 220947].
- Fig. 85. *Assimineea* (*Metassimineea*) *philippinica* O. BOETTGER, ⁵/₁.
15 km N of Bang Prakon Junction (4935) [SMF 220961a].
- Fig. 86. *Assimineea* (*Sphaerassimineea*) *brevicula* (PFEIFFER), ⁵/₁.
Bang Prakong River; Chachoengsao (453) [SMF 220944].
- Fig. 87. *Assimineea* (*Ovassimineea*) *obtusa* WATTEBLÉ, ¹⁰/₁.
Klong Na Chom Thian, Satahip; Chonburi (3509) [SMF 219825].
- Fig. 88. *Assimineea* (*Ovassimineea*) *microscopica* BRANDT, ¹⁵/₁.
Klong Yai Ping at Bang Gra Dan, Laem Ngob; Trad (4109A) [Holotype SMF 197305].
- Fig. 89. *Assimineea* (*Assimineea*) *woodmasoniana* NEVILL, ¹⁰/₁.
Ban Klong Sun, Ban Gradan; Trad (4901) [SMF 220955].
- Fig. 90. *Assimineea* (*Assimineea*) *hidalgoi* GASSIES, ¹⁰/₁.
Ratana Tara Beach near Grabi (3513) [SMF 227204].
- Fig. 91. *Assimineea* (*Assimineea*) *nitida* (PEASE), ¹⁰/₁.
Prasae Estuary, Glaeng; Rayong (4928) [SMF 220958].
- Fig. 92. *Assimineea* (*Assimineea*) *schlickumi* n. sp., ¹⁵/₁.
Pak Panang; Nakhon Sritammarat (3498A) [Holotype SMF 227211].
- Fig. 93. *Assimineea* (*Assimineea*) *schuetti* n. sp., ¹⁵/₁.
Klong Yai Pin at Ban Glea Dan, Laem Ngob; Trad (4096A) [Holotype SMF 227210].
- Fig. 94. *Assimineea* (*Assimineea*) *zilchi* n. sp., ¹⁵/₁.
Ban Klong Sun near Ban Gradan; Trad (4902A) [Holotype SMF 227207].
- Fig. 95. *Assimineea* (*Eussoia*) *javana* (THIELE), ⁵/₁.
Ban Bang Mak; Trang (3493) [SMF 225810].
- Fig. 96. *Assimineea* (*Austropilula*) *beddomeana* NEVILL, ¹⁰/₁.
Mangrove forest about 2 km S of Palian; Trang (4924) [SMF 225807].
- Fig. 97. *Paludinella* (*Paludinella*) *kuiperi* n. sp., ¹⁵/₁.
Swamp at Bang Prakon Highway 3 bridge (4919A) [Holotype SMF 227212].
- Fig. 98. *Paludinella* (*Paludinella*) *thonburi* BRANDT, ¹⁵/₁.
Klong Mun in Thonburi (4948A) [Holotype SMF 197308].
- Fig. 99. *Paludinella* (*Schuettiella*) *daengsvangi* BRANDT, ¹⁰/₁.
Klong Prempachakon, Bangkok-Dusit (440A) [Holotype SMF 197307].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 12.

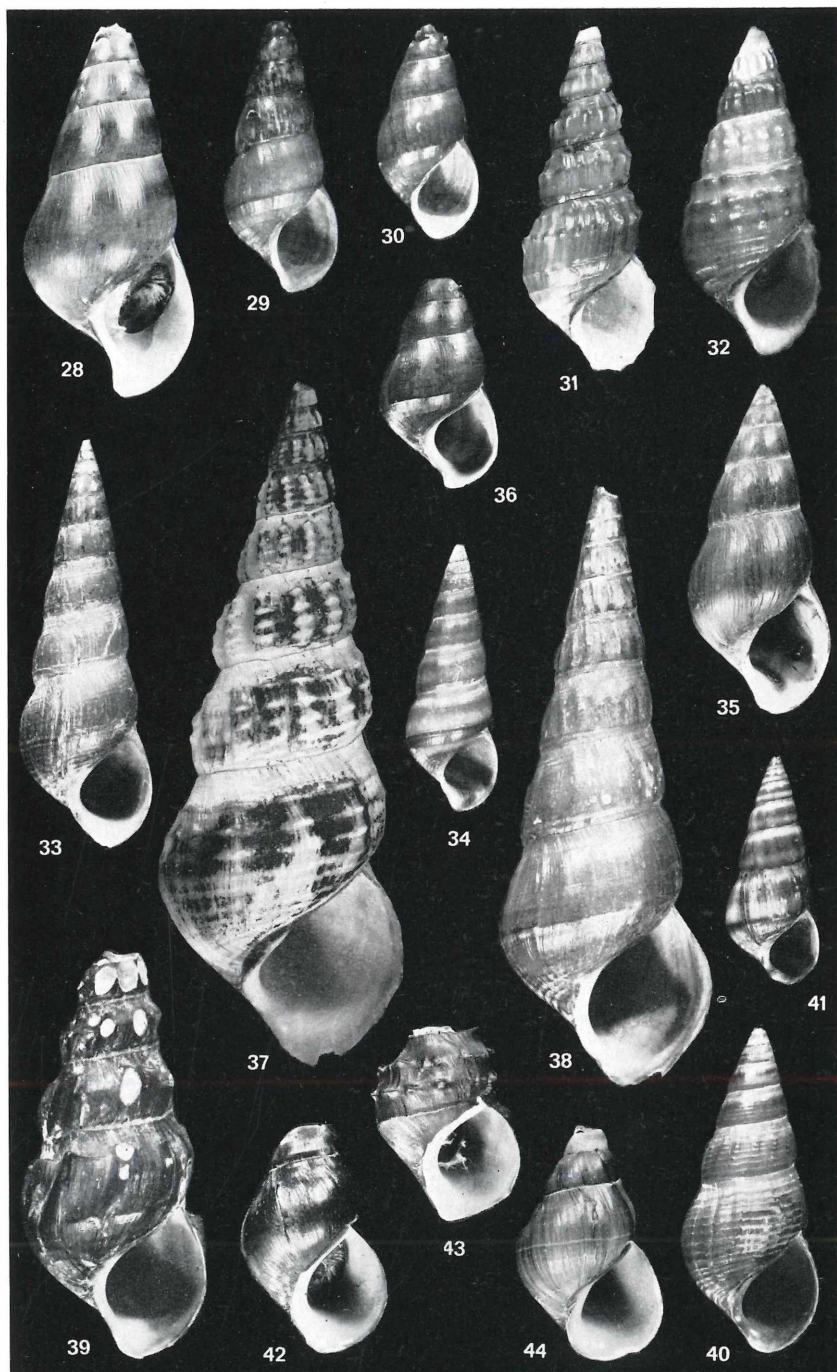
- Fig. 1. *Cyclotropis carinata* (LEA), ⁵/₁.
Klong Bang Plue; Thonburi (4931) [SMF 193748a].
- Fig. 2. *Cyclotropis terae* n. sp., ⁵/₁.
Ban Bang Mak; Trang (4933A) [Holotype SMF 227199].
- Fig. 3. *Cyclotropis bollingi* n. sp., ⁵/₁.
Klong Bang O; Thonburi (4950A) [Holotype SMF 227205].
- Fig. 4. *Cyclotropis bedaliensis* (RENSCH), ¹⁰/₁.
Bangkok (4081) [SMF 193750a].
- Fig. 5. *Chamlongia harinasutai* BRANDT, ⁸/₁.
Near Ban Don Makok on Maenam Prasac; Rayong (4111A) [Holotype SMF 197316].
- Fig. 6. *Paludomus petrosus* (GOULD), ³/₂.
Klong Chumpon, 26 km W of Chumpon (589) [SMF 215954].
- Fig. 7. *Paludomus siamensis* BLANFORD, ³/₂.
River Mae Som near Pako; Prae (602) [SMF 215955].
- Fig. 8. *Thiara scabra* (MÜLLER), ¹/₁.
Muak Lek, Arboretum; Saraburi (626) [SMF 219838].
- Fig. 9-12. *Melanoides tuberculata* (MÜLLER), ¹/₁.
9) Mae Jo, Fishery Station; Chiang Mai (528) [SMF 219872].
10) Mae Sarieng River at Mae Sarieng (3748) [SMF 219917].
11) Huai Hua Hin Fon, E of Mae Sot (634) [SMF 215957].
12) Klong Chandi, Railway bridge; Nakon Sritammarat (619) [SMF 215956].
- Fig. 13. *Melanoides jugicostis* (HANLEY & THEOBALD), ¹/₁.
Muok Lek, E of Saraburi (636) [SMF 215958].
- Fig. 14-18. *Tarebia granifera* (LAMARCK).
14) Maenam Kwa Noi, 12 km N of Nakon Thai (607) [SMF 220300], ¹/₁.
15) 122.5 km E of Pitsanulok; Pitchit (594) [SMF 220298], ¹/₁.
16) Maenam Rab; Trang (593) [SMF 220296], ¹/₁.
17) Klong Bang Sapan Yai, 107 km N of Chumpon (608) [SMF 220302], ³/₂.
18) Bang Pra Lake near Chonburi (671) [SMF 220306], ³/₂.
- Fig. 19-22. *Sermyla riqueti* (GRATELOUP).
19) Chao Praya River, Bangkok (3811) [SMF 219867a], ¹/₁.
20) Kao Yoi; Petburi (624) [SMF 219861], ²/₁.
21) Klong Jokaré, Ang Tong; Ko Samui (3802) [SMF 219863], ²/₁.
22) Narativat, canal from the lagoon (3817) [SMF 219870], ²/₁.
- Fig. 23. *Neoradina prasongi* n. g. n. sp., ¹/₁.
Stream 7 km from Grabi to Kao Tong; Grabi (3950A) [Holotype SMF 215933].
- Fig. 24. *Adamietta housei* (LEA), ¹/₁.
Ban Huai Yang; Saraburi (543) [SMF 215959].
- Fig. 25. *Brotia (Brotia) pagodula* (GOULD), ¹/₁.
Maenam Moei, 8 km W of Mae Ramat (3891) [SMF 220338].
- Fig. 26. *Brotia (Brotia) b. binodosa* (BLANFORD), ¹/₁.
Maenam Kaek Noi, Sopa Falls; Pitsanulok (493) [SMF 220339].
- Fig. 27. *Brotia (Brotia) b. spiralis* n. subsp., ¹/₁.
Kaek River, 38.5 km E of Pitsanulok (3881A) [Holotype SMF 220340].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 13.

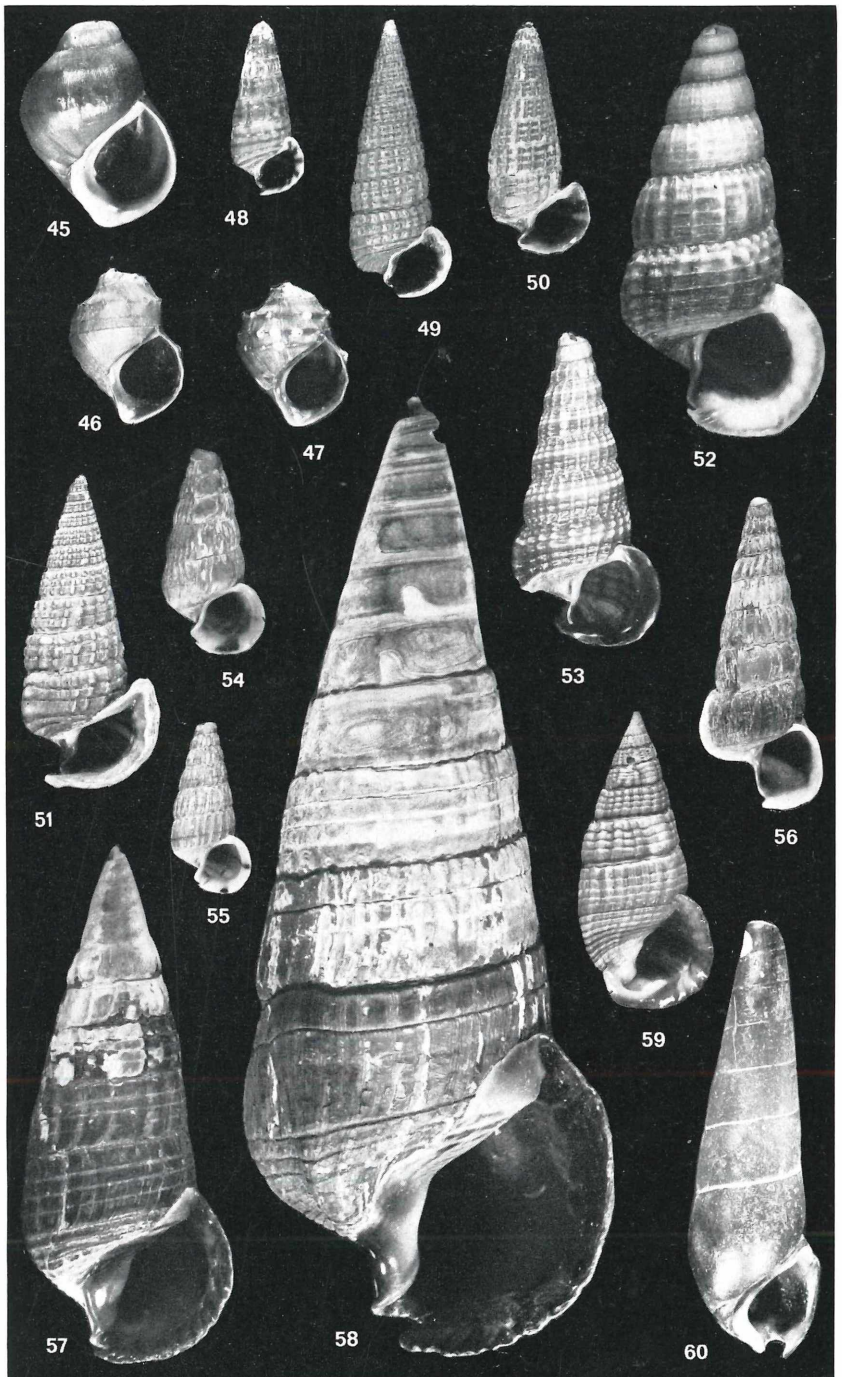
- Fig. 28. *Brotia (Brotia) binodosa subgloriosa* BRANDT, ¹/₁.
Huai Chieng Nam, 92 km E of Pitsanulok (495A) [Holotype SMF 197374].
- Fig. 29-30. *Brotia (Brotia) insolita* (BROT), ¹/₁.
29) Mae Gaeng Dom near Dan Sai; Loei (560) [SMF 220344a].
30) Huai Nam San at Tad San Waterfall; Loei (3894) [SMF 220510a].
- Fig. 31. *Brotia (Brotia) pseudoasperata* BRANDT, ¹/₁.
Maenam San at Ban Gaeng Hai (599A) [Holotype SMF 197375].
- Fig. 32. *Brotia (Brotia) baccata* (GOULD), ¹/₁.
Nam Mae Samat at Pa Bong, 15 km S of Mae Hongson (556) [SMF 215991].
- Fig. 33-34. *Brotia (Brotia) citrina* (BROT), ¹/₁.
33) Ban Pa Sing, 16 km N of Nan (474) [SMF 220517].
34) Pa Ko, Mae Som River; Prae (502) [SMF 220521a].
- Fig. 35. *Brotia (Brotia) manningi* BRANDT, ¹/₁.
Huai Lan at Ban Dam Pon; Lom Sak (3901A) [Holotype SMF 197376].
- Fig. 36. *Brotia (Brotia) microsculpta* BRANDT, ¹/₁.
Maenam Kaek, Tong Selaeng Luang Bot. Garden (3900A) [Holotype SMF 197378].
- Fig. 37-38. *Brotia (Brotia) c. costula* (RAFINESQUE), ¹/₁.
37) River Ping, Wutikon Bridge, S of Tak (477) [SMF 220537a].
38) Mae Moei River, Mae Sot; Tak (3959) [SMF 220558].
- Fig. 39. *Brotia (Brotia) c. varicosa* (TROSCHER), ¹/₁.
Klong Manao Chawang; Nakon Sritammarat (3964) [SMF 220568].
- Fig. 40. *Brotia (Brotia) c. peninsularis* n. subsp., ¹/₁.
Maenam Lampa, W of Pattalung (496A) [Holotype SMF 220570].
- Fig. 41. *Brotia (Senckenbergia) wykoffi* n. sp., ¹/₁.
Sai Yok, NW of Candhanaburi (471A) [Holotype SMF 215931].
- Fig. 42. *Paracrostoma ps. pseudosulcospira* (BRANDT), ¹/₁.
Maenam Kaek Noi, Wang Nok Nang Aen; Wang Distr. (491A) [Holotype SMF 197379].
- Fig. 43. *Paracrostoma ps. armata* (BRANDT), ¹/₁.
Maenam Kaek Noi at the Gaeng Song Rapids (492A) [Holotype SMF 197380].
- Fig. 44. *Paracrostoma soleimiana* (BRANDT), ¹/₁.
Maenam Pong at Ban Pa Nok Kao; Loei (546A) [Holotype SMF 197377].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 14.

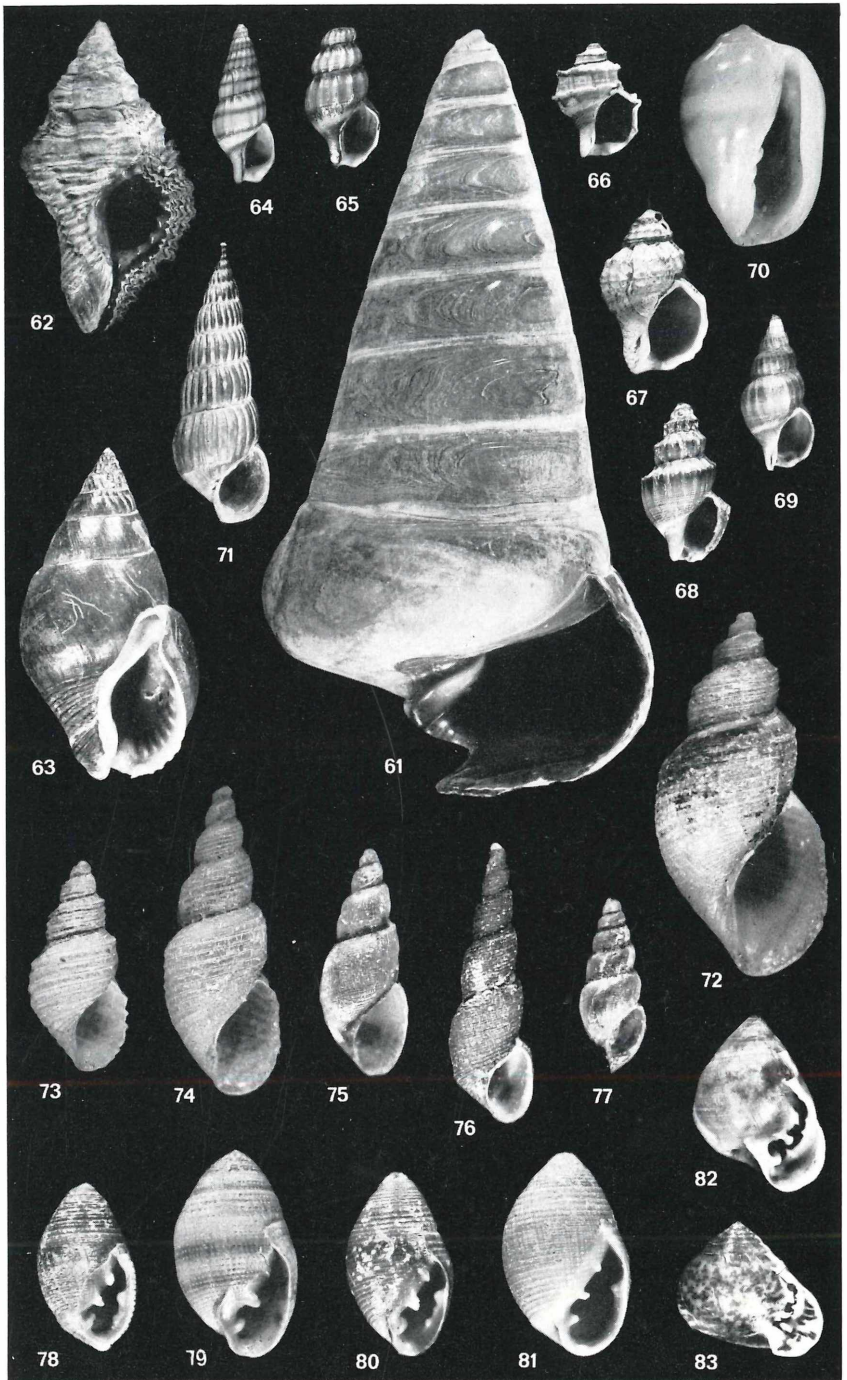
- Fig. 45. *Paracrostoma pal. paludiformis* (YEN), ¹/₁.
Kaek River at Sopa Falls, 71 km E of Pitsanulok (3889) [SMF 215961].
- Fig. 46. *Paracrostoma pal. dubiosa* n. subsp., ¹/₁.
Kaek River, Tong Salaeng Luang Rapids, 80 km E of Pitsanulok (3888A)
[Holotype SMF 215964].
- Fig. 47. *Paracrostoma morrisoni* n. sp., ¹/₁.
Kaek River at Sopa Falls, 71 km E of Pitsanulok (3888A) [Holotype SMF
215966].
- Fig. 48. *Cerithidea (Cerithideopsilla) cingulata* (GMELIN), ¹/₁.
Bang Na Klua; Chonburi (674) [SMF 220621].
- Fig. 49. *Cerithidea (Cerithideopsilla) djadjariensis* (MARTIN), ¹/₁.
Pang Nga, Customhouse (4840) [SMF 220618].
- Fig. 50. *Cerithidea (Cerithideopsilla) alata* (PHILIPPI), ¹/₁.
Mouth of the Chantaburi River; Tachalaeb (676) [SMF 220604].
- Fig. 51. *Cerithidea (Cerithideopsilla) microptera* (KIENER), ¹/₁.
Klong Tha Som, Kao Saming; Trad (4837) [SMF 220601].
- Fig. 52. *Cerithidea (Cerithidea) obtusa* (LAMARCK), ¹/₁.
Chantaburi River (700) [SMF 220589].
- Fig. 53. *Cerithidea (Cerithidea) quadrata* SOWERBY, ¹/₁.
Mangrove swamp near Klung; Chantaburi (4817) [SMF 220593].
- Fig. 54-55. *Cerithidea (Cerithidea) weyersi* DAUTZENBERG, ¹/₁.
Kantang; Trang (4831) [SMF 215968/2].
- Fig. 56. *Cerithidea (Cerithidea) charbonieri* (PETIT), ¹/₁.
Paknam Bandon; Surat Thani (3921) [SMF 220597].
- Fig. 57-58. *Terebralia palustris* (LINNAEUS), ¹/₁.
57) Chantaburi River at Tachalaeb (682) [SMF 220646].
58) Welu River near Ban Long Mai; Chantaburi (681) [SMF 220647].
- Fig. 59. *Terebralia sulcata* (BORN), ¹/₁.
Ban Pai; Rayong (690) [SMF 220643].
- Fig. 60. *Faunus ater* (LINNAEUS), ¹/₁.
Canal of the lagoon of Narathivat (3923) [SMF 215973].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 15.

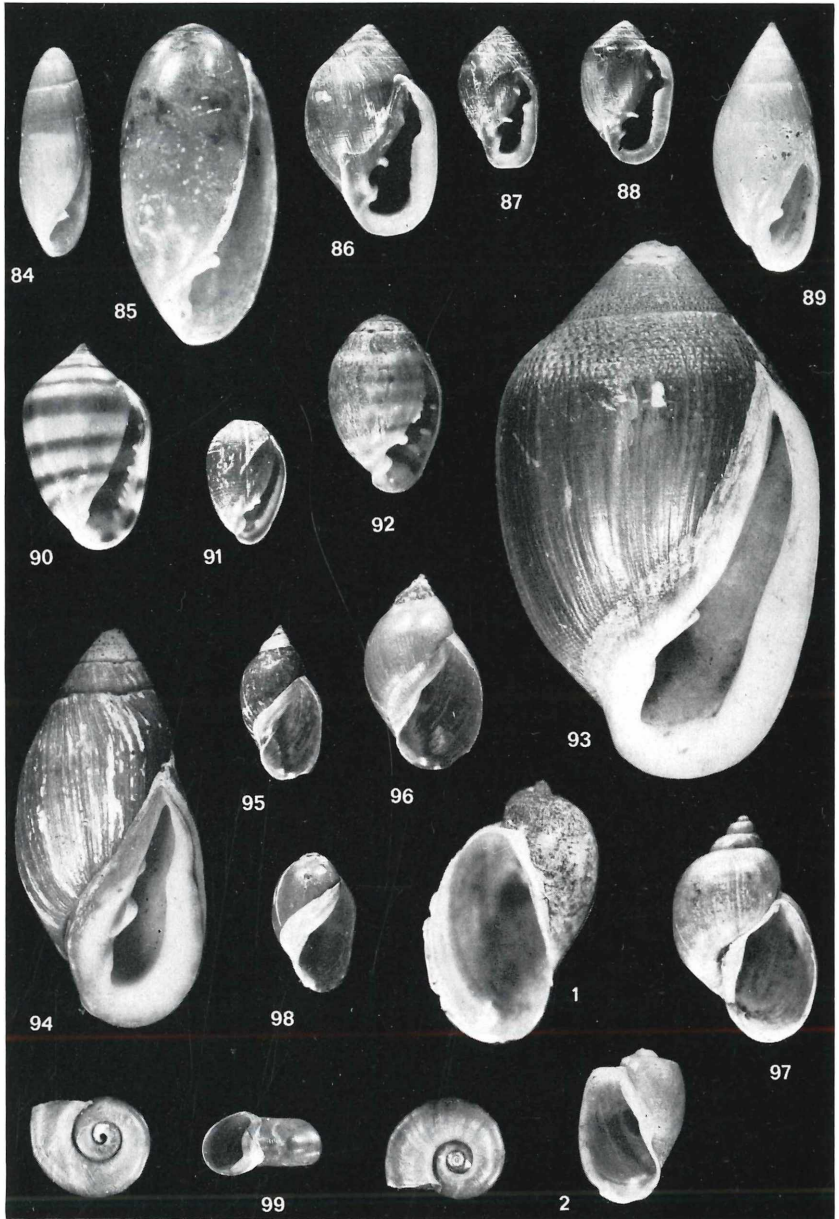
- Fig. 61. *Telescopium telescopium* (LINNAEUS), ¹/₁.
Trench 1 km S of Grabi (4851) [SMF 220648].
- Fig. 62. *Chicoreus capucinus* (LAMARCK), ¹/₁.
Dja Bi Lang Harbour; Satun (9914) [SMF 219820a].
- Fig. 63. *Alectrion (Zeuxis) taenia* (GMELIN), ¹/₁.
Laem Sing; Chantaburi (9791) [SMF 220808].
- Fig. 64-65. *Clea (Anentome) helena* (PHILIPPI), ¹/₁.
64) Mekong, 2 km S of Bandan (5293) [SMF 219823].
65) Petburi River at Ban Lad; Petburi (651) [SMF 193686a].
- Fig. 66. *Clea (Anentome) spinosa* TEMCHAROEN, ¹/₁.
Mekong at Bandan (5297) [SMF 198593].
- Fig. 67. *Clea (Anentome) jullieni* (DESHAYES), ¹/₁.
Mekong near Bandan; Ubon (3972) [SMF 215978a].
- Fig. 68. *Clea (Anentome) scalarina* (DESHAYES), ¹/₁.
Laos: Mekong at Muang Khong (16550) [SMF 196091].
- Fig. 69. *Clea (Anentome) wykoffi* n. sp., ¹/₁.
Mekong at Bandan; Ubon (3973A) [Holotype SMF 219824].
- Fig. 70. *Rivomarginella morrisoni* BRANDT, ³/₁.
Maenam Mae Klong near Ban Pong; Ratburi (961A) [Holotype SMF 197297].
- Fig. 71. *Chrysallida (Salasiella) eppersoni* BRANDT, ³/₁.
Estuary of Huai Song Kuk at Ban Ampoe, Satahip Distr.; Chonburi (4351A) [Holotype SMF 197319].
- Fig. 72. *Morrisonietta krungtepensis* BRANDT, ⁸/₁.
Klong Premprachakon, Bangkok-Dusit (444A) [Holotype SMF 197323].
- Fig. 73. *Morrisonietta spiralis* BRANDT, ⁸/₁.
Paknam Bandon; Surat Thani (4077A) [Holotype SMF 197325].
- Fig. 74. *Morrisonietta siamensis* BRANDT, ⁸/₁.
Klong Pong Pueag at Ban Tangwien, Glaeng Distr.; Rayong (1007A) [Holotype SMF 197324].
- Fig. 75. *Morrisonietta gracilis* BRANDT, ⁸/₁.
Klong Bang O; Thonburi (4074A) [Holotype SMF 197322].
- Fig. 76. *Morrisonietta acicula* BRANDT, ⁸/₁.
Klong Ban Don Makok, Glaeng Distr.; Rayong (4076A) [Holotype SMF 197320].
- Fig. 77. *Morrisonietta bandonensis* BRANDT, ⁸/₁.
Paknam Bandon; Surat Thani (3396A) [Holotype SMF 197321].
- Fig. 78. *Laemodonta typica* (H. & A. ADAMS), ³/₁.
2 km S of Palian; Trang (4313) [SMF 227231a].
- Fig. 79. *Laemodonta punctigera* (H. & A. ADAMS), ³/₁.
Laem Ngob; Trad (4314) [SMF 220649].
- Fig. 80. *Laemodonta punctatostriata* (H. & A. ADAMS), ³/₁.
5 km to Ban Rong Mai from Welu Bridge (995) [SMF 220651a].
- Fig. 81. *Laemodonta siamensis* (MORELET), ³/₁.
Laem Ngob; Trad [SMF 220653].
- Fig. 82. *Pythia plicata* (GRAY), ¹/₁.
Pak Panang; Nakon Sritammarat (972) [SMF 220654].
- Fig. 83. *Pythia (Trigonopythia) trigona* (TROSCHEL), ¹/₁.
Laem Sog, Ban Cha Kham; Laem Ngob Distr.; Trad (984) [SMF 220661].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 16.

- Fig. 84. *Cylindrotis quadrasi* MOELLENDORFF, ³/₁.
Klong Yai Pin, Ban Glea Don; Laem Ngob Distr.; Trad (4331) [SMF 220665a].
- Fig. 85. *Cylindrotis siamensis* n. sp., ⁸/₁.
Klung Harbour; Chantaburi (4334A) [Holotype SMF 198348a].
- Fig. 86. *Cassidula aurisfelis* (BRUGUIÈRE), ¹/₁.
Ban Klong Tamru; Chonburi (945) [SMF 220668].
- Fig. 87. *Cassidula multiplicata* MARTENS, ¹/₁.
Ranong, Custom House (948) [SMF 220785].
- Fig. 88. *Cassidula mustelina* (DESHAYES), ¹/₁.
Ban Ampoe, Satahib; Chonburi (4281) [SMF 220792].
- Fig. 89. *Auriculastra subula* (QUOY & GAIMARD), ³/₁.
Ban Ampoe, Satahib; Chonburi (4337) [SMF 220794].
- Fig. 90. *Melampus (Melampus) fasciatus* (DESHAYES), ²/₁.
Island of Puket, near town of Puket (966) [SMF 220798].
- Fig. 91. *Melampus (Micromelampus) nucleolus* MARTENS, ²/₁.
2 km S of Palian (1000) [SMF 220800].
- Fig. 92. *Melampus (Micromelampus) siamensis* MARTENS, ²/₁.
Pak Panang; Nakon Sritammarat (970) [SMF 220804].
- Fig. 93. *Ellobium aurismidae* (LINNAEUS), ¹/₁.
Tachalae; Chantaburi (913) [SMF 220796].
- Fig. 94. *Ellobium aurisjudae* (LINNAEUS), ¹/₁.
Ban Ampoe, Satahib Distr.; Chonburi (939) [SMF 220795].
- Fig. 95. *Lymnaea (Radix) auricularia rubiginosa* (MICHELIN), ¹/₁.
Chandi [SMF 219832].
- Fig. 96. *Lymnaea (Radix) auricularia swinhoei* (H. ADAMS), ¹/₁.
Wat Chom Kam; Mae Hongson (860) [SMF 219831].
- Fig. 97. *Lymnaea (Radix) viridis* (QUOY & GAIMARD), ³/₁.
Pak Klong San; Thonburi (861) [SMF 219833].
- Fig. 98. *Lymnaea (Radix) luteola* (LAMARCK), ¹/₁.
Ban Krung Khayan, Thung Yai Distr.; Nakon Sritammarat (4260) [SMF 219836].
- Fig. 99. *Indoplanorbis exustus* (DESHAYES), ¹/₁.
Ditch near Wat Sri Muang School, Prachinburi (4121) [SMF 220809a].
- Fig. 1. *Camptoceras jiraponi* HUBENDICK, ⁶/₁.
Wat Gaeo at Bang Kum; Thonburi (901A) [Holotype SMF 197364].
- Fig. 2. *Amerianna carinata* (H. ADAMS), ²/₁.
Bangkok-Dusit, Klong Premprachakon (892) [SMF 195085].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 17

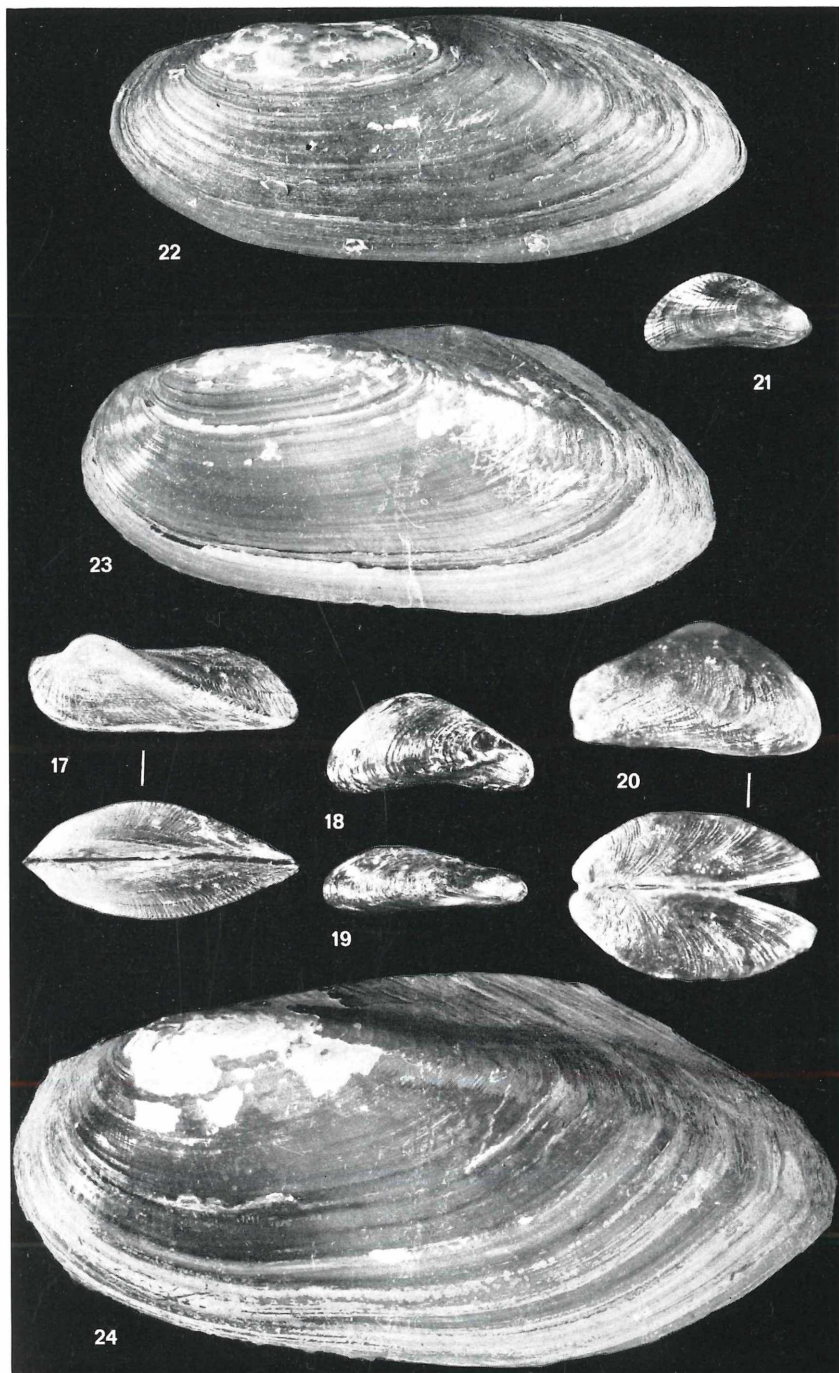
- Fig. 3. *Gyraulus convexiusculus* (HUTTON), ³/₁.
Klong near Ratburi Station; Ratburi (4163) [SMF 219817].
- Fig. 4. *Gyraulus siamensis* (MARTENS), ³/₁.
Bangkok-Pratumwan, Phyatai Road (799) [SMF 220810].
- Fig. 5. *Gyraulus prasongi* n. sp., ⁸/₁.
Swamp 2 km N of Satun (4201A) [Holotype SMF 198287].
- Fig. 6. *Gyraulus hubendicki* n. sp., ⁸/₁.
Swamp 2 km N of Satun (4193A) [Holotype SMF 198300].
- Fig. 7. *Gyraulus rotula* (BENSON), ⁸/₁.
Aranyapratet near Air-port (4202) [SMF 198302a].
- Fig. 8. *Gyraulus bakeri* n. sp., ⁸/₁.
Huai Kam Mi, 46 km N of Prae (4203A) [Holotype SMF 198296].
- Fig. 9. *Hippeutis (Helicorbis) umbilicalis* (BENSON), ³/₁.
Prachinburi, swamp in town (770) [SMF 220812].
- Fig. 10. *Segmentina (Polypilis) calathus* (BENSON), ³/₁.
Tak, swamp near Kitikachon Bridge (779) [SMF 220813].
- Fig. 11. *Segmentina (Polypilis) hemisphaerula* (BENSON), ³/₁.
Ayutthiya, Klong in Rama Park (778) [SMF 220814].
- Fig. 12. *Segmentina (Trochorbis) trochoides* (BENSON), ³/₁.
Bangkok-Dusit, Pracharat Road (747) [SMF 220815a].
- Fig. 13. *Ferrissia (Pettancyclus) baconi* (BOURGUIGNAT), ⁸/₁.
Nam Mae Ngao, Ngao; Lampang (1011) [SMF 220818].
- Fig. 14. *Ferrissia (Pettancyclus) verruca* (BENSON), ⁸/₁.
Huai Nam Un, Ban Pang Mon, 53 km S of Nan; Sa Distr. (889) [SMF 221385a].
- Fig. 15. *Ferrissia (Pettancyclus) siamensis* n. sp., ⁸/₁.
Creek N of Ban Kham, 18 km NW of Nan (1013A) [Holotype SMF 228816].
- Fig. 16. *Gundlachia hubendicki* n. sp., ⁸/₁.
Klong Premprachakon, Bangkok-Dusit (881A) [Holotype SMF 198303].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 18.

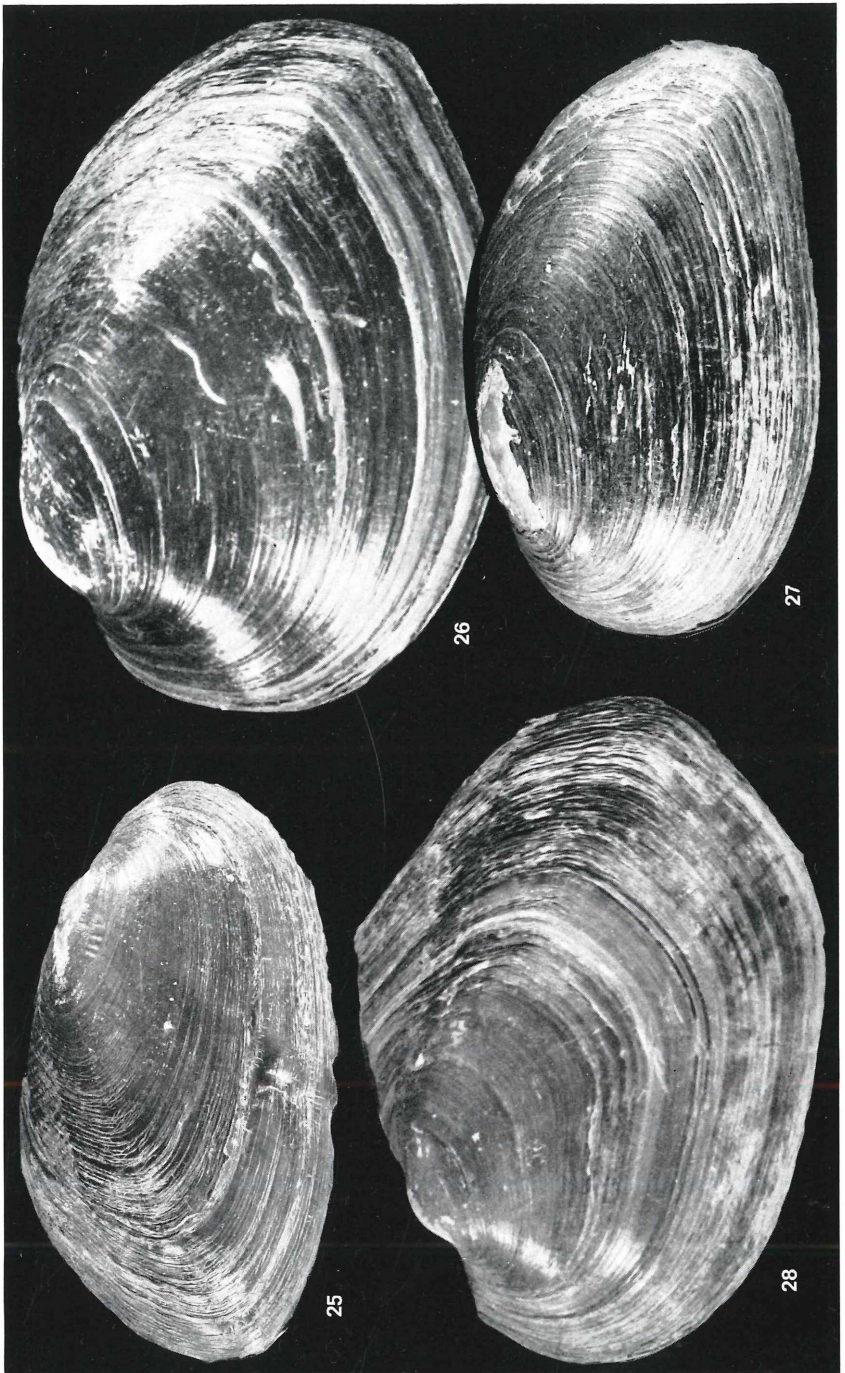
- Fig. 17. *Scaphula pinna* BENSON, $\frac{3}{1}$.
Bang Pa-In, trench in the park (2836) [SMF 220820a].
- Fig. 18-19. *Limnoperna siamensis* (MORELET), $\frac{1}{1}$.
Maenam Kham at Tat Panom; Nakon Panom (2842) [SMF 219122a].
- Fig. 20. *Limnoperna supoti* n. sp., $\frac{8}{1}$.
Maenam Kaek in Sopa Falls, 80 km E of Pitsanulok (6535A) Holotype SMF 219130].
- Fig. 21. *Brachidontes arcuatulus* (HANLEY), $\frac{1}{1}$.
Tale Luang at Ban Sam Pam; Pattalung (2772) [SMF 219128a].
- Fig. 22. *Pilsbryoconcha lemeslei* (MORELET), $\frac{1}{1}$.
Huai Tadjek, Nang Rong; Buriram (2662) [SMF 220822].
- Fig. 23. *Pilsbryoconcha exilis exilis* (LEA), $\frac{1}{1}$.
Ratburi [SMF 220823].
- Fig. 24. *Pilsbryoconcha exilis compressa* (MARTENS), $\frac{1}{1}$.
Bang Pa-In, in park lake (2626) [SMF 220824].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 19.

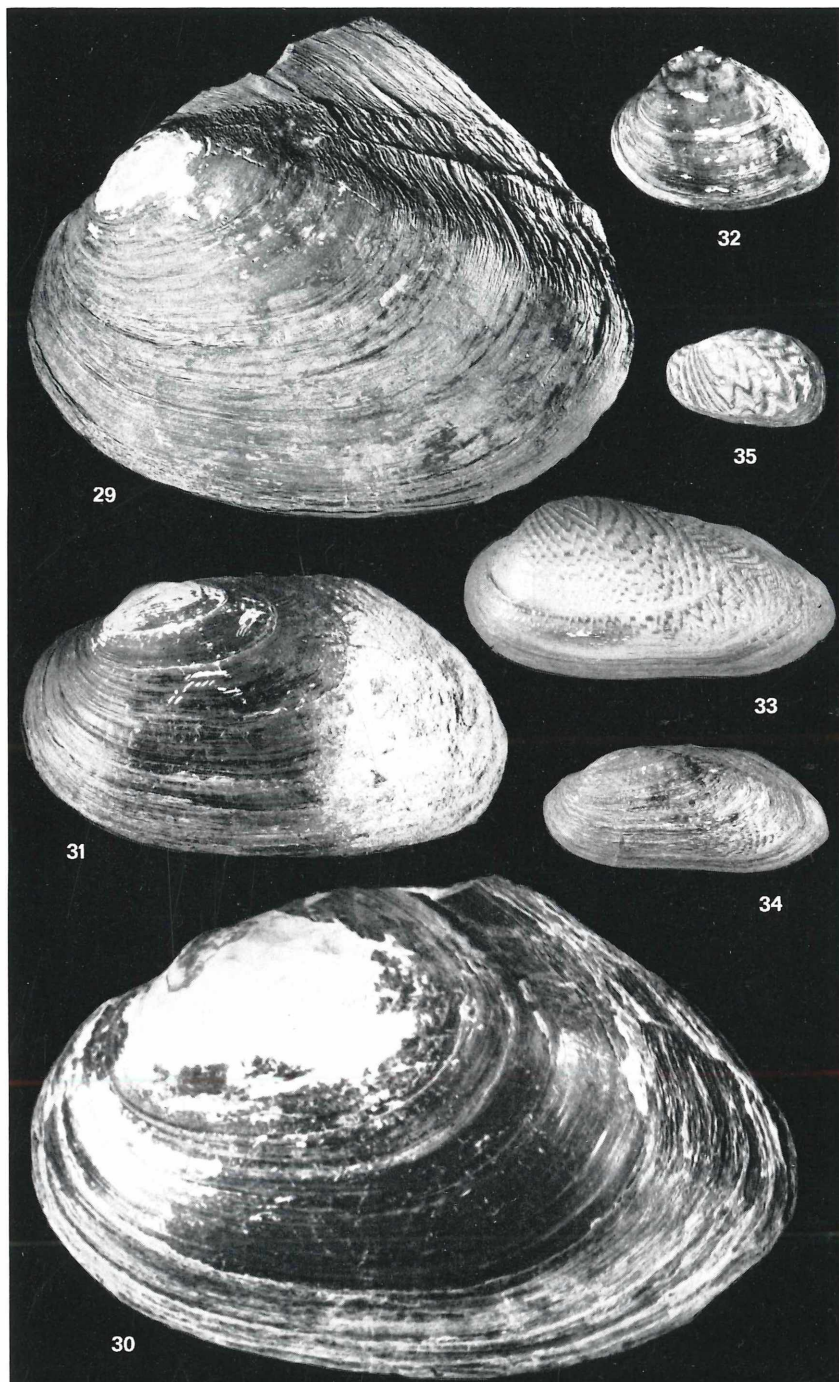
- Fig. 25. *Pseudodon mouhoti* (LEA), ¹/₁.
Huai Claeng Yang, Pibun Mangsahan, Chonh Mok; Ubon (5941) [SMF 220900a].
- Fig. 26. *Pseudodon inoscularis callifer* (MARTENS), ¹/₁.
Klong Bang Phae at Dong Seng; Ratburi (5924) [SMF 188806a].
- Fig. 27. *Pseudodon inoscularis cumingi* (LEA), ¹/₁.
Huai Kroad, Ban Bung, Bang La Mung; Chonburi (5931) [SMF 188811].
- Fig. 28. *Pseudodon cambodjensis cambodjensis* (PETIT), ¹/₁.
Lopburi River, Lopburi (2608) [SMF 188792a].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 20.

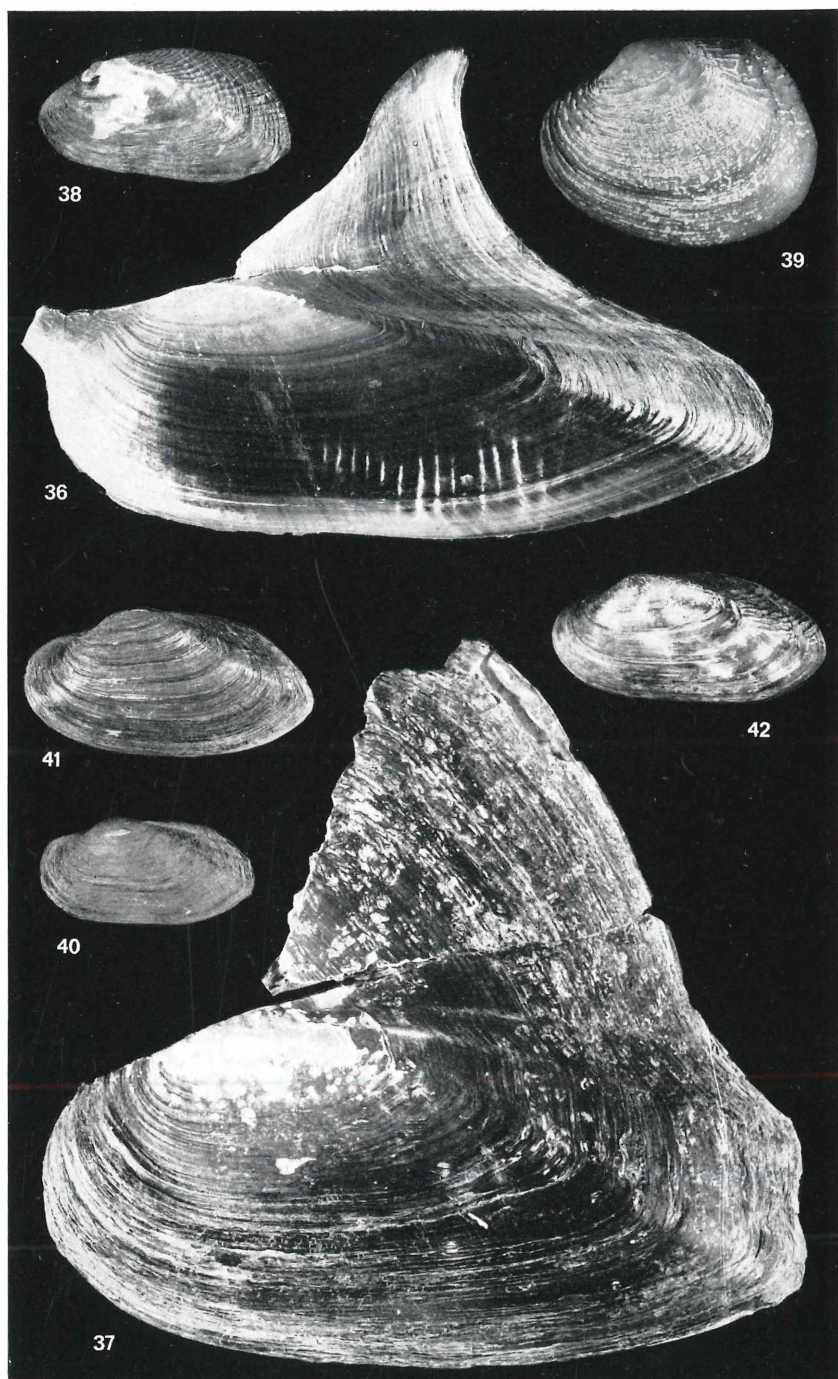
- Fig. 29. *Pseudodon cambodjensis tenerrimus* n. subsp., ¹/₁.
Songkram River at Sri Songkram (5937A) [Holotype SMF 188817].
- Fig. 30. *Pseudodon vondembuschianus ellipticus* (CONRAD), ¹/₁.
Lopburi River, Lopburi (2424) [SMF 188720].
- Fig. 31. *Pseudodon vondembuschianus chaperi* (MORGAN), ¹/₁.
Perlis (Malaya): stream near Kapong Pog Malew (2565) [SMF 188740a].
- Fig. 32. *Unionetta fabagina* (DESHAYES), ¹/₁.
Maenam Songkram at Sri Songkram; Nakon Panom (5872) [SMF 220833].
- Fig. 33. *Scabies crispata* (GOULD), ¹/₁.
Bangkok-Dusit, Klong around Chitlada Palace (2375) [SMF 188682a].
- Fig. 34. *Scabies phaselus* (LEA), ¹/₁.
Takrong River; Nakon Ratchasima (2512) [SMF 188695a].
- Fig. 35. *Scabies nucleus* (LEA), ¹/₁.
Laos: Mekong River at Paksé (15785) [SMF 198394].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 21.

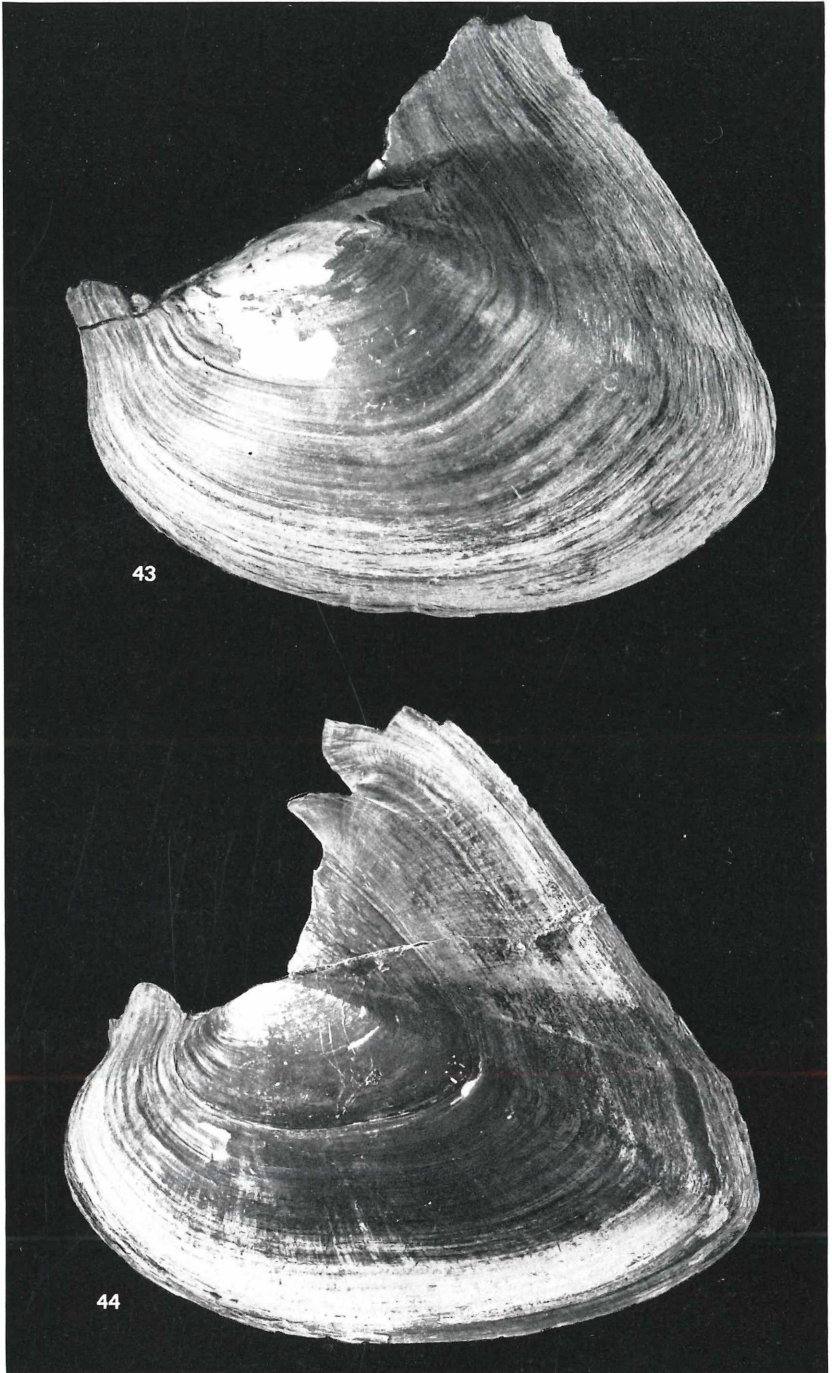
- Fig. 36. *Hyriopsis (Hyriopsis) bialatus* SIMPSON, ³/₄.
Bang Pa-In, klong in the park (2681) [SMF 221330].
- Fig. 37. *Hyriopsis (Hyriopsis) delaportei* (CROSSE & FISCHER), ¹/₁.
Cambodia: Sekong River at Stung Treng (16954) [SMF 221307].
- Fig. 38. *Harmandia munensis* n. sp., ¹/₁.
Mun River at Pibun Mangsahan (5792A) [Holotype SMF 220828].
- Fig. 39. *Parreysia burmana* (BLANFORD), ¹/₁.
Moei River at Ban Mae Kon Ken; Mae Sot [SMF 220857].
- Fig. 40. *Indonaia substriata* (LEA), ¹/₁.
Maenam Maeklong at Ratburi town (2469) [SMF 220834].
- Fig. 41. *Indonaia pilata* (LEA), ¹/₁.
Laos: Mekong River at Moulapanuk (16856) [SMF 220837].
- Fig. 42. *Indonaia humilis* (LEA), ¹/₁.
Laos: Se Bang Fai River, oppos. Tat Panom (16853) [SMF 220838].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 22.

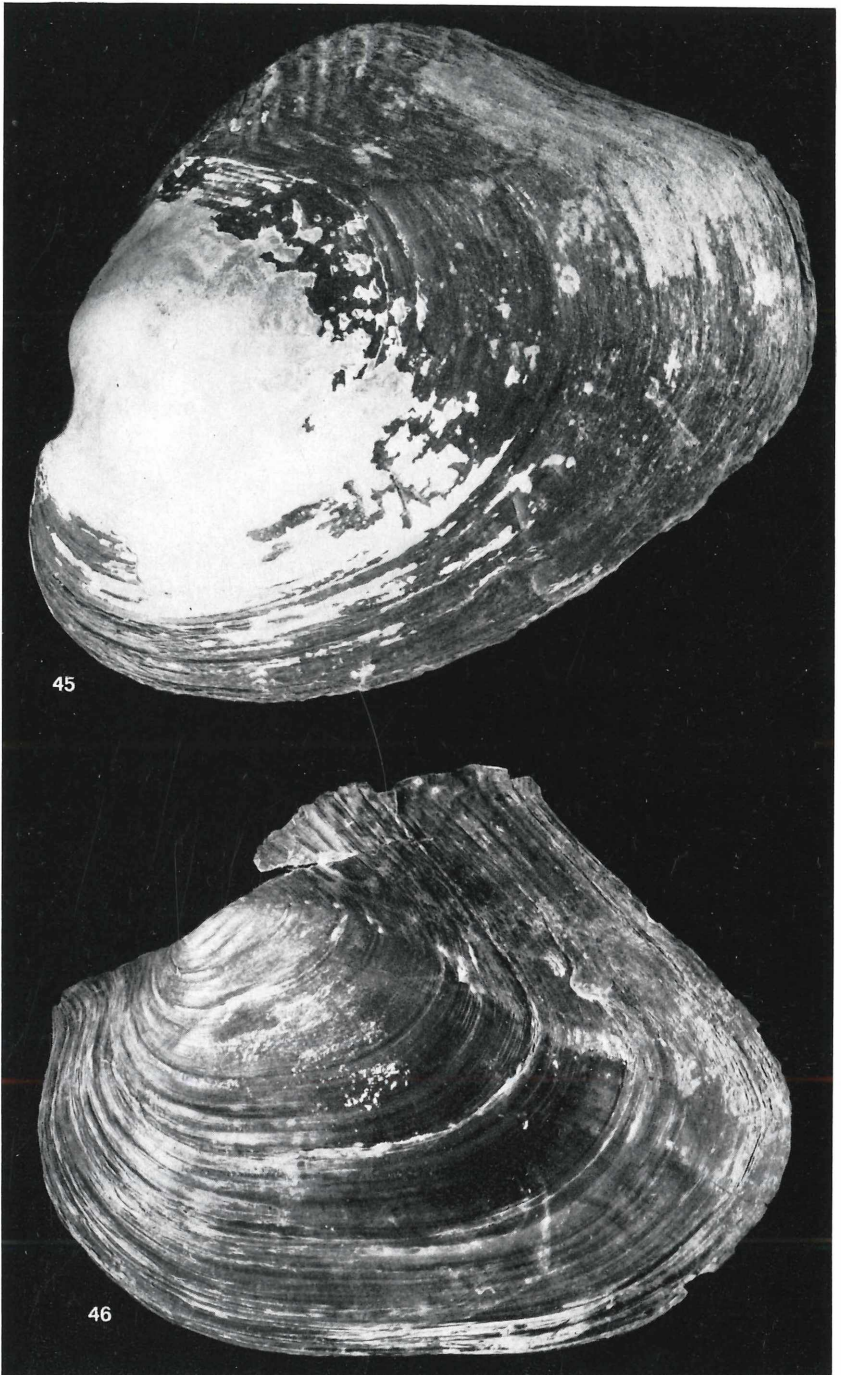
- Fig. 43. *Hyriopsis (Limnoscapha) desowitzi* n. sp., ¹/₁.
Klong Rapipat at Ban Ta Luang; Ayutthia (2561A) [Holotype SMF 221303].
- Fig. 44. *Hyriopsis (Limnoscapha) myersiana* (LEA), ³/₄.
Klong Rapipat at Ban Ta Luang; Ayutthia (2295) [SMF 221305].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 23.

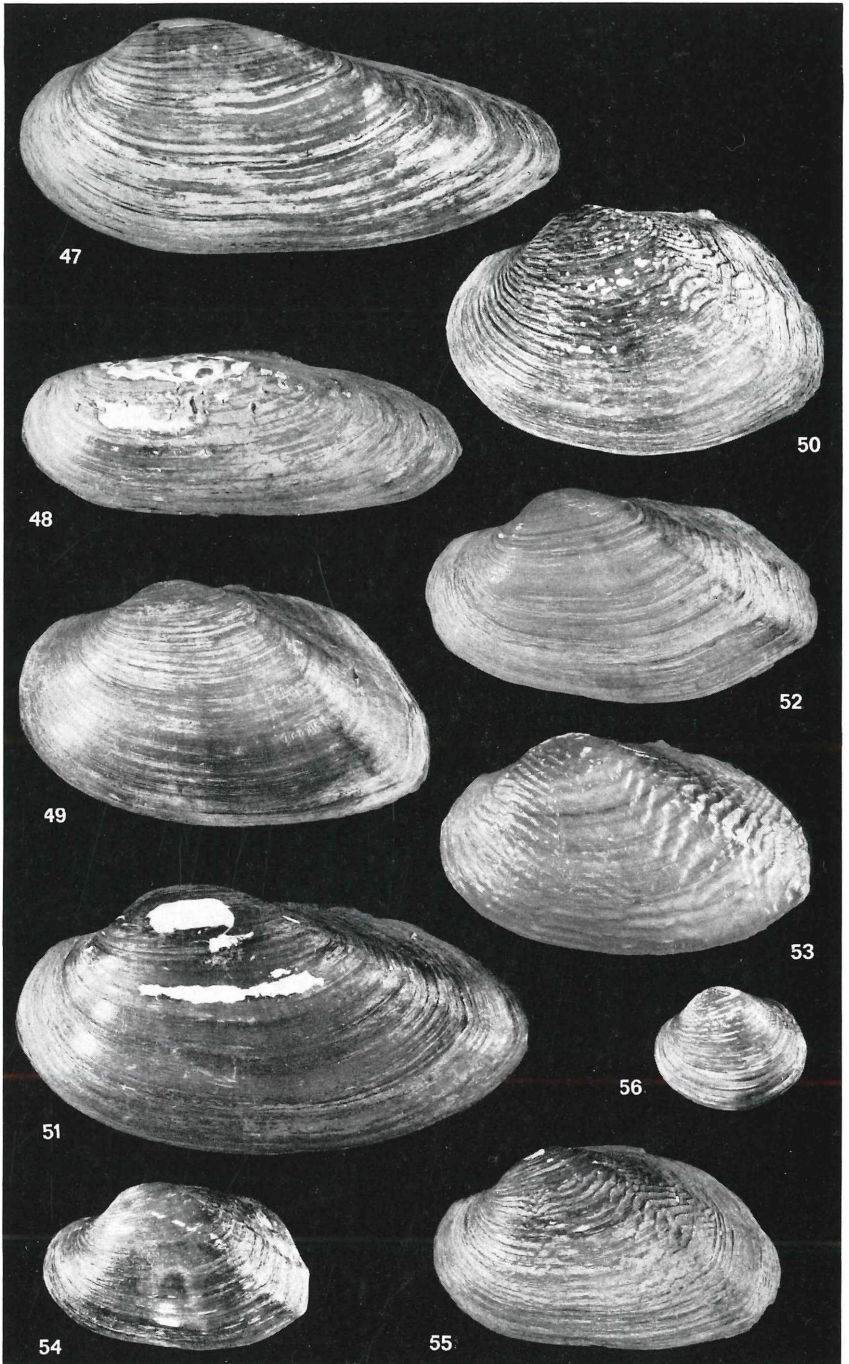
- Fig. 45. *Chamberlainia hainesiana* (LEA), $\frac{3}{4}$.
Maenam Kwae Noi at Sai Yok; Canchanaburi (2353) [SMF 188669].
- Fig. 46. *Cristaria plicata* (LEACH), $\frac{3}{4}$.
Mekong River at Bandan (5897) [SMF 220859].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 24.

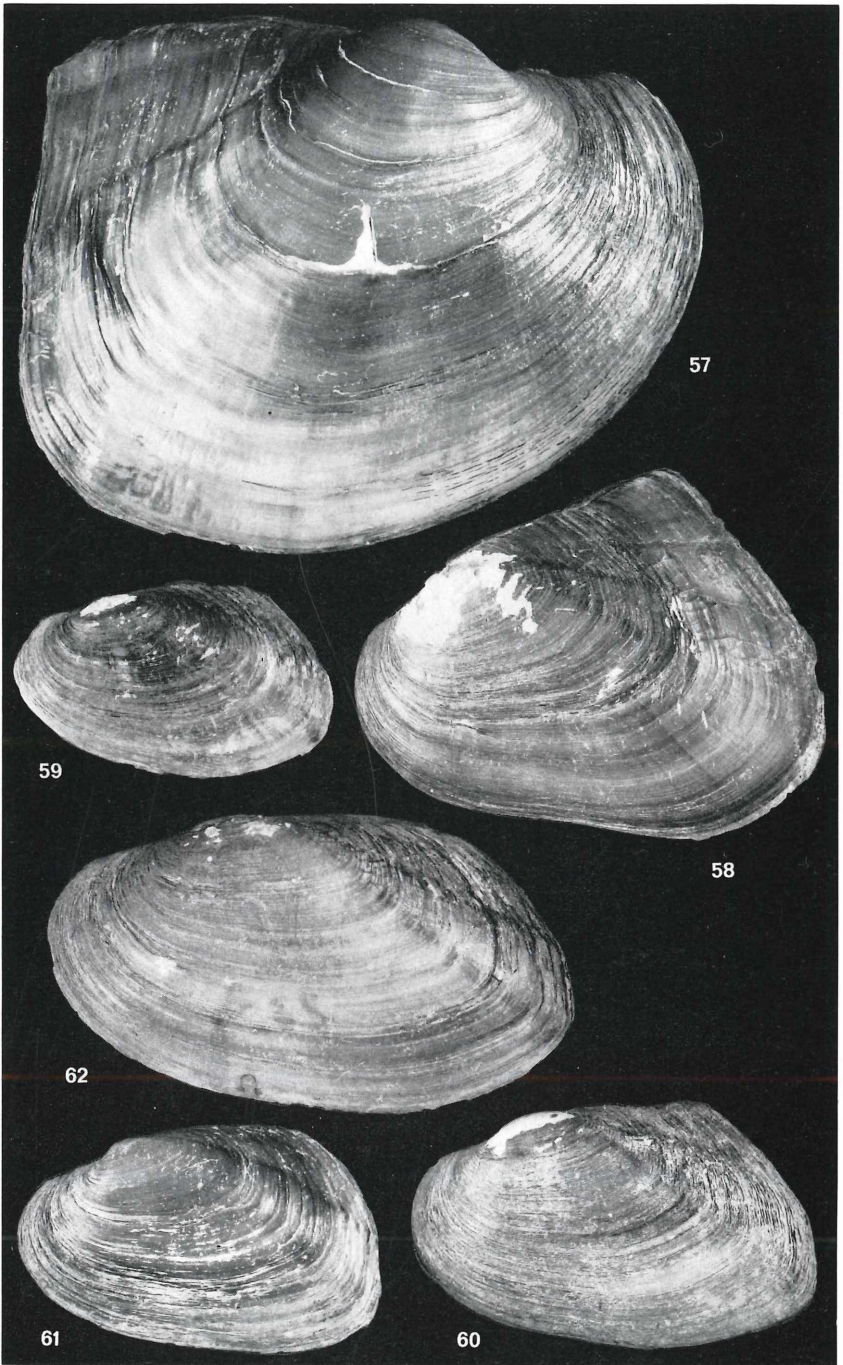
- Fig. 47. *Ensidens ingallsianus ingallsianus* (LEA), ¹/₁.
Bang Pa-In, Schloßpark (2443) [SMF 188647a].
- Fig. 48. *Ensidens ingallsianus dugasti* (MORLET), ¹/₁.
Maenam Songkram near Sri Songkram; Nakon Panom (2393) [SMF 198402a].
- Fig. 49. *Uniandra contradens ascia* (HANLEY), ¹/₁.
Maeklong River at Ban Pong; Ratburi (2341) [SMF 188838a].
- Fig. 50. *Uniandra contradens rusticoides* n. subsp., ¹/₁.
Klong Min near Chandi, Chawang; Nakong Sritammarat (2435) [Holotype SMF 220845].
- Fig. 51-52. *Uniandra contradens tumidula* (LEA), ¹/₁.
51) Bangkok-Dusit, Klong around Chitlada Palace (2347) [SMF 188868a].
52) (*asperula* LEA) Maenam Kwae Noi near Kanchanaburi (2413) [SMF 220854].
- Fig. 53. *Uniandra contradens rustica* (LEA), ¹/₁.
Klong Ta Luang, Ban Wattayom, Wang Thong; Pitsanulok (6014) [SMF 220850].
- Fig. 54. *Uniandra contradens crossei* (DESHAYES), ¹/₁.
Laos: Mekong at Takek (2346) [SMF 220848].
- Fig. 55. *Uniandra contradens fischeriana* (MORLET), ¹/₁.
Klong Pra Satung at Srakeo (2434) [SMF 220849].
- Fig. 56. *Uniandra subcircularis* n. sp., ¹/₁.
Laos: Mekong between Takek and Nakon Panom (16921A) [Holotype SMF 220846].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 25.

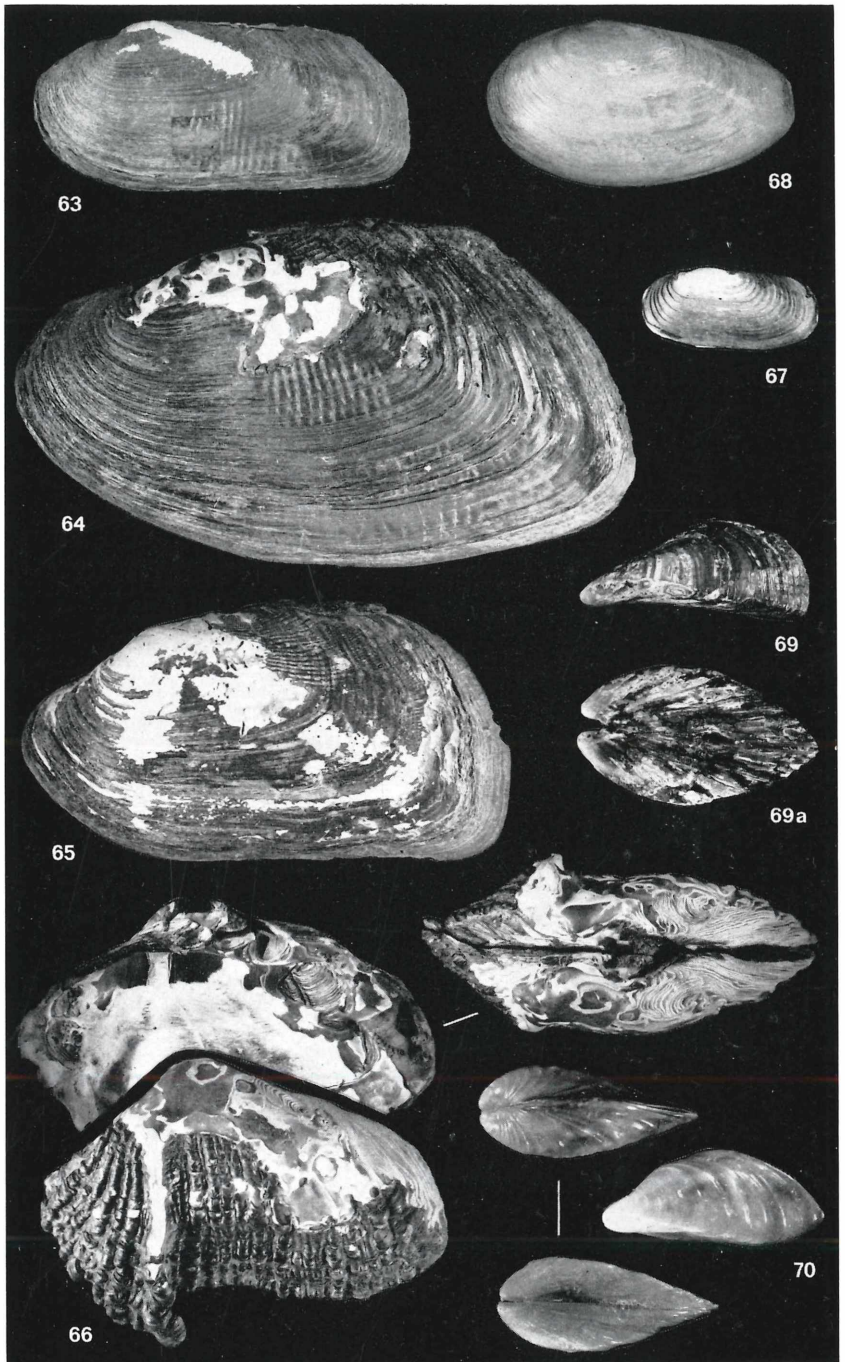
- Fig. 57. *Physunio superbus* (LEA), ¹/₁.
Mae Klong at Ban Rai, Potaram; Ratburi (2643) [SMF 188834a].
- Fig. 58. *Physunio eximius* (LEA), ¹/₁.
Mun River at Ban Kha Yung (2584) [SMF 220840].
- Fig. 59. *Physunio inornatus* (LEA), ¹/₁.
Klong Ta Luang, Noen Glum, Ban Wattayom; Pitsanulok (2642) [SMF 220844].
- Fig. 60. *Physunio micropterus* (MORELET), ¹/₁.
Huai Wat Luang near Aranyapratet (2348) [SMF 220842].
- Fig. 61. *Physunio cambodiensis* (LEA), ¹/₁.
River Nam On, S of Ngao (2474) [SMF 220843].
- Fig. 62. *Physunio modelli* n. sp., ¹/₁.
Maenam Pong at Pong Nib Dam; Konkaen (2523) [Holotype SMF 220841].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 26.

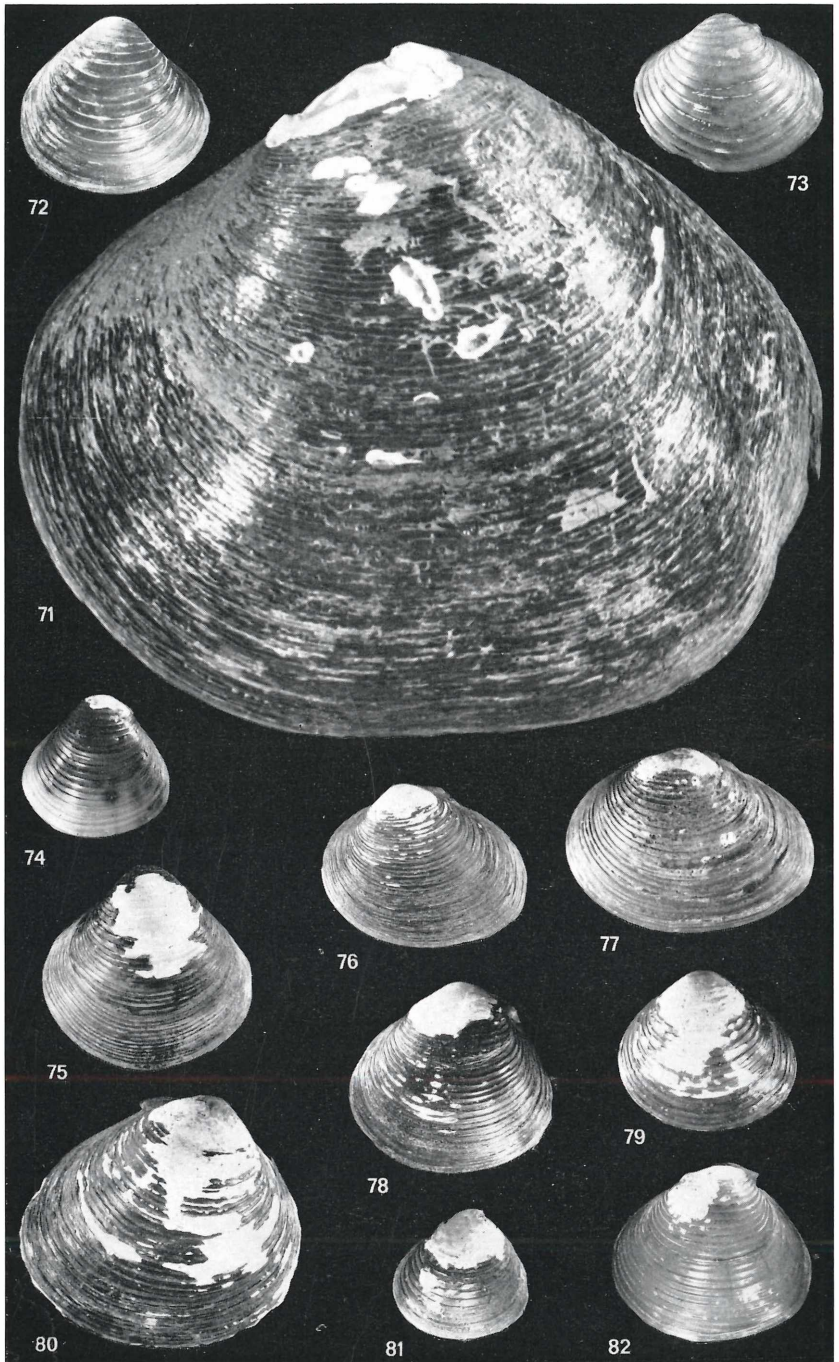
- Fig. 63. *Trapezoides exolescens exolesecens* (GOULD), ¹/₁.
Huai Kaek Noi, Ban La Po; Pitsanulok (2649) [SMF 188747a].
- Fig. 64. *Trapezoides exolescens pallegoixi* (SOWERBY), ¹/₁.
Lam Chi River at Mahachanachai; Ubon (2580) [SMF 188746a].
- Fig. 65. *Trapezoides exolescens comptus* (DESHAYES), ¹/₁.
Laos: Mekong at Ban Done Det, S of Khong (16838) [SMF 205137a].
- Fig. 66. *Modellnaia siamensis* n. g. n. sp., ¹/₁.
Mun River at Ban Tha Tum; Surin (2641A) [Holotype SMF 220829].
- Fig. 67. *Novaculina siamensis* MORLET, ¹/₁.
Klong Rapiat at Ban Ta Luang; Ayutthia (2692) [SMF 219062a].
- Fig. 68. *Pharella waltoni* n. sp., ¹/₁.
Klong Bang Sue, Bangkok-Dusit (2631) [Holotype SMF 219058].
- Fig. 69. *Sinomytilus harmandi* (ROCHEBRUNE), ¹/₁.
Laos: Mekong River at Paksé [SMF 229198].
- Fig. 70. *Sinomytilus morrisoni* n. sp., ¹/₄.
Mun River, 6 km W of Ban Ta Thum [Holotype SMF 229202].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 27

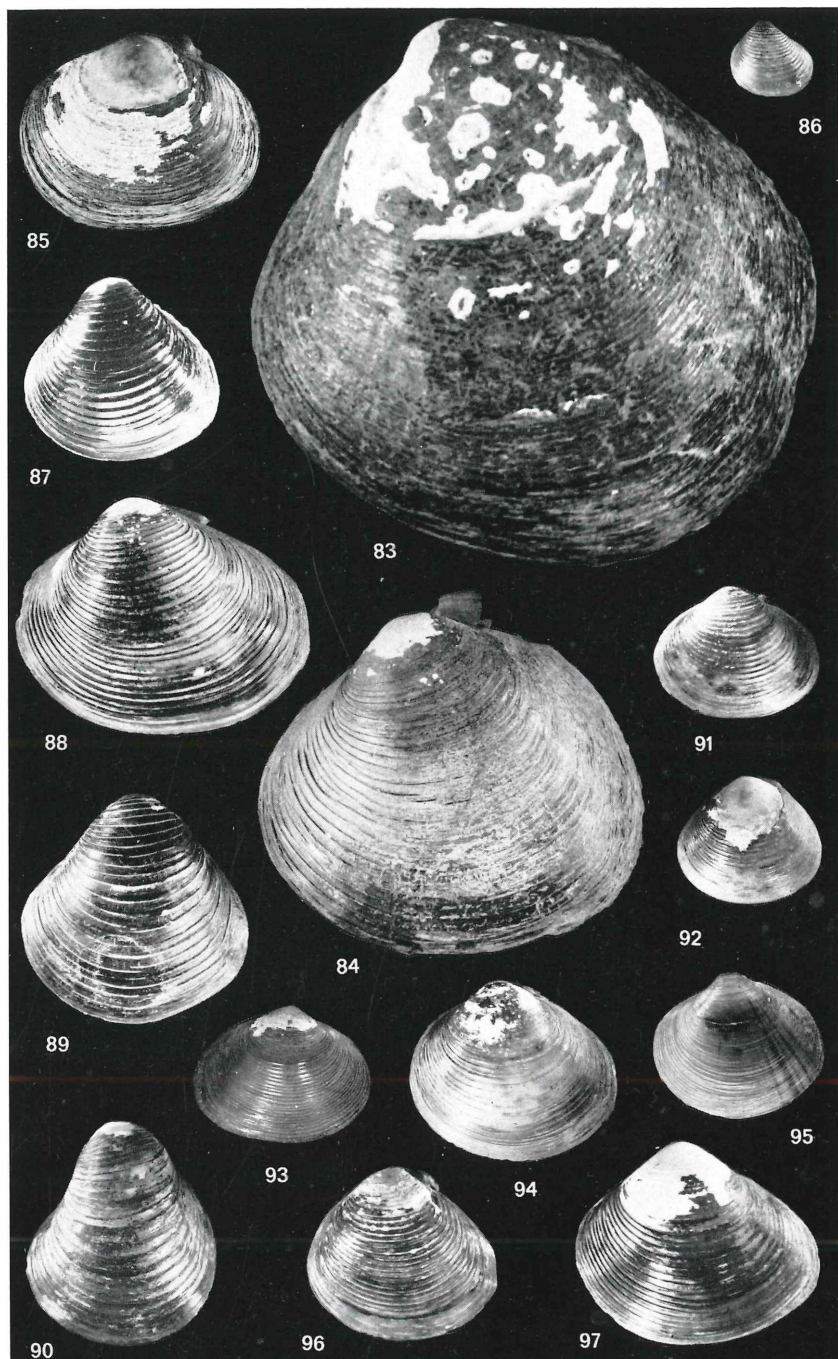
- Fig. 71. *Polymesoda (Geloina) coaxans* (GMELIN), 1/1.
Ban Nam Chio, 8 km S of Trat (2797) [SMF 219009].
- Fig. 72. *Corbicula blandiana* PRIME, 1/1.
Mun River, Ubon (6706) [SMF 234380].
- Fig. 73. *Corbicula arata* (SOWERBY), 1/1.
Maenam Ping, Wutikon Bridge S of Tak (2752) [SMF 197381].
- Fig. 74-75. *Corbicula lydigiana* PRIME, 1/1.
74) Lopburi River near Lopburi (2721) [SMF 197463].
75) (= *larnaudieri* PRIME) Ban Song Roi, Maeklong River [SMF 197456a].
- Fig. 76-77. *Corbicula lamarckiana* PRIME, 1/1.
76) Maenam Yom at Prae (6738) [SMF 197397a].
77) Petburi River, Petburi (2750) [SMF 197405a].
- Fig. 78. *Corbicula cyreniformis* PRIME, 1/1.
Petburi River at Petburi town (6702) [SMF 197386a].
- Fig. 79. *Corbicula castanea* (MORELET), 1/1.
Maenam Yom at Prae (6765) [SMF 197384a].
- Fig. 80. *Corbicula bocourti* (MORELET), 1/1.
Mekong at Nakon Panom (2854) [SMF 234381].
- Fig. 81. *Corbicula erosa* PRIME, 1/1.
Klong Pra Sae Bon, Glaeng Distr. (6760) [SMF 234386].
- Fig. 82. *Corbicula javanica* (MOUSSON), 1/1.
Saiburi River at Pattani (6803) [SMF 205112a].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 28.

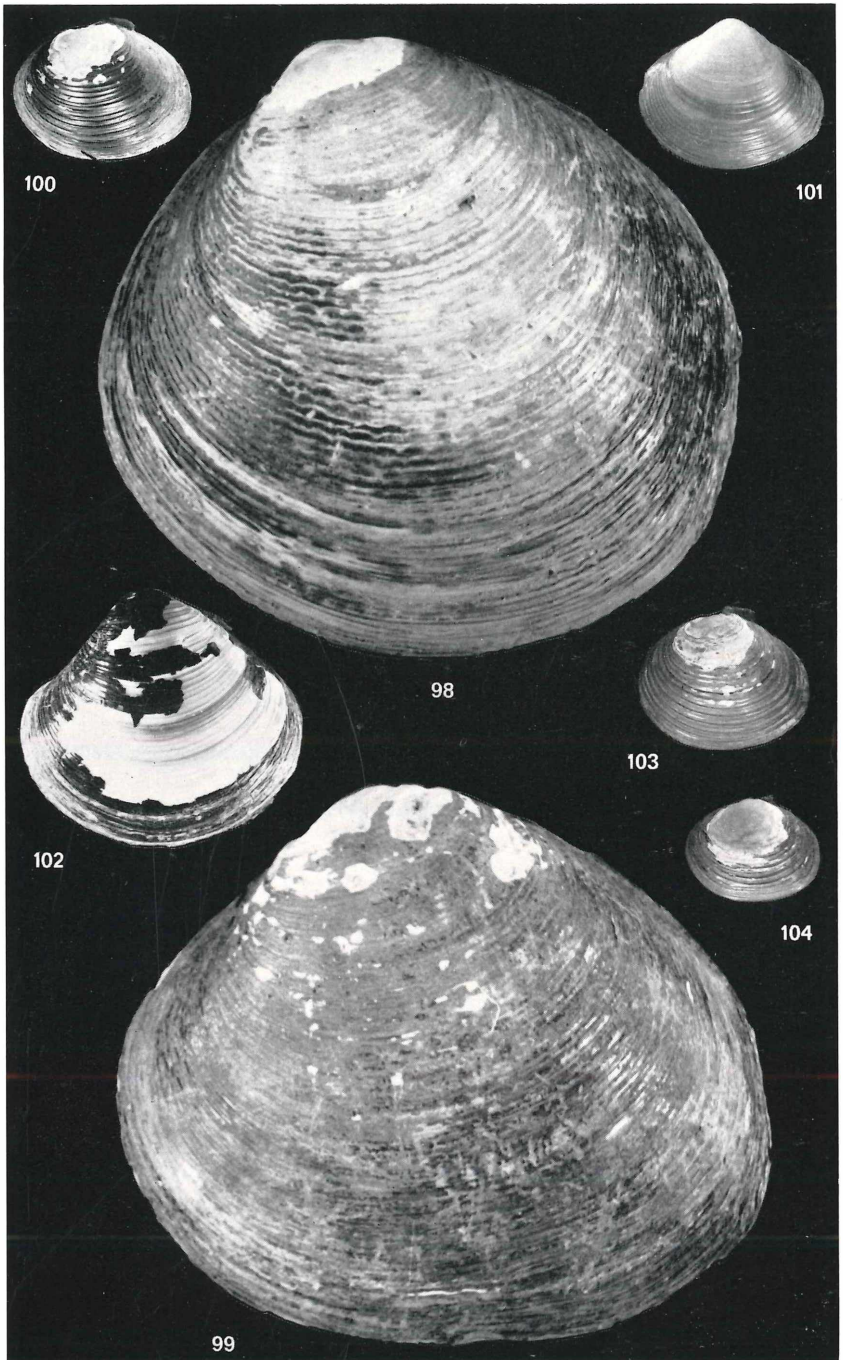
- Fig. 83. *Polymesoda (Geloina) bengalensis* (LAMARCK), 1/1.
Ban Muang, Takua Pa; Pang Nga (6642) [SMF 219018].
- Fig. 84. *Batissa similis* PRIME, 1/1.
Mae Noi River between Grabi and Trang (2788) [SMF 217999a].
- Fig. 85. *Corbicula tenuis* CLESSIN, 1/1.
Laos: Mekong River at Paksé (17043) [SMF 197436].
- Fig. 86. *Corbicula regia* CLESSIN, 1/1.
Trang (2706) [SMF 228100a].
- Fig. 87. *Corbicula gustaviana* MARTENS, 1/1.
Tale Luang at Lam Pam; Pattalung (6805) [SMF 197423a].
- Fig. 88. *Corbicula noetlingi* MARTENS, 1/1.
Maenam Fang, 6 km S of Fang (2738) [SMF 197418a].
- Fig. 89-90. *Corbicula moreletiana* PRIME, 1/1.
89) Irrigation canal Ubon Ratachatani (2702) [SMF 197466a].
90) (= *petiti* MORLET) Cambodia: Mekong River at Phnom Penh (17006)
[SMF 228101a].
- Fig. 91. *Corbicula iravadica* HANLEY & THEOBALD, 1/1.
Huai Mae Dao near Mae Sot; Tak (2735) [SMF 197396a].
- Fig. 92. *Corbicula gubernatoria* PRIME, 1/1.
Saigon [SMF 225798a].
- Fig. 93. *Corbicula pingensis* n. sp., 1/1.
Maenam Ping at Chieng Mai (6720) [Holotypus SMF 234287].
- Fig. 94. *Corbicula occidentiformis* n. sp., 1/1.
Maenam Loei near Loei (2734A) [Holotypus SMF 197431].
- Fig. 95. *Corbicula leviuscula* PRIME, 1/1.
Mekong at Ban Khum Rapids, Bandan; Ubon [SMF 225771].
- Fig. 96. *Corbicula solidula* PRIME, 1/1.
Lam Than, Maenam Pao; Kalasin (2737) [SMF 197424a].
- Fig. 97. *Corbicula fluminea* (O. F. MÜLLER), 1/1.
Maenam Chao Praya at Chainat (2710) [SMF 197387].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 29.

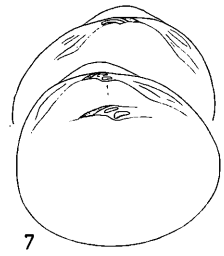
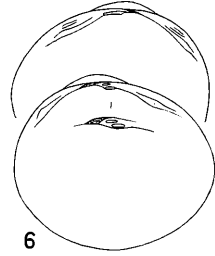
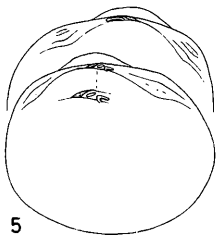
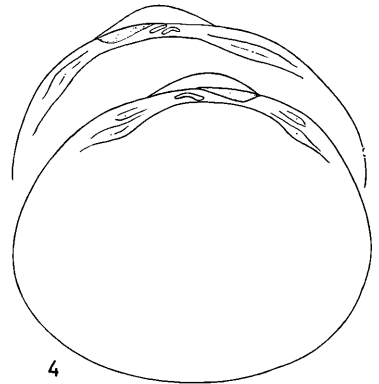
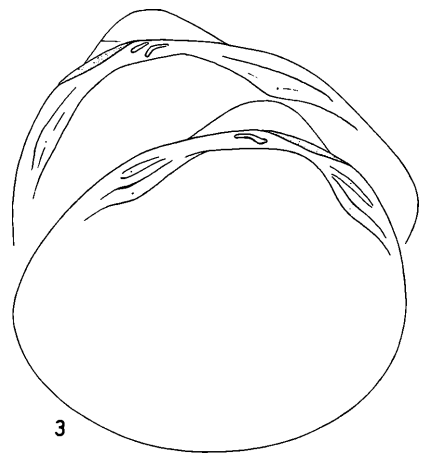
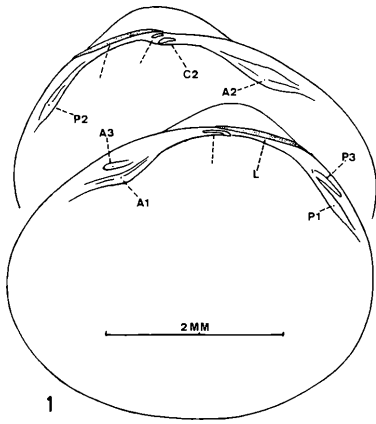
- Fig. 98. *Polymesoda (Geloina) proxima* (PRIME), ¹/₁.
Klong Ta Kruat between Chantaburi and Tachalaeb (6646) [SMF 219021].
- Fig. 99. *Polymesoda (Geloina) galathea* (MÖRCH), ¹/₁.
Ban Muang, Takua Pa; Pang Nga (2789) [SMF 216000].
- Fig. 100. *Corbicula messengeri* BAVAY & DAUTZENBERG, ¹/₁.
Tonkin: Between Lang-Son and That-Khé [Syntype SMF 197414].
- Fig. 101. *Corbicula virescens* n. sp., ¹/₁.
Chao Praya River at Nakon Sawan (2751A) [Holotype SMF 228106].
- Fig. 102. *Corbicula baudoni* MORLET, ¹/₁.
Mae Klong River, Ratburi (2724) [SMF 197461a].
- Fig. 103. *Corbicula vokesi* n. sp., ¹/₁.
Mekong River at Nakon Panom (6741) [Holotype SMF 234461].
- Fig. 104. *Corbicula heardi* n. sp., ¹/₁.
Mekong River at Nakon Panom (6751) [Holotype SMF 197413].



BRANDT: The non-marine aquatic Mollusca of Thailand.

Plate 30.

- Fig. 1. *Pisidium javanum* VAN BENTHEM JUTTING.
Bangkok, Klong Premprachakon (2808).
- Fig. 2. *Pisidium clarkeanum* G. & H. NEVILL.
Pool in front of Chieng Dao Cave (11263).
- Fig. 3. *Pisidium nevilleanum* THEOBALD.
Ban Dan Dao, Dan Sai; Loei (ex 2813).
- Fig. 4. *Pisidium casertanum* (POLI).
Hot springs at Botanical garden Fang (11264).
- Fig. 5. *Pisidium prasongi* KUIPER n. sp.
Mae Sarieng River, side branch S of Mae Sarieng (2835).
- Fig. 6. *Pisidium sumatranum* MARTENS.
SW of Loei, between Ban Khuk Kam Pa and Ban Kok Charupa (2806).
- Fig. 7. *Pisidium annandalei* PRASHAD.
Klong Nga at Chandi, Chawang Distr. (11195).



BRANDT: The non-marine aquatic Mollusca of Thailand.

VII. Index.

<i>abbotti</i> BRANDT, <i>Assiminea</i>	142	<i>Anomia</i>	259
— <i>Assiminea</i> (<i>Sculptassiminea</i>)	142	<i>Anulotaia</i>	31
<i>abbreviatus</i> GOULD, <i>Solenocurtus</i> ..	305	<i>aperta</i> TEMCHAROEN, <i>Lithoglyphopsis</i>	112
<i>abnormalis</i> HABE, <i>Sinotaia ingallsiana</i>	27	<i>arata</i> SOWERBY, <i>Corbicula</i>	313
<i>abnormis</i> MORELET, <i>Unio</i>	294	<i>arata</i> THEOBALD, <i>Corbicula</i>	313
<i>acanthica</i> LEA, <i>Melania</i>	163	— <i>Cyrena</i>	313
<i>acicula</i> BRANDT, <i>Morrisonietta</i>	210	<i>arboricola</i> REEVE, <i>Littorina</i>	53
— <i>Paraprososthenia</i>	86	<i>arcuatula(us)</i> HANLEY, <i>Brachidontes</i>	257
<i>acicula</i> GMELIN, <i>Buccinum</i>	197	— <i>Modiola</i>	257
<i>acuminata</i> ANCEY, <i>Pachydrobia</i>	74	<i>armata</i> BRANDT,	
<i>acus</i> LESSON, <i>Pirena</i>	197	<i>Brotia</i> (<i>Paracrostoma</i>) <i>pseudo-</i>	
<i>acuta</i> BRANDT, <i>Stenothyra</i>	128	<i>sulcospira</i>	186
<i>acuta</i> POIRIER, <i>Jullienia</i>	81, 82	— <i>Paracrostoma pseudosulcospira</i> ..	186
<i>adami</i> BRANDT, <i>Paraprososthenia</i> ..	86	<i>articulata</i> GOULD, <i>Nerita</i>	6
<i>Adamietta</i> n. gen.	171	<i>arturrolli</i> BRANDT, <i>Sinotaia</i>	30
<i>adamsi</i> ISSEL, <i>Neritina</i>	9	<i>ascia</i> HANLEY, <i>Contradens</i>	289
<i>Adeorbis</i>	158	— <i>Uniandra contradens</i>	289, 291
<i>aenigmatica</i> LAMARCK, <i>Anomia</i>	259	— <i>Unio</i>	289
<i>Afropisidium</i>	329	<i>aspera</i> GMELIN, <i>Helix</i>	163
<i>alata(um)</i> PHILIPPI,		<i>asperata</i> LAMARCK, <i>Melania</i>	177
<i>Cerithidea</i> (<i>Cerithideopsilla</i>)	191	<i>asperula</i> BROT, <i>Melania</i>	167
— <i>Cerithium</i>	191	<i>asperulus</i> LEA, <i>Ensidents</i> (<i>Uniandra</i>)	291
<i>Amerianna</i>	237	— <i>Unio</i>	290
<i>amphibia</i> LESSON, <i>Nerita</i>	8	<i>Assiminea</i>	141
<i>ampullacea</i> LINNAEUS,		<i>Assiminea</i> (<i>Assiminea</i>)	147
<i>Ampullaria</i> (<i>Pila</i>)	50	<i>Assiminea</i> (<i>Austropilula</i>)	151
— <i>Helix</i>	49	<i>Assiminea</i> (<i>Eussoia</i>)	150
— <i>Pila</i>	49	<i>Assiminea</i> (<i>Metassiminea</i>)	143
<i>ampullaria</i> = <i>ampullacea</i> LINNAEUS	51	<i>Assiminea</i> (<i>Ovassiminea</i>)	146
<i>ampullaria</i> LESSON, <i>Nerita</i>	8	<i>Assiminea</i> (<i>Sculptassiminea</i>)	141
<i>andersoniana(us)</i> NEVILL, <i>Indonaia</i> ..	285	<i>Assiminea</i> (<i>Sphaerassiminea</i>)	144
— <i>Limnaea</i>	231	<i>associatus</i> WESTERLUND, <i>Planorbis</i> ..	239
<i>Anentome</i>	200	<i>ater</i> (<i>atra</i>) LINNAEUS, <i>Faunus</i>	197
<i>angelica</i> ANNANDALE, <i>Pachylabra</i> ..	51	— <i>Pirena</i>	197
— <i>Pila</i>	51	— <i>Strombus</i>	197
<i>angularis</i> HOMBRON & JACQUINOT,		<i>atropurpurea</i> RÉCLUZ, <i>Nerita</i>	7
<i>Nerita</i>	7	<i>auricula</i> KÜSTER, <i>Limnaeus</i>	229
<i>angulifera</i> QUOY & GAIMARD,		<i>auricularia</i> LINNAEUS,	
<i>Littorina</i>	53	<i>Lymnaea</i> (<i>Radix</i>)	229
<i>annamitica</i> WATTEBLÉD, <i>Corbicula</i> ..	314	<i>Auriculastra</i>	221
— <i>Limnaea</i>	231	<i>auriculus</i> KÜSTER, <i>Limnaeus</i>	229
<i>annandalei</i> BRANDT,		<i>aurisfelis</i> BRUGUIÈRE, <i>Bulimus</i>	219
<i>Cipangopaludina</i>	37	— <i>Cassidula</i>	219
— <i>Stenothyra</i>	131	— <i>Sidula</i>	219
<i>annandalei</i> KOBELT,		<i>aurisjudae</i> LINNAEUS, <i>Auricula</i>	227
<i>Vivipara bengalensis</i>	23	— <i>Bulla</i>	227
<i>annandalei</i> PRASHAD, <i>Pisidium</i>	332	— <i>Ellobium</i>	227
— <i>Pisidium</i> (<i>Odhneripisidium</i>)	332	<i>aurismalchi</i> MÜLLER, <i>Ellobium</i>	227
<i>annendalei</i> KOBELT, <i>Vivipara</i>	23	<i>aurismidae</i> LINNAEUS, <i>Auricula</i>	226
<i>anodontinum</i> ROCHEBRUNE,		— <i>Bulla</i>	226
<i>Pseudodon</i>	266	— <i>Ellobium</i>	226

<i>australiana</i> TAPP. CANEFRI, <i>Auricula</i>	227	<i>birmanica</i> TROSCHER, <i>Nerita (Pila)</i> ..	6
<i>australis</i> PETTERD, <i>Assimineae</i>	144	<i>birmanus</i> HANLEY & THEOBALD,	
<i>Austropilula</i>	151	<i>Unio</i>	279
<i>avarix</i> ANNANDALE, <i>Hydrobioides</i> ..	66	<i>Bithynia</i>	57
<i>avellana</i> RÉCLUZ, <i>Nerita (Clithon)</i> ..	12	<i>Bithynia (Digonistoma)</i>	58
— <i>Neritina</i>	12	<i>Bithynia (Gabbia)</i>	61
<i>baccata</i> GOULD, <i>Acrostoma</i>	178	<i>bizonalis</i> MÖRCH,	
— <i>Brotia</i>	178	<i>Nerita (Theliostyla)</i>	7
— <i>Melania</i>	178	<i>bizonata</i> DESHAYES, <i>Canidia</i>	203
<i>baconii</i> BOURGUIGNAT, <i>Ancylus</i>	249	<i>blaisei</i> DAUTZENBERG & FISCHER,	
— <i>Ancylus (Ferrissia)</i>	249	<i>Limnaea</i>	231
— <i>Ferrissia</i>	249	<i>blandiana</i> PRIME, <i>Corbicula</i>	313
— <i>Ferrissia (Pettancylus)</i>	249	<i>bockii</i> BROT, <i>Melania</i>	163
<i>bakeri</i> BRANDT, <i>Gyraulus</i>	242	<i>bocourti</i> BROT, <i>Canidia</i>	201
<i>balansai</i> MABILLE, <i>Limnaea</i>	231	<i>bocourti</i> MABILLE, <i>Chlorostracia</i>	47
<i>balteata</i> REEVE, <i>Nerita</i>	6	— <i>Mekongia</i>	47
<i>bandonensis</i> BRANDT, <i>Morrisonietta</i>	210	<i>bocourti</i> MORELET, <i>Corbicula</i> ..	314, 324
<i>bandoniana</i> = <i>baudoniana</i>	201	— <i>Corbicula fluminea</i>	314
<i>baschi</i> BRANDT, <i>Wattebledia</i>	65	— <i>Cyrena (Corbicula)</i>	314
<i>basicarinata</i> KOBELT, <i>Sinotaia ciliata</i>	34	<i>Bocourtia</i>	334
— <i>Vivipara</i>	34	<i>boeana</i> BROT, <i>Melania</i>	182
<i>basisculpta</i> BRANDT, <i>Stenothyra</i>	118	<i>bollingi</i> BRANDT, <i>Cyclotropis</i>	156
<i>batana</i> GOULD, <i>Melania</i>	167	— <i>Paraprososthenia</i>	86
<i>Batissa</i>	312	<i>bollingi</i> DAVIS, <i>Tricula</i>	68
<i>baudoni</i> MORELET, <i>Corbicula</i>	323	<i>bombayana</i> BLANFORD, <i>Fairbankia</i> ..	139
— <i>Corbicula fluminea</i>	323	— <i>Rissoina (Fairbankia)</i>	139
<i>baudonianus</i> MABILLE & LE MESLE,		<i>bombayana</i> THEOBALD, <i>Pisidium</i>	330
<i>Hemisinus</i>	201	<i>borneensis</i> PHILIPPI, <i>Ampullaria</i>	52
<i>bavayi</i> BRANDT, <i>Pachydrobia</i>	74, 76	— <i>Pachylabra</i>	52
<i>bedaliensis</i> RENSCH, <i>Assimineae</i>	157	<i>bourguignati</i> MABILLE, <i>Chlorostracia</i>	47
— <i>Cyclotropis</i>	157	<i>bowelli</i> PRESTON, <i>Limnaea</i>	231
— <i>Syncera</i>	157	<i>Brachidontes</i>	257
<i>beddomeana</i> NEVILL, <i>Assimineae</i>	151	<i>brandti</i> TEMCHAROEN,	
— <i>Assimineae (Austropilula)</i>	151	<i>Paraprososthenia</i>	86
<i>begini</i> MORLET, <i>Ampullaria</i>	51	<i>braueri</i> KOBELT, <i>Mekongia swainsoni</i>	43
<i>bella</i> VON DEM BUSCH, <i>Neritina</i>	9	— <i>Vivipara</i>	43
<i>bellus</i> MORELET, <i>Anodonta</i>	278	<i>brenieri</i> BAVAY & DAUTZENBERG,	
<i>bengalensis</i> LAMARCK, <i>Cyrena</i>	310	<i>Ancylus</i>	249
— <i>Paludina</i>	21, 24	<i>brevicula</i> PFEIFFER, <i>Assimineae</i>	145
— <i>Polymesoda (Geloina)</i>	310	— <i>Assimineae (Sphaerassimineae)</i>	145
— <i>Vivipara</i>	22	— <i>Hydrocena</i>	145
<i>bensoni</i> PFEIFFER <i>Cassidula</i>	220	<i>brevis</i> BAVAY, <i>Pachydrobia</i>	106
<i>bernardiana</i> PRIME, <i>Cyrena</i>	311	— <i>Pachydrobiella</i>	106
<i>bertini</i> POIRIER, <i>Pachydrobia</i>	80	<i>brohardia</i> GRANGER, <i>Ampullaria</i> ..	49
<i>beryllina</i> BROT, <i>Melania</i>	165	<i>broti</i> DESHAYES, <i>Canidia</i>	203
<i>bialata(us)</i> LEA, <i>Dipsas</i>	278	— <i>Unio</i>	280
— <i>Symphynota</i>	278	— <i>Unionetta</i>	280
<i>bialatus</i> SIMPSON, <i>Hyriopsis</i>	272	<i>broti</i> REEVE, <i>Melania</i>	167
<i>bicristata</i> STRUBELL, <i>Microcondylaea</i>	289	<i>Brotia</i>	172
<i>bilineata</i> HEUDE, <i>Corbicula</i>	314	<i>Brotia (Senckenbergia)</i>	184
<i>bilocularis</i> LINNAEUS, <i>Septifer</i>	258	<i>bruguierei</i> SOWERBY, <i>Neritina</i>	14
<i>binodosa</i> BLANFORD, <i>Brotia</i>	174	<i>brunnescens</i> TRYON, <i>Stenomelania</i> ..	171
— <i>Melania</i>	174	<i>brunneus</i> H. & A. ADAMS, <i>Planorbis</i>	234
		<i>burchi</i> DAVIS, <i>Tricula</i>	68

<i>burmana(us)</i> BLANFORD, <i>Parreysia</i> ..	279	<i>ceramense</i> RÖDING, <i>Ellobium</i>	226
— <i>Unio</i>	279	<i>cerasus</i> TROSCHEL, <i>Limnaeus</i>	232
<i>burmanica</i> NEVILL,		<i>Cerithidea</i>	189
<i>Paludina siamensis</i>	36	<i>Cerithidea (Cerithidea)</i>	192
<i>caenosus</i> BENSON, <i>Planorbis</i>	244, 246	<i>Cerithidea (Cerithideopsilla)</i>	190
<i>caerulea(us)</i> LEA, <i>Indonaia</i>	285	<i>Cerithideopsilla</i>	190
— <i>Nodularia</i>	285	<i>ceylanica</i> MABILLE & LE MESLE,	
<i>calathus</i> BENSON, <i>Planorbis</i> 244, 245, 246		<i>Cyrena</i>	309
— <i>Segmentina (Polypylis)</i>	245	<i>ceylonensis</i> RÉCLUZ, <i>Neritina</i>	10
<i>callifer</i> MARTENS, <i>Anodonta</i>	267	<i>ceylonica</i> CHEMNITZ, <i>Cyrena</i> ..	309, 310
— <i>Pseudodon inoscularis</i>	267	— <i>Venus</i>	309
<i>callistoma</i> MORELET, <i>Ampullaria</i> ..	49	<i>chalanguensis</i> DESHAYES, <i>Paludina</i> 27, 28	
<i>cambodgensis</i> PETIT, <i>Monocondylea</i> 269		<i>Chamberlainia</i>	276
<i>cambodgensis</i> REEVE, <i>Semisinus</i>	202	<i>Chamlongia</i>	158
<i>cambodiensis</i> BRANDT, <i>Stenothyra</i> ..	120	<i>chaperi</i> MORGAN, <i>Pseudodus</i>	271
<i>cambodiensis</i> CLESSIN, <i>Modiola</i>	256	— <i>Pseudodon vondembuschianus</i> ..	271
<i>cambodiensis</i> LEA, <i>Physunio</i>	297	— <i>Sermyla</i>	182
— <i>Unio</i>	297	<i>charbonnieri</i> PETIT, <i>Aphanistylus</i> ..	194
<i>cambodiensis</i> SOWERBY, <i>Unio</i>	291	— <i>Cerithidea</i>	194
<i>campodjensis</i> MABILLE & LE MESLE,		— <i>Cerithium</i>	194
<i>Filopaludina (Siamopaludina)</i>		— <i>Potamides (Aphanistylus)</i>	194
<i>martensi</i>	28	<i>charon</i> PRESTON, <i>Neoradina</i>	170
— <i>Paludina</i>	28	<i>chefouensis</i> CLESSIN, <i>Limnaea</i>	231
<i>cambodjensis</i> PETIT, <i>Monocondylaea</i> 269		<i>chemnitzi</i> BECK, <i>Cassidula</i>	219
— <i>Pseudodon</i>	269	<i>Chicoreus</i>	199
<i>cambodjensis</i> REEVE, <i>Hemisinus</i>	202	<i>chinensis</i> MARTENS, <i>Limnaeus</i>	231
<i>cambojiensis</i> REEVE, <i>Clea (Anentome)</i> 202		<i>chinensis</i> PFEIFFER, <i>Ellobium</i>	228
— <i>Melania</i>	202	<i>Chlorostracia</i>	38
<i>Camptoceras</i>	236	<i>chocolatum</i> BROT, <i>Melania</i>	167
<i>Camptoceras (Culmenella)</i>	236	<i>Chrysallida</i>	206
<i>canalis</i> SOWERBY, <i>Neritina</i>	14	<i>Chrysallida (Salasiella)</i>	206
<i>cantori</i> REEVE, <i>Pirena</i>	197	<i>ciliata</i> REEVE, <i>Paludina</i>	34
<i>capucinus</i> LAMARCK, <i>Chicoreus</i>	199	<i>cincta</i> RÉCLUZ, <i>Neritina</i>	10
— <i>Murex</i>	199	<i>cingulata</i> BRANDT, <i>Hubendickia</i> ..	92, 97
<i>carinata</i> H. ADAMS, <i>Amerianna</i>	237	<i>cingulata(us)</i> GMELIN, <i>Murex</i>	190
— <i>Physa (Ameria)</i>	237	— <i>Cerithidea (Cerithideopsilla)</i> ..	190
<i>carinata</i> BECK, <i>Polyodonta</i>	216	<i>cingulata</i> MARTENS, <i>Paludina</i>	27
<i>carinata</i> LEA, <i>Assimineia</i>	155	<i>Cipangopaludina</i>	37
— <i>Cyclotropis</i>	155	<i>circumspissus</i> MORELET, <i>Planorbis</i> ..	234
— <i>Syncera</i>	156	<i>citrina</i> BROT, <i>Brotia</i>	179
<i>carinifera</i> MENKE, <i>Littorinopsis</i>	55	— <i>Melania</i>	179
— <i>Phasianella</i>	55	<i>citrinoides</i> BROT, <i>Melania</i>	179
<i>casertanum</i> POLI, <i>Cardium</i>	329	<i>clarckeanum</i> = <i>clarckeanum</i>	330
— <i>Pisidium</i>	329, 330	<i>clarckeanum</i> G. & H. NEVILL,	
<i>Cassidula</i>	219	<i>Pisidium</i>	330
<i>castanea</i> MORELET, <i>Corbicula</i>	317	— <i>Pisidium (Afropisidium)</i>	330
— <i>Cyrena (Corbicula)</i>	317	<i>clausa</i> H. & A. ADAMS,	
<i>castelneai</i> ROCHEBRUNE, <i>Harmandia</i> 284		<i>Plecotrema</i>	214
<i>celebensis</i> MARTENS, <i>Ancylus</i>	248	<i>Clea</i>	200
<i>celebensis</i> QUOY & GAIMARD,		<i>Clea (Anentome)</i>	200
<i>Ampullaria</i>	49	<i>Clenchiella</i>	69
— <i>Melania</i>	167	<i>Clithon</i>	9
— <i>Pachylabra</i>	50	<i>Clithon (Clithon)</i>	11
		<i>Clithon (Pictonerita)</i>	10

<i>coaxans</i> GMELIN, <i>Venus</i>	309	<i>costellata</i> KOBELT,	
— <i>Polymesoda</i> (<i>Geloina</i>)	309	<i>Vivipara martensiana</i>	27
<i>cochinchinensis</i> BAVAY & DAUTZENBERG,		<i>costula</i> RAFINESQUE, <i>Antimelania</i> ..	181
<i>Fairbankia</i>	138	— <i>Brotia</i>	181, 182
<i>cochinchinensis</i> CLESSIN, <i>Corbicula</i> ..	318	— <i>Brotia</i> (<i>Antimelania</i>)	183
<i>cochinchinensis</i> MORELET, <i>Paludina</i> ..	28	— <i>Melania</i>	181
<i>coffea</i> PHILIPPI, <i>Melania</i>	167	<i>crassilabrum</i> REEVE, <i>Melania</i>	71
<i>coffea</i> WOOD, <i>Voluta</i>	219	<i>crassispiralis</i> ANNANDALE, <i>Vivipara</i>	29
<i>colonialis</i> PRIME, <i>Corbicula</i>	315	<i>crassum</i> LAMARCK, <i>Cerithium</i>	194
<i>columbaria</i> RÉCLUZ, <i>Neritina</i>	12	<i>crebristriata(us)</i> ANTHONY,	
<i>compressa</i> LEA, <i>Monocondylaea</i>	264	<i>Monocondylaea</i>	267
<i>compressa</i> MARTENS, <i>Spatha</i>	264	— <i>Pseudodon</i> (<i>Trigonodon</i>)	270
— <i>Pilsbryoconcha exilis</i>	264	<i>crenifera</i> LEA, <i>Melania</i>	167
<i>compressus</i> HUTTON, <i>Planorbis</i> 239, 240		<i>crepidinata</i> REEVE, <i>Melania</i>	165
<i>comptus</i> DESHAYES, <i>Unio</i>	300	<i>crepidularia</i> LAMARCK, <i>Neritina</i>	16
— <i>Trapezoides exolescens</i>	300	<i>crispata</i> GOULD, <i>Indonaiia</i>	282
<i>concaua</i> TEMCHAROEN, <i>Lacunopsis</i> ..	108	— <i>Nodularia</i>	282
<i>concinnum</i> H. & A. ADAMS,		— <i>Scabies</i>	281
<i>Plecotrema</i>	212	— <i>Unio</i>	281
<i>confinis</i> BRANDT, <i>Stenothyra</i>	119	<i>Cristaria</i>	278
<i>confusa</i> DOHRN, <i>Neoradina</i>	170	<i>crooki</i> BRANDT, <i>Hubendickia</i>	92, 94
<i>confusus</i> ROCHEBRUNE, <i>Planorbis</i> ..	240	— <i>Jullienia</i>	81, 83
<i>conica</i> BRANDT, <i>Lacunopsis</i>	108	— <i>Pachydrobia</i>	74, 79
<i>conica</i> GRAY, <i>Ampullaria</i>	52	— <i>Stenothyra</i>	122
— <i>Pachylabra</i>	52	— <i>Wykoffia</i>	83
<i>conica</i> TEMCHAROEN, <i>Manningiella</i> ..	102	<i>crosseana</i> MABILLE & LE MESLE,	
<i>conica</i> PHILIPPI, <i>Litorina</i>	55	<i>Limnaea</i>	230
— <i>Littorinopsis</i>	55	<i>crosseana</i> MORLET, <i>Dreisensia</i>	307
<i>conicus</i> MORLET, <i>Paludomus</i>	43	<i>crosseana</i> PRIME, <i>Corbicula</i>	317
<i>consobrina</i> GARRETT, <i>Plecotrema</i> ..	214	<i>crosseana</i> WATTEBLED, <i>Bythinia</i>	64
<i>continentalis</i> BRANDT,		— <i>Wattebledia</i>	64
<i>Filopaludina</i> (<i>Siamopaludina</i>)		<i>crossei</i> DESHAYES, <i>Conradens</i>	292
<i>javanica</i>	25	— <i>Uniandra conradens</i>	292
<i>Conradens</i>	289	— <i>Unio</i>	292
<i>conradens</i> LEA, <i>Uniandra</i>	289	<i>cucullata</i> BORN, <i>Lopha</i>	259
— <i>Unio</i>	289	<i>Culmenella</i>	236
<i>convexiusculus</i> HUTTON, <i>Gyraulus</i> ..	239	<i>cumingi</i> GOULD, <i>Glauconomya</i>	334
— <i>Gyraulus chinensis</i>	239, 240	<i>cumingii</i> LEA, <i>Anodonta</i>	268
— <i>Planorbis</i>	239	— <i>Monocondylaea</i>	268
<i>cor</i> LAMARCK, <i>Corbicula</i>	322	— <i>Pseudodon</i>	268
<i>Corbicula</i>	312	— <i>Pseudodon inoscularis</i>	268
<i>cornea</i> LINNAEUS, <i>Nerita</i>	8	<i>curvata</i> PRESTON,	
— <i>Neritina</i>	8	<i>Pseudodon crebristriatus</i>	267
— <i>Neritodryas</i>	8	<i>curvicosta</i> MARTENS, <i>Melania</i>	182
<i>cornucopia</i> BENSON, <i>Neritina</i>	16	<i>cyanostomus</i> MORELET, <i>Paludomus</i> ..	71
<i>coromandeliana</i> SOWERBY, <i>Neritina</i> 15		<i>Cyclotropis</i>	154
— <i>Neritina</i> (<i>Vittoida</i>)	15	<i>cylindrica</i> BRANDT, <i>Hubendickia</i> ..	92, 96
<i>coromandelicus</i> DUNKER, <i>Planorbis</i> 234		<i>Cylindrotis</i>	217
<i>coronata</i> BAVAY, <i>Lacunopsis</i> ..	108, 110	<i>cyprinoides</i> QUOY & GAIMARD,	
<i>coronata</i> BRANDT, <i>Hubendickia</i> ..	92, 96	<i>Cyrena</i>	309
<i>corrugata</i> LAMARCK, <i>Glauconomya</i> ..	334	<i>cyreniformis</i> PRIME, <i>Corbicula</i>	318
— <i>Melania</i>	181	<i>cyrtocheila</i> = <i>cyrtochila</i>	128
<i>costata</i> POIRIER, <i>Wykoffia</i>	113	<i>cyrtochila</i> VAN BENTHEM JUTTING,	
<i>costatus</i> SCHRÖTER, <i>Strombus</i>	164	<i>Stenothyra</i>	128

<i>dactylus</i> PFEIFFER, <i>Auricula</i>	227	<i>dominula</i> TAPP. CANEFRI, <i>Melania</i> . .	165
<i>daengsvangi</i> BRANDT, <i>Paludinella</i> . .	154	<i>doreyana</i> LESSON, <i>Melania</i>	163
— <i>Paludinella</i> (<i>Schuetziella</i>)	154	<i>dorrianus</i> WATTEBLED, <i>Planorbis</i> . .	244
<i>dalyi</i> BLANFORD, <i>Ampullaria</i>	50	<i>Dostia</i>	16
— <i>Pachylabra turbinis</i>	50	<i>dubia</i> GMELIN, <i>Nerita</i>	9
<i>dammermani</i> ODHNER, <i>Pisidium</i>	332	— <i>Neritina</i>	12
<i>datura</i> DOHRN, <i>Melania</i>	163	— <i>Neritodryas</i>	9
<i>dautzenbergi</i> MORLET, <i>Unio</i>	291	<i>dubiosa</i> BRANDT, <i>Paracrostoma paludiformis</i>	188
<i>dautzenbergi</i> WALKER, <i>Hydrobioides</i> 66		<i>dubiosa</i> POIRIER, <i>Pachydrobia</i>	80
<i>dautzenbergiana</i> MORLET, <i>Stenomelania</i>	179	<i>ducalis</i> PRIME, <i>Corbicula</i>	315
<i>dautzenbergiana</i> WATTEBLED, <i>Bithynia</i>	60	<i>duclerci</i> ROCHEBRUNE, <i>Unio</i>	276
— <i>Bithynia</i>	60	— <i>Simpsonia</i>	276
<i>davisi</i> BRANDT, <i>Paraprososthenia</i> 86, 88		<i>dugasti</i> MORLET, <i>Unio</i>	288
<i>dealbatus</i> GMELIN, <i>Strombus</i>	197	— <i>Ensidents ingallsianus</i>	288
<i>decipiens</i> DESHAYES, <i>Cyrena</i>	310	— <i>Melania</i>	179
<i>decussatula</i> BLANFORD, <i>Paludina</i>	36	<i>dunckeri</i> PFEIFFER, <i>Auriculastra</i>	222
<i>deiecta</i> TEMCHAROEN, <i>Lacunopsis</i> . .	108	<i>eburneus</i> SOWERBY, <i>Planorbis</i>	234
<i>delaportei</i> CROSSE & FISCHER, <i>Arconaia</i>	273	<i>echinata</i> QUOY & GAIMARD, <i>Lopha</i>	260
— <i>Hyriopsis</i>	273	<i>elegans</i> BAVAY, <i>Hydrorissoia</i>	104
— <i>Unio</i> (<i>Arconaia</i>)	273	<i>elegans</i> REEVE, <i>Melania</i>	163
<i>delphinopterus</i> DAUTZENBERG & FISCHER, <i>Unio</i>	272	<i>Elizia</i>	305
<i>delphinus</i> GRUNER, <i>Metaptera</i>	272	<i>ellipticum(us)</i> CONRAD, <i>Pseudodon</i> . .	270
— <i>Unio</i>	272	— <i>Pseudodon vondembuschianus</i> . .	270
<i>demangei</i> BAVAY & DAUTZENBERG, <i>Planorbis</i> (<i>Segmentina</i>)	246	<i>Ellobium</i>	226
<i>demangei</i> ROCHEBRUNE, <i>Simpsonia</i> . .	276	<i>elongata</i> KÜSTER, <i>Auricula</i>	222
<i>demissus</i> WESTERLUND, <i>Planorbis</i> . .	239	— <i>Auriculastra</i>	222
<i>denisoniensis</i> BROT, <i>Melania</i>	165	<i>emarginatus</i> LEA, <i>Mycetopoda</i>	334
<i>denticulata</i> LEA, <i>Melania</i>	163	— <i>Mycetopus</i>	334
<i>depressa</i> BENSON, <i>Neritina</i>	16	— <i>Solenia</i>	334
<i>desowitzi</i> BRANDT, <i>Hyriopsis</i> (<i>Limnoscapha</i>)	274	<i>endeli</i> SOWERBY, <i>Theodoxus</i>	12
<i>dhanushori</i> PRASHAD, <i>Trapezoides</i> 299		<i>Ensidents</i>	287
<i>dicaela(us)</i> MORELET, <i>Helix</i>	246	<i>episcopalis</i> I. & H. LEA, <i>Melania</i> . .	182
— <i>Planorbis</i>	246	<i>episcopalis</i> PRIME, <i>Corbicula</i> . .	322, 326
<i>digona</i> BLANFORD, <i>Paludina</i>	23	<i>eppersoni</i> BRANDT, <i>Chrysalida</i> (<i>Salasiella</i>)	207
<i>Digonistoma</i>	58	<i>erosa</i> DESHAYES, <i>Corbicula</i>	322
<i>dimotus</i> LEA, <i>Uniandra contradens</i> . .	289	<i>erosa</i> SOLANDER, <i>Polymesoda</i>	310
<i>discreta</i> MABILLE, <i>Limnaea</i>	231	<i>erythrocheila</i> DAUTZENBERG & FISCHER, <i>Ampullaria turbinis</i>	51
<i>dissimilis</i> MÜLLER, <i>Idiopoma</i>	36	<i>eurypterus</i> REEVE, <i>Potamides</i>	191
— <i>Nerita</i>	36	— <i>Tympanotomus</i>	191
<i>distinguenda</i> BROT, <i>Melania</i>	165	— <i>Tympanotonos</i>	191
<i>distoma</i> ANNANDALE, <i>Hydrobioides nassa</i>	65	<i>Eussoia</i>	150
<i>djadjarjensis</i> MARTIN, <i>Potamides</i> . .	191	<i>evansi</i> SMITH, <i>Modiola</i>	257
— <i>Cerithidea</i> (<i>Cerithideopsilla</i>) . .	191	<i>exaltata</i> RÉCLUZ, <i>Neritina</i>	16
<i>doliaris</i> GOULD, <i>Filopaludina</i>	23	<i>exilis</i> DUNKER, <i>Uniandra</i>	289
— <i>Paludina</i>	23	<i>exilis</i> LEA, <i>Anodonta</i>	263
— <i>Vivipara</i>	21, 22, 23, 27	— <i>Pilsbryoconcha</i>	263
— <i>Vivipara bengalensis</i>	23	<i>exilis</i> MORELET, <i>Monocondylus</i>	266
		<i>eximia</i> DUNKER, <i>Cyrena</i>	310
		— <i>Polymesoda</i>	310

<i>eximius</i> LEA, <i>Unio</i>	295	<i>fischeriana</i> POIRIER, <i>Pachydrobia</i> ..	80
— <i>Physunio</i>	294, 295	<i>fischerpiettei</i> BRANDT, <i>Lacunopsis</i> ..	108
— <i>Physunio</i> (<i>Lens</i>)	295	— <i>Paraprosthenia</i>	86
<i>exolescens</i> GOULD, <i>Unio</i>	299	<i>flava</i> CLESSIN, <i>Corbicula</i>	321
— <i>Trapezoides</i>	299	<i>flava</i> DESHAYES, <i>Jullienia</i>	81
<i>expansa</i> BRANDT, <i>Manningiella</i>	101	<i>flavida</i> BRANDT, <i>Mekongia swainsoni</i> ..	44
<i>expatriata</i> PRESTON, <i>Neoradina</i>	170	<i>flavida</i> DUNKER, <i>Melania</i>	167
<i>extensa</i> BRANDT, <i>Mekongia sphaericula</i>	46	<i>floresiana</i> RENSCH, <i>Pisidium</i>	329
<i>extusa</i> REEVE, <i>Melania</i>	165	<i>fluminea</i> MÜLLER, <i>Corbicula</i> ..	315, 319
<i>exustus</i> DESHAYES, <i>Indoplanorbis</i> ..	234	— <i>Tellina</i>	319
— <i>Planorbis</i>	234	<i>fluviatile</i> FÉRUSSAC, <i>Cerithium</i>	197
<i>eyriesi</i> MORELET, <i>Eyriesia</i>	33	<i>fluviatile(is)</i> POTIEZ & MICHAUD, <i>Cerithium</i>	190
— <i>Mekongia</i>	33	<i>Potamides</i>	190
— <i>Paludina</i>	33	<i>Tympanotomus</i>	190
— <i>Vivipara</i>	33	<i>Tympanotonos</i>	190
<i>Eyriesia</i>	33	<i>fluviatilis</i> MÜLLER, <i>Tellina</i>	319
 		<i>foliaceus</i> GOULD, <i>Unio</i>	299
<i>faba</i> SOWERBY, <i>Clithon</i>	12	— <i>Trapezoides</i>	299
— <i>Neritina</i>	12	<i>foliorum</i> GMELIN, <i>Buccinum</i>	53
<i>fabagina</i> DESHAYES, <i>Unio</i>	280	<i>folium</i> LINNAEUS, <i>Lopha</i>	259
— <i>Unionetta</i>	280	<i>forcarti</i> BRANDT, <i>Anulotaia</i>	31
<i>Fairbankia</i>	138	<i>fragilis</i> NEVILL, <i>Unio</i>	300
<i>fasciata</i> BRANDT, <i>Stenothyra</i>	123	<i>frauenfeldi</i> DESHAYES, <i>Paludina</i>	44
<i>fasciata(us)</i> DESHAYES, <i>Auricula</i>	223	<i>frauenfeldi</i> MORELET, <i>Paludina</i>	27
— <i>Melampus</i>	223	<i>frayssesi</i> GASSIES <i>Melampus</i>	225
<i>fasciata</i> LAMARCK, <i>Nerita</i>	9	<i>fruhstorferi</i> KOBELT, <i>Bellamya</i> (<i>Mekongia</i>) <i>moreleti</i> ..	40
<i>fasciata</i> ROCHEBRUNE, <i>Bocourtia</i>	334	— <i>Mekongia moreleti</i>	40
<i>fasciata</i> ROISSY, <i>Ampullaria</i>	49	— <i>Vivipara moreleti</i>	40
<i>fasciolata</i> MORELET, <i>Hydrocena</i>	155	<i>fuliginosa</i> THEOBALD, <i>Neritina</i>	11
<i>fasciolata</i> OLIVIER, <i>Melanoides</i>	164	<i>fulva</i> REEVE, <i>Paludina</i>	36
<i>Faunus</i>	197	<i>fulvida</i> PFEIFFER, <i>Hydrocena</i>	155
<i>felex</i> = <i>felis</i>	219	— <i>Hydrocena</i> (<i>Omphalotropis</i>)	155
<i>felis</i> LAMARCK, <i>Auricula</i>	219	<i>funesta</i> TAPP. CANEFRI, <i>Neritina</i>	9
<i>Fenouilia</i>	72	<i>funiculata</i> WALKER, <i>Bithynia</i>	58
<i>Ferrissia</i>	247	— <i>Bithynia</i> (<i>Digoniostoma</i>)	58
<i>Ferrissia</i> (<i>Pettancylus</i>)	248	— <i>Digoniostoma</i>	60
<i>ferrugineus</i> ANNANDALE, <i>Physunio</i> ..	296	<i>fusca</i> H. ADAMS, <i>Canidia</i>	201
<i>Filopaludina</i>	20	<i>fusca</i> HOMBRON & JACQUINOT, <i>Auricula</i>	219
<i>Filopaludina</i> (<i>Siamopaludina</i>)	25	<i>fuscata</i> BORN, <i>Neoradina</i>	170
<i>filosa(us)</i> REEVE, <i>Bellamya</i>	24	<i>fuscum</i> SCHUMACHER, <i>Telescopium</i> ..	196
— <i>Filopaludina</i>	24	<i>fusiformis</i> DESHAYES, <i>Canidia</i>	201
— <i>Paludina</i>	24	 	
— <i>Sinotaia</i> (<i>Filopaludina</i>) <i>bengalensis</i>	22	<i>Gabbia</i>	61
— <i>Viviparus</i>	21, 22	<i>gagates</i> TROSCHER, <i>Neritina</i>	8
<i>filosa</i> SOWERBY, <i>Littorina</i>	53	<i>gaimardi</i> SOULEYET, <i>Neritina</i>	10
<i>fischeriana</i> MABILLE & LE MESLE, <i>Dactylochlamys</i>	33	<i>galathea</i> MÖRCH, <i>Cyrena</i>	311
— <i>Paludina</i>	33	— <i>Cyrena</i> (<i>Corneocyclus</i>)	311
<i>fischeriana(us)</i> MORLET, <i>Unio</i>	292	— <i>Polymesoda</i> (<i>Geloina</i>)	311
— <i>Contradens dimotus</i>	292	<i>Gangetia</i>	114
— <i>Nodularia</i>	292	<i>Gangetica</i> = <i>Gangetia</i>	114
— <i>Uniandra contradens</i>	292	<i>Geloina</i>	309

<i>glabrata</i> A. ADAMS, <i>Nematura</i>	129	<i>hardouini</i> MORGAN, <i>Stenothyra</i>	133
— <i>Stenothyra</i>	129	<i>harinasutai</i> BRANDT, <i>Chamlongia</i>	158
<i>Glauconomya</i>	334	<i>harmandi</i> CROSSE & FISCHER,	
<i>Glaucostracia</i>	39	<i>Pseudodon</i>	268
<i>globosa</i> POIRIER, <i>Lacunopsis</i>	108	— <i>Pseudodon inoscularis</i>	268
<i>globosa</i> SWAINSON, <i>Ampullaria</i>	51	<i>harmandi</i> POIRIER, <i>Jullienia</i>	81, 84
— <i>Pila</i>	51	— <i>Lacunopsis</i>	108, 111
<i>gochenouri</i> BRANDT, <i>Hubendickia</i>	92, 95	— <i>Pachydrosia</i>	80
<i>goniomphala(os, us)</i> MORELET,		<i>harmandi</i> ROCHEBRUNE, <i>Dreissena</i>	307
<i>Bithynia</i>	58, 59, 60	— <i>Sinomylus</i>	307
— <i>Bithynia</i>	60	<i>Harmandia</i>	284
— <i>Bithynia (Digonostoma)</i>	60	<i>harmandiana</i> ROCHEBRUNE, <i>Canidia</i>	201
— <i>Paludina</i>	60	<i>heardi</i> BRANDT, <i>Corbicula</i>	328
<i>goodwinii</i> SMITH, <i>Limnaea</i>	231	<i>helena</i> PHILIPPI, <i>Canidia</i>	201
<i>gracilis</i> BRANDT, <i>Hydrorisoia</i>	104, 106	— <i>Clea (Anentome)</i>	201
— <i>Morrisonietta</i>	209	— <i>Melania</i>	201
<i>gracilis</i> HAAS, <i>Hyriopsis</i>	272	— <i>Melanopsis</i>	201
<i>gracilis</i> LEA, <i>Ampullaria</i>	51	<i>heliciformis</i> FRAUENFELD, <i>Paludina</i>	36
— <i>Pachylabra</i>	52	<i>Helicorbis</i>	244
— <i>Pila</i>	51	<i>hemisphaerula</i> BENSON, <i>Planorbis</i>	246
<i>gracilis</i> PRIME, <i>Corbicula</i>	315	— <i>Segmentina (Polypylis)</i>	246
<i>gracilis</i> SOWERBY, <i>Anodon</i>	264	<i>benzadensis</i> PILSBRY, <i>Idiopoma</i>	36
<i>granifera</i> LAMARCK, <i>Melania</i>	167	<i>herculea</i> GOULD, <i>Melania</i>	181
— <i>Tarebia</i>	167	<i>herculea(us)</i> MIDDENDORFF, <i>Anodonta</i>	278
— <i>Thiara (Tarebia)</i>	168	— <i>Dipsas</i>	278
<i>granospira</i> MOUSSON, <i>Melania</i>	167	<i>hians</i> SOWERBY, <i>Limnaea</i>	232
<i>granospiralis</i> ZOLLINGER, <i>Melania</i>	167	<i>hidalgoi</i> GASSIES, <i>Assiminea</i>	148
<i>granum</i> VON DEM BUSCH, <i>Melanium</i>	163	— <i>Hydrocena</i>	148
<i>granum</i> MORELET, <i>Assiminea</i>	148	— <i>Paludinella</i>	148
<i>gravidus</i> LEA, <i>Physunio</i>	294	— <i>Syncera</i>	148
— <i>Unio</i>	294	<i>hindu</i> CLESSIN, <i>Planorbis</i>	234
<i>gravis</i> HEUDE, <i>Corbicula</i>	314	<i>Hippentis</i>	243
<i>gravis</i> = <i>gravis</i> HEUDE	314	<i>Hippentis (Helicorbis)</i>	244
<i>gruneri</i> CLESSIN,		<i>hirsuta</i> GARRETT, <i>Plecotrema</i>	214
<i>Planorbis (Segmentina)</i>	244	<i>holosculpta</i> BRANDT,	
<i>gruneri</i> PHILIPPI, <i>Ampullaria</i>	49	<i>Stenothyra koratensis</i>	121
<i>gryphaea</i> HEUDE, <i>Corbicula</i>	318	<i>hospitalis</i> BRANDT, <i>Hydrorisoia</i>	104, 106
<i>guangdungensis</i> KOBELT,		<i>housei</i> LEA, <i>Adamietta</i>	171
<i>Sinotaia quadrata</i>	30	— <i>Melania</i>	171
<i>gubernatoria</i> PRIME, <i>Corbicula</i>	325	— <i>Unio</i>	275
<i>Gundlachia</i>	251	<i>hubendickei</i> BRANDT, <i>Gundlachia</i>	251
<i>gustaviana</i> MARTENS, <i>Corbicula</i>	320	— <i>Gyraulus</i>	241
<i>guttata</i> RÉCLUZ, <i>Nerita</i>	10	<i>Hubendickia</i>	91
<i>Gyraulus</i>	238	<i>humilis</i> LEA, <i>Indonaia</i>	286
<i>hageni</i> STRUBELL, <i>Uniandra</i>	289	— <i>Unio</i>	286
<i>hagemulleri</i> MABILLE, <i>Limnaea</i>	231	<i>hybocystoides</i> BAVAY, <i>Stenothyra</i>	117
<i>hainesiana(us)</i> LEA, <i>Chamberlainia</i>	276	<i>hydaspicola</i> THEOBALD, <i>Pisidium</i>	329, 330
— <i>Paludina</i>	39, 42	<i>Hydrobioides</i>	65
— <i>Unio</i>	276	<i>Hydrorisoia</i>	103
— <i>Vivipara</i>	42	<i>hydrorisoidea</i> BRANDT,	
<i>halophila</i> KOBELT,		<i>Paraprososthenia</i>	86
<i>Vivipara annendalei</i>	23	<i>Hyriopsis</i>	272
<i>hanseni</i> BRANDT, <i>Paraprososthenia</i>	86, 90	<i>Hyriopsis (Hyriopsis)</i>	272
		<i>Hyriopsis (Limnoscapha)</i>	274

<i>Idiopoma</i>	34	<i>javanica</i> BROTH, <i>Melania</i>	165
<i>ignota</i> THIELE, <i>Assimineae</i>	144	<i>javanica</i> VON DEM BUSCH, <i>Paludina</i>	25
<i>ijimai</i> BRANDT, <i>Paraprososthenia</i> 86, 90		— <i>Filopaludina</i> (<i>Siamopaludina</i>) ..	25
<i>imporforatum</i> H. & A. ADAMS,		<i>javanica</i> MOUSSON, <i>Corbicula</i>	315
<i>Plectotrema</i>	213	— <i>Cyrena orientalis</i>	315
<i>imperialis</i> MORELET, <i>Unio</i>	276	<i>javanica</i> REEVE, <i>Ampullaria</i>	52
<i>impressa</i> DESHAYES, <i>Cyrena</i>	310	<i>javanum</i> VAN BENTHEM JUTTING,	
<i>impurus</i> TROSCHEL, <i>Limnaeus</i>	232	<i>Pisidium</i>	331
<i>inaequalis</i> ROCHEBRUNE, <i>Oxynaia</i> ..	292	— <i>Pisidium</i> (<i>Afropisidium</i>)	331
— <i>Unio</i>	289	— <i>Pisidium</i> (<i>Neopisidium</i>)	331
<i>incerta</i> TEMCHAROEN, <i>Hubendickia</i> ..	102	<i>javanus</i> LEA, <i>Uniandra</i>	289
— <i>Manningiella</i>	99, 102	<i>jiraponi</i> BRANDT, <i>Stenothyra</i>	121
<i>indica</i> SOULEYET, <i>Melania</i>	181	<i>jiraponi</i> HUBENDICK, <i>Camptoceras</i> ..	236
<i>indicator</i> MONTFORT, <i>Telescopium</i> ..	196	— <i>Camptoceras</i> (<i>Culmenella</i>)	236
<i>indicus</i> BENSON, <i>Planorbis</i>	234	<i>jousseaumi</i> MABILLE, <i>Chlorostracia</i> ..	47
<i>Indonaia</i>	285	<i>judaica</i> MOUSSON, <i>Melania</i>	165
<i>Indoplanorbis</i>	234	<i>jugicostis</i> HANLEY & THEOBALD,	
<i>indragirica</i> MARTENS, <i>Melania</i>	182	<i>Melania</i>	166
<i>inflammatum</i> BOLTEN, <i>Ellobium</i>	219	— <i>Melanoides</i>	166
<i>inflata</i> PFEIFFER, <i>Pythia</i>	216	— <i>Tiara</i> (<i>Melanoides</i>)	166
<i>infracostata</i> MOUSSON, <i>Melania</i>	182	<i>jullieni</i> DESHAYES, <i>Canidia</i>	203
<i>ingallsiana(us)</i> LEA, <i>Bellamya</i>	27	— <i>Clea</i> (<i>Anentome</i>)	203
— <i>Ensidens</i>	288	— <i>Melania</i>	181
— <i>Idiopoma</i>	35	<i>Jullienia</i>	81
— <i>Paludina</i>	27, 35	<i>jullieniana</i> CLESSIN, <i>Corbicula</i>	318
— <i>Sinotaia</i>	27	<i>juncea</i> LEA, <i>Melania</i>	165
— <i>Unio</i>	288	<i>junghubni</i> MARTIN, <i>Melania</i>	167
— <i>Vivipara</i>	27		
<i>inornatus</i> LEA, <i>Physunio</i>	295	<i>kelletti</i> SOWERBY, <i>Anodon</i>	264
— <i>Unio</i>	290, 295	<i>kennardi</i> BULLEN, <i>Segmentina</i>	246
<i>inornatus</i> REEVE, <i>Unio</i>	290	<i>kintanensis</i> MORGAN, <i>Melania</i>	182
<i>inocularis</i> GOULD, <i>Anodon</i>	267	<i>klossi</i> GHOSH, <i>Limnaea</i>	230
— <i>Pseudodon</i>	267	<i>kmeriana</i> MORLET, <i>Paludina</i>	43
<i>insolita</i> BROTH, <i>Brotia</i>	176	— <i>Mekongia swainsoni</i>	43
— <i>Melania</i>	176	<i>knorri</i> RÉCLUZ, <i>Neritina</i>	14
<i>insularis</i> PRIME, <i>Corbicula</i>	314, 318	<i>kobelti</i> H. ROLLE, <i>Melania</i>	182
<i>intermedia</i> PHILIPPI, <i>Littorina</i>	54	<i>koratensis</i> BRANDT, <i>Stenothyra</i>	120
— <i>Littorinops</i>	54	<i>kritjianensis</i> MARTIN, <i>Melania</i>	168
<i>interrupta</i> RÉCLUZ, <i>Nerita</i>	12	<i>krungtepensis</i> BRANDT, <i>Morrisonietta</i>	208
<i>intrepida</i> FULTON, <i>Melania</i>	163	— <i>Stenothyra</i>	131
<i>Iravadia</i>	135	<i>kuiperi</i> BRANDT, <i>Paludinella</i>	153
<i>iravadica</i> HANLEY & THEOBALD,			
<i>Corbicula</i>	323	<i>labiata</i> BRANDT, <i>Stenothyra</i>	126
<i>iris</i> MOUSSON, <i>Neritina</i>	14	<i>labiosa(us)</i> BENSON, <i>Paludomus</i> 160, 161	
<i>iravadica</i> [= <i>iravadica</i>] BLANFORD,		<i>labiosa</i> CLESSIN, <i>Limnaea</i>	232
<i>Bythinia</i>	59	<i>labrosum</i> RÖDING, <i>Ellobium</i>	227
		<i>Lacunopsis</i>	107
<i>jaculus</i> ROCHEBRUNE, <i>Unio</i>	288	<i>lacustris</i> ANNANDALE,	
<i>javana(us)</i> MARTENS, <i>Ancylus</i>	248	<i>Hydrobioides nassa</i>	65
— <i>Ferrissia</i>	248	— <i>Pachylabra turbinis</i>	50
— <i>Ferrissia</i> (<i>Pettancylus</i>)	248	<i>Laemodonta</i>	212
<i>javana</i> THIELE, <i>Assimineae</i> (<i>Eussoia</i>)	151	<i>laevis</i> BAVAY, <i>Melania</i>	168
— <i>Paludinella</i>	151	<i>laevis</i> MORELET, <i>Bitinia</i>	59
— <i>Syncera</i>	151		

— <i>Bithynia</i>	59	<i>Lopha</i>	259
<i>laeviuscula</i> = <i>leviuscula</i>	326	<i>ludovicianum</i> ROCHEBRUNE, <i>Diplodon</i>	300
<i>lagrandierei</i> BAVAY, <i>Anulotaia</i>	31	<i>lugens</i> PRASHAD, <i>Contradens dimotus</i>	289
<i>lamarckii</i> DESHAYES, <i>Mekongia</i>	45	<i>lugubris</i> LESSON, <i>Nerita</i>	9
— <i>Paludina</i>	45	<i>lurida</i> MORELET, <i>Paludina</i>	28
<i>lamarckiana</i> PRIME, <i>Corbicula</i>	316	<i>luteola</i> LAMARCK, <i>Lymnaea</i>	232
<i>laminata</i> ROCHEBRUNE, <i>Anodonta</i> ..	264	— <i>Lymnaea</i> (<i>Ceracina</i>)	230
<i>laosensis</i> FISCHER, <i>Anodonta</i>	279	— <i>Lymnaea</i> (<i>Radix</i>)	232
<i>laosensis</i> LEA, <i>Margaritanopsis</i>	261	<i>lydigiana</i> PRIME, <i>Corbicula</i>	316, 321
— <i>Margaritifera</i> (<i>Margaritanopsis</i>) ..	261	<i>Lymnaea</i>	229
— <i>Unio</i>	261	<i>Lymnaea</i> (<i>Radix</i>)	229
<i>largillierti</i> MARTENS, <i>Planorbis</i>	246	<i>lymnaeaeformis</i> ROCHEBRUNE,	
<i>largillierti</i> PHILIPPI, <i>Corbicula</i>	323	<i>Bocourtia</i>	334
<i>larnaudiei</i> = <i>larnaudieri</i> PRIME	316	<i>lyrata</i> REEVE, <i>Melania</i>	167
<i>larnaudieri</i> PRIME, <i>Corbicula</i>	316		
<i>lateritia</i> LEA, <i>Melania</i>	167	<i>mabiliei</i> ROCHEBRUNE, <i>Pseudodon</i> ..	266
— <i>Melanoides</i>	168	<i>mcmulleni</i> BRANDT, <i>Pachydrobia</i> ..	74, 80
<i>laticallosa</i> ANNANDALE & RAO,		— <i>Stenothyra</i>	119
<i>Limnaea</i>	231	<i>macropterus</i> DUNKER, <i>Unio</i>	294
<i>laticallosiformis</i> YEN, <i>Galba</i>	232	<i>maculata</i> BRANDT, <i>Stenothyra</i>	130
<i>layardi</i> DOHRN, <i>Melania</i>	165	<i>maculata</i> MARTENS, <i>Omphalotropis</i> ..	155
<i>layardi</i> REEVE, <i>Psammobia</i>	305	<i>maekoki</i> BRANDT,	
— <i>Psammotaea</i>	305	<i>Filopaludina</i> (<i>Siamopaludina</i>) ..	29
<i>Lecythoconcha</i>	19	— <i>Siamopaludina</i>	29
<i>lemeslei</i> MORELET, <i>Anodonta</i>	263	<i>magnifica</i> LEA, <i>Symphynota</i>	278
— <i>Pilsbryoconcha</i>	263	<i>magnifica</i> PHILIPPI, <i>Ampullaria</i>	49
<i>lemeslei</i> ROCHEBRUNE, <i>Limnoperna</i> ..	256	<i>Mairwaringia</i>	138
<i>lemoinei</i> MORLET, <i>Corbicula</i>	318	<i>malabarica</i> PHILIPPI, <i>Ampullaria</i> ..	52
<i>lemsleyi</i> = <i>lemeslei</i>	263	<i>malanensis</i> = <i>oualaniensis</i>	10
<i>levayi</i> BAVAY, <i>Hydrorissoia</i>	87	<i>malayana</i> BROT, <i>Melania</i>	165
— <i>Lacunopsis</i>	108, 109	<i>mandalbarthi</i> BRANDT, <i>Sinotaia</i> ..	30
— <i>Paraprosthenia</i>	86, 87	— <i>Stenothyra</i>	126
<i>leviuscula</i> PRIME, <i>Corbicula</i>	326	<i>mandarinus</i> MORELET, <i>Unio</i>	281
<i>ligidiana</i> = <i>lydigiana</i> PRIME	316	<i>manningi</i> BRANDT, <i>Brotia</i>	179
<i>limnaeiformis</i> ANNANDALE, <i>Ellobium</i> ..	228	<i>Manningiella</i>	98
<i>Limnoperna</i>	255	<i>margaritina</i> LESCHKE, <i>Melania</i>	168
<i>Limnoscapha</i>	274	<i>Margaritanopsis</i>	261
<i>lineata</i> GMELIN, <i>Nerita</i>	6	<i>marginata</i> MORELET, <i>Hydrocena</i>	145
<i>lineata</i> GRAY, <i>Helix</i>	167	<i>martensi</i> FRAUENFELD, <i>Paludina</i>	27
<i>lineolata</i> REEVE, <i>Paludina</i>	22	— <i>Filopaludina</i> (<i>Siamopaludina</i>) ..	26, 27
— <i>Vivipara</i>	22	— <i>Vivipara</i>	27
<i>linguaeformis</i> MORELET,		<i>martensiana</i> = <i>martensi</i>	27
<i>Pilsbryoconcha exilis</i>	265	<i>martini</i> OOSTINGH, <i>Melania</i>	168
<i>linnaei</i> PHILIPPI, <i>Ampullaria</i>	49	<i>massiei</i> BAVAY, <i>Lacunopsis</i>	108, 110
<i>linneana</i> PRIME, <i>Corbicula</i>	316	<i>massiei</i> FISCH. & DTZBG., <i>Unio</i>	294
<i>lirata</i> BENSON, <i>Melania</i>	167	<i>massiei</i> MORLET, <i>Dreissensia</i>	307
<i>liratum</i> H. & A. ADAMS, <i>Plecotrema</i> ..	212	<i>massini</i> MORELET, <i>Unio</i>	294
<i>liratus</i> WESTERLUND,		<i>mauritsi</i> BUTOT, <i>Telescopium</i>	196
<i>Planorbis</i> (<i>Gyraulus</i>)	242	<i>mederianus</i> KÜSTER, <i>Uniandra</i>	289
<i>lirocincta</i> BOETTGER,		<i>megapterus</i> MORELET, <i>Unio</i>	272
<i>Assimineae philippinica</i>	144	<i>megaspida</i> KÜSTER, <i>Limnaeus</i>	229
<i>Lithoglyphopsis</i>	112	<i>mekongensis</i> BRANDT, <i>Anulotaia</i>	32
<i>Littorinopsis</i>	53	<i>Mekongia</i>	38
<i>longulus</i> MOUSSON, <i>Limnaeus</i>	229	<i>Melampus</i>	223

<i>Melampus (Micromelampus)</i>	224	<i>molleuri</i> MORLET, <i>Unio</i>	280
<i>Melanoides</i>	164	<i>monile</i> QUOY & GAIMARD, <i>Auricula</i>	223
<i>melanostoma</i> GRAY, <i>Litorina</i>	55	<i>monilifera(um)</i> H. & A. ADAMS,	
— <i>Littorina</i>	55	<i>Laemodonta</i>	214
— <i>Littorinopsis</i>	55	— <i>Plecotrema</i>	214
<i>melanostoma</i> TROSCHEL, <i>Neritina</i>	16	<i>monilifera</i> BENSON, <i>Nematura</i>	124
<i>melvilli</i> PRESTON, <i>Melania</i>	168	— <i>Stenothyra</i>	124
<i>menkeana</i> LEA, <i>Melania</i>	182	<i>mordax</i> DOHRN, <i>Plecotrema</i>	214
<i>merguiensis</i> HANLEY & THEOBALD,		<i>moreleti</i> CROSSE & FISCHER,	
<i>Planorbis</i>	234	<i>Pseudodon</i>	271
<i>mertoniana</i> RÉCLUZ, <i>Nerita</i>	10	<i>moreleti</i> DESHAYES, <i>Paludina</i>	42, 45
<i>messengeri</i> BAVAY & DAUTZENBERG,		<i>moreletiana</i> PRIME, <i>Corbicula</i>	315, 321
<i>Corbicula</i>	327	— <i>Corbicula fluminea</i>	321
<i>Metassininea</i>	143	<i>morio</i> DESHAYES, <i>Neritina</i>	8
<i>meukiana</i> = <i>menkeana</i> LEA	182	<i>morrisoni</i> BRANDT, <i>Paracrostoma</i>	188
<i>Micromelampus</i>	224	— <i>Rivomarginella</i>	205
<i>microptera(um, us)</i> KIENER,		— <i>Sinomytilus</i>	307
<i>Cerithidea (Cerithideopsisilla)</i>	191	<i>Morrisonietta</i>	207
— <i>Cerithium</i>	191	— <i>mouhotii</i> LEA, <i>Monocondylaea</i>	265
— <i>Potamides</i>	191	— <i>Pseudodon</i>	265
<i>micropteroides</i> ANNANDALE, <i>Physunio</i>	296	— <i>Pseudodon (Bineurus)</i>	266
<i>micropterus</i> MORELET, <i>Physunio</i>	296	<i>mouhotiana</i> LEA, <i>Monocondylaea</i>	265
— <i>Unio</i>	296	<i>moussoni</i> DESHAYES, <i>Corbicula</i>	315
<i>microscopica</i> BRANDT, <i>Assimineae</i>	146	<i>moussoni</i> MARTENS, <i>Cyrena</i>	309
— <i>Assimineae (Ovassimineae)</i>	146	— <i>Stenothyra</i>	125
<i>microscopica</i> NEVILL, <i>Clenchiella</i>	69	<i>multiplicata</i> MARTENS, <i>Cassidula</i>	220
— <i>Valvata</i> (?)	69	<i>multistriata</i> PRESTON, <i>Neoradina</i>	170
<i>microsculpta</i> BRANDT, <i>Brotia</i>	180	<i>munensis</i> BRANDT,	
— <i>Hubendickia</i>	100	<i>Filopaludina (Siamopaludina)</i>	
— <i>Jullienia</i>	81	<i>martensi</i>	29
— <i>Manningiella</i>	99, 100	— <i>Harmandia</i>	284
— <i>Stenothyra</i>	117	— <i>Hydrorissoia</i>	104, 106
<i>microsculpta</i> NEVILL, <i>Assimineae</i>	142	— <i>Jullienia</i>	81, 83
— <i>Assimineae (Sculptassimineae)</i>	142	— <i>Lacunopsis</i>	108, 109
<i>microstoma</i> LEA, <i>Melania</i>	167	— <i>Pachydrobia</i>	74, 76
<i>midae</i> LAMARCK, <i>Auricula</i>	226	<i>mustelae</i> BECK, <i>Cassidula</i>	221
<i>midae</i> RÖDING, <i>Ellobium</i>	226	<i>mustelina</i> DESHAYES, <i>Auricula</i>	221
<i>miniata</i> MARTENS, <i>Assimineae</i>	145	— <i>Cassidula</i>	221
<i>minima</i> TEMCHAROEN, <i>Wykoffia</i>	113	— <i>Sidula</i>	221
<i>minor</i> MARTENS,		<i>mutatus</i> MOUSSON, <i>Uniandra</i>	289
<i>Planorbis coromandelicus</i>	234	<i>myersiana(us)</i> LEA, <i>Hyriopsis</i>	275
<i>minor</i> MORLET, <i>Unio scobinatus</i>	282	— <i>Hyriopsis (Limnoscapha)</i>	275
<i>minutissima</i> WATTEBLÉ, <i>Valvata</i>	69	— <i>Metaptera</i>	275
<i>misellus</i> MORELET, <i>Trapezoides</i>	299	— <i>Unio</i>	275
— <i>Unio</i>	299, 300	<i>mytiloides</i> LAMARCK, <i>Lopha</i>	259
<i>mitescens</i> SCHEPMAN,		<i>nana</i> ANNANDALE & RAO,	
<i>Melania sumatrensis</i>	182	<i>Limnaea acuminata</i>	232
<i>miyitkyinae</i> PRASHAD,		<i>nana</i> NEVILL, <i>Neoradina</i>	170
<i>Parreysia burmanus</i>	279	<i>nana</i> PRASHAD, <i>Stenothyra</i>	134
<i>modellati</i> BRANDT, <i>Physunio</i>	297	<i>nana</i> REEVE, <i>Pirena</i>	197
<i>Modellnaia</i> n. gen.	301	<i>nassa</i> THEOBALD, <i>Bithynia</i>	65
<i>modicus</i> H. & A. ADAMS, <i>Planorbis</i>	234	— <i>Bithynia</i>	65
<i>moerchi</i> MENKE, <i>Auricula</i>	228	— <i>Hydrobioides</i>	65
<i>moesta</i> HINDS, <i>Melania</i>	165		

<i>nebulata</i> RÉCLUZ, <i>Nerita</i>	10	<i>ornata</i> VON DEM BUSCH, <i>Melania</i>	164
<i>Neoradina</i> n. gen.	169	<i>oualanensis</i> = <i>oualaniensis</i>	10
<i>nepalensis</i> KOBELT, <i>Vivipara bengalensis</i>	24	<i>oualaniensis</i> LESSON, <i>Clithon (Pictoneritina)</i>	10
<i>Nerita</i>	6	— <i>Neritina</i>	10
<i>Neritilia</i>	17	<i>oualaniensis</i> = <i>oualaniensis</i>	10
<i>Neritina</i>	13	<i>ovalina</i> DESHAYES, <i>Corbicula</i>	315
<i>Neritina (Dostia)</i>	16	<i>ovalis</i> BRANDT, <i>Stenothyra</i>	118
<i>Neritina (Viitoida)</i>	14	<i>ovalis</i> GRAY, <i>Limnaea</i>	232
<i>Neritodryas</i>	8	<i>ovalis</i> MORLET, <i>Pseudodon</i>	270
<i>nevilliei</i> MORELET, <i>Ellobium</i>	228	<i>Ovassimineae</i>	146
<i>nevillianum</i> THEOBAD, <i>Pisidium</i>	330	<i>Pachydrobia</i>	73
— <i>Pisidium (Afropisidium)</i>	330	<i>Pachydrobiella</i>	106
<i>nicobarica</i> TAPP. CANEFRI, <i>Melania</i> ..	165	<i>pachysoma</i> BENSON, <i>Indonaiia</i>	285
<i>nigrobifasciata</i> VAN BENTHEM JUTTING, <i>Neritina ualanensis</i>	10	<i>pagodula</i> GOULD, <i>Brotia</i>	173
<i>ningpoensis</i> LEA, <i>Melanoides</i>	165	— <i>Io</i>	173
<i>nitida</i> PEASE, <i>Assimineae</i>	148	— <i>Melania</i>	173
— <i>Hydrocena</i>	148	— <i>Tiara (Acrostoma)</i>	173
— <i>Syncera</i>	148	<i>pagoda</i> LEA, <i>Melania</i>	163
<i>nitidellus</i> MARTENS, <i>Planorbis</i>	246	<i>pagoda</i> MORELET, <i>Ampullaria</i>	49
<i>noetlingi</i> MARTENS, <i>Corbicula</i>	319	<i>pagodus</i> REEVE, <i>Pirena</i>	197
<i>Novaculina</i>	303	<i>paivanus</i> MORELET, <i>Unio</i>	291
<i>novaehiberniae</i> LESSON, <i>Littorina</i> ..	53	<i>pajacomboensis</i> BULLEN, <i>Uniandra</i> ..	289
<i>nubila</i> VON DEM BUSCH, <i>Neritina</i>	10	<i>palembangensis</i> STRUBELL, <i>Melania</i> ..	182
<i>nuclea(us)</i> MARTYN, <i>Cassidula</i>	220	<i>pallegoixi</i> SOWERBY, <i>Anodon</i>	300
— <i>Sidula</i>	220	— <i>Trapezoides</i>	300
<i>nucleolus</i> MARTENS, <i>Melampus</i>	224	— <i>Trapezoides exolescens</i>	300
— <i>Melampus (Micromelampus)</i>	224	<i>paludiformis</i> YEN, <i>Paracrostoma</i> ..	187
<i>nucleolus</i> TROSCHER, <i>Limnaeus</i>	232	— <i>Semisulcospira</i>	187
<i>nucleus</i> LEA, <i>Scabies</i>	283	<i>Paludinella</i>	152
— <i>Unio</i>	283	<i>Paludinella (Schwettiella)</i>	154
<i>nucula</i> TEMCHAROEN, <i>Jullienia</i>	81	<i>Paludomus</i>	160
<i>oblitus</i> LEA, <i>Unio</i>	281	<i>palustris</i> LINNAEUS, <i>Potamides</i>	195
<i>obtusa(um)</i> LAMARCK, <i>Cerithidea</i> ..	192	— <i>Strombus</i>	194
— <i>Cerithium</i>	192	— <i>Terebralia</i>	194
— <i>Potamides</i>	192	<i>papillosa</i> DEGNER, <i>Melania</i>	182
<i>obtusa</i> TROSCHER, <i>Paludina</i>	36	<i>papua</i> LESSON, <i>Cyrena</i>	309
<i>obtusa</i> WATTEBLED, <i>Assimineae</i>	146	<i>papuensis</i> VAN BENTHEM JUTTING, <i>Clenchiella</i>	69
— <i>Assimineae (Ovassimineae)</i>	146	<i>Paracrostoma</i>	184
<i>occidentalis</i> HEUDE, <i>Dipsas</i>	278	<i>paradoxa</i> CROSSE & FISCHER, <i>Pachydrobia</i>	74
<i>occidentiformis</i> BRANDT, <i>Corbicula</i> ..	325	<i>Paraprososthenia</i>	85
<i>Odhneripisidium</i>	331	<i>Parreysia</i>	279
<i>ollula</i> GOULD, <i>Limnaea</i>	231	<i>parreysii</i> BROT, <i>Melania</i>	165
<i>oparica</i> H. & A. ADAMS, <i>Auriculastra</i> ..	222	<i>parva(um)</i> LEA, <i>Melania</i>	71
<i>orbata</i> PERRY, <i>Pomacea</i>	49	— <i>Pachychilus</i>	71
<i>orbicularis</i> MORELET, <i>Monocondylus</i> ..	269	— <i>Pachydrobia</i>	71
<i>orbiculata</i> WOOD, <i>Eliza</i>	305	— <i>Rehderiella</i>	71
<i>orientalis</i> DESHAYES, <i>Planorbis</i>	234	<i>patrangensis</i> MORLET, <i>Unio</i>	275
<i>orientalis</i> PHILIPPI, <i>Ampullaria</i>	52	<i>pavici</i> = <i>paviei</i>	276
<i>ornata</i> A. ADAMS, <i>Cerithidea</i>	193	<i>paviei</i> BRANDT, <i>Hydrorissoia</i>	104
<i>ornata</i> BLANFORD, <i>Iravadia</i>	135	<i>paviei</i> MORLET, <i>Unio</i>	276
— <i>Rissoina (Iravadia)</i>	135		

<i>pavonina</i> ROCHEBRUNE,	
<i>Chamberlainia</i>	276
— <i>Dysnomia</i>	276
<i>pazii</i> LEA, <i>Unio</i>	288
<i>Pedalion</i>	259
<i>peguensis</i> ANTHONY, <i>Melania</i>	181
— <i>Monocondylaea</i>	267
— <i>Unio</i>	299
<i>peguensis</i> BLANFORD, <i>Clithon</i>	11
— <i>Neritina</i>	11
<i>peguensis</i> KOBELT, <i>Vivipara variata</i> ..	36
<i>pellicens</i> TAPP. CANEFRI, <i>Melania</i> ..	165
<i>pellislacerti</i> MORELET, <i>Unio</i>	281
<i>pellucida</i> BAVAY, <i>Manningiella</i> .. 99,	102
— <i>Pachydrobia</i>	102
<i>peninsularis</i> BRANDT, <i>Brotia costula</i> ..	183
— <i>Filopaludina sumatrensis</i>	23
<i>perakensis</i> MORGAN, <i>Ampullaria</i>	52
— <i>Sermyla</i>	182
<i>percha</i> ANNANDALE, <i>Ellobium</i>	228
<i>perdecollata</i> NEVILL, <i>Neoradina</i>	170
<i>perdix</i> KING & BRODERIP, <i>Litorina</i> ..	55
<i>persculpta</i> HAAS, <i>Nodularia</i>	282
<i>pervius</i> MARTENS, <i>Limnaeus</i>	231
<i>pesmei</i> MORLET, <i>Ampullaria</i>	51
— <i>Pachylabra</i>	51
— <i>Pila</i>	51
<i>petiti</i> CLESSIN, <i>Corbicula</i>	321
<i>petiti</i> MORLET, <i>Corbicula</i>	321
— <i>Corbicula fluminea</i>	321
<i>petiti</i> RÉCLUZ, <i>Neritina</i>	14
<i>petiti</i> TAPP. CANEFRI, <i>Melania</i>	165
<i>petrosa(us)</i> GOULD, <i>Paludina</i>	160
— <i>Paludomus</i>	160
<i>Pettancylus</i>	248
<i>Pharella</i>	304
<i>phaselus</i> LEA, <i>Scabies</i>	283
— <i>Unio</i>	283
<i>phaseolus</i> = <i>phaselus</i> LEA	283
<i>philippiana</i> REEVE, <i>Littorina</i>	53
<i>philippinarum</i> SOWERBY, <i>Neritina</i> ..	9
<i>philippinensis</i> MOUSSON, <i>Limnaeus</i> ..	231
<i>philippinica</i> BOETTGER, <i>Assimineae</i> ..	143
— <i>Assimineae (Metassimineae)</i>	143
<i>physcus</i> ANNANDALE & RAO, <i>Limnaea</i> ..	232
<i>Physunio</i>	293
<i>picta</i> REEVE, <i>Pirena</i>	197
<i>Pictoneritina</i>	10
<i>pierrei</i> ROCHEBRUNE, <i>Pseudodon</i>	266
<i>Pila</i>	47
<i>pilata(us)</i> LEA, <i>Indonaia</i>	286
— <i>Unio</i>	286
<i>Pilsbryoconcha</i>	262
<i>pingensis</i> BRANDT, <i>Corbicula</i>	324
<i>pinguicola</i> MARTENS, <i>Melania</i>	163
<i>pinguis</i> DOHRN, <i>Limnaea</i>	232
<i>pinguis</i> MARTENS, <i>Assimineae</i>	145
<i>pinna</i> BENSON, <i>Scaphula</i>	254
<i>pirenoidea</i> NEVILL, <i>Neoradina</i>	170
<i>pisidiformis</i> PRIME, <i>Corbicula</i>	317
<i>Pisidium</i>	328
<i>Pisidium (Afropisidium)</i>	329
<i>Pisidium (Odhneripisidium)</i>	331
<i>Pisidium (Pisidium)</i>	329
<i>plana</i> VON DEM BUSCH, <i>Neoradina</i> ..	170
<i>planospira</i> ANTON, <i>Nerita</i>	7
— <i>Nerita (Theliostyla)</i>	7
<i>plicata(us)</i> GRAY, <i>Pythia</i>	216
— <i>Scarabus</i>	216
<i>plicata(us)</i> LEACH, <i>Cristaria</i>	278
— <i>Dipsas</i>	278
<i>poirieri</i> BRANDT, <i>Jullienia</i>	74, 81
— <i>Pachydrobia</i>	74
<i>polita</i> A. ADAMS, <i>Nematura</i>	127
— <i>Stenothyra</i>	127
<i>polita</i> BRANDT, <i>Manningiella</i> .. 99,	100
<i>polita</i> DESHAYES, <i>Ampullaria</i>	49
— <i>Pachylabra</i>	49
— <i>Pila</i>	49
<i>polita</i> MOUSSON, <i>Anodonta</i>	263
<i>politus</i> SOWERBY, <i>Anodon</i>	264
<i>polygramma</i> MARTENS, <i>Paludina</i> ..	22
— <i>Filopaludina sumatrensis</i>	22
<i>Polymesoda</i>	308
<i>Polymesoda (Geloina)</i>	309
<i>Polypylis</i>	245
<i>polyzonata</i> FRAUENFELD, <i>Taia</i>	21, 30
<i>ponderosa</i> PRESTON, <i>Pseudodon</i>	270
<i>pongensis</i> BRANDT, <i>Mekongia</i>	41
<i>prasongi</i> BRANDT, <i>Gyraulus</i>	241
— <i>Jullienia</i>	81, 85
— <i>Neoradina</i>	170
— <i>Pachydrobia</i>	74, 78
— <i>Stenothyra</i>	132
<i>prasongi</i> KUIPER n. sp.,	
<i>Pisidium (Odhneripisidium)</i>	333
<i>prestoniana</i> BULLEN,	
<i>Melania curvicosta</i>	182
<i>primeana</i> MORELET, <i>Corbicula</i>	314
<i>princeps</i> LEA, <i>Melanopsis</i>	197
<i>proclivis</i> MARTENS, <i>Planorbis</i>	239
<i>provisoria</i> BROT, <i>Melania</i>	182
<i>proxima</i> PRIME, <i>Cyrena</i>	311
— <i>Polymesoda (Geloina)</i>	311
<i>prunus</i> TROSCHER, <i>Limnaeus</i>	232
<i>Psammobia</i>	305
<i>Psammotaeta</i>	305
<i>pseudoasperata</i> BRANDT, <i>Brotia</i>	177

<i>Pseudodon</i>	265	<i>Rehderiella</i> n. gen.	70
<i>pseudohelicina</i> KOBELT, <i>Vivipara variata</i>	36	<i>remosaei</i> PHILIPPI, <i>Paludina</i>	36
<i>pseudospinosa</i> PRASHAD, <i>Acrostoma variabile</i>	182	<i>reticulata</i> BRANDT, <i>Iravadia</i>	136
<i>pseudosulcospira</i> BRANDT, <i>Paracrostoma</i>	185	<i>reticulata</i> QUOY & GAIMARD, <i>Nerita</i> ..	9
— <i>Brotia</i> (<i>Paracrostoma</i>)	185	<i>reticulata</i> SCHUMACHER, <i>Auricula</i> ..	227
<i>pugilis</i> HINDS, <i>Melania</i>	163	<i>retifera</i> SOWERBY, <i>Neritina</i>	12
<i>pulchella</i> (<i>um</i>) BENSON, <i>Bithynia</i>	61	<i>retropicta</i> MARTENS, <i>Clithon</i>	11
— <i>Bithynia</i> (<i>Digoniosstoma</i>)	61	<i>rhodostoma</i> ROUSSEAU, <i>Auricula</i>	221
— <i>Digoniosstoma</i>	61	<i>riquetii</i> GRATELOUP, <i>Melania</i>	169
<i>pulchella</i> (<i>us</i>) PETIT, <i>Auricula</i>	225	— <i>Sermyla</i>	169
— <i>Melampus</i>	225	<i>Rivomarginella</i>	205
— <i>Melampus</i> (<i>Micromelampus</i>)	225	<i>rivularis</i> PHILIPPI, <i>Melania</i>	165
— <i>Tralia</i> (<i>Tifata</i>)	225	<i>rivulicola</i> ANNANDALE, <i>Hydrobioides nassa</i>	65
<i>pulchella</i> RÉCLUZ, <i>Nerita</i>	12	<i>robusta</i> H. ADAMS, <i>Bithynia</i>	60
— <i>Neritina</i> (<i>Vitta</i>)	10	<i>rohdei</i> BRANDT, <i>Fairbankia</i>	139
<i>pulcher</i> TAPP. CANEFRI, <i>Trapezoides</i> 299		<i>rolfbrandti</i> TEMCHAROEN, <i>Hubendickia</i>	92
<i>pulcherrima</i> MOUSSON, <i>Neritina</i>	15	— <i>Jullienia</i>	81
<i>pulligera</i> LINNAEUS, <i>Nerita</i>	14	<i>roseni</i> BRANDT, <i>Stenothyra</i>	123
— <i>Neritina</i>	14	<i>rostrata</i> SOWERBY, <i>Anodonta</i>	279
<i>punctata</i> POTIEZ & MICHAUD, <i>Melania</i>	164	<i>rothiana</i> MOUSSON, <i>Melania</i>	164
<i>punctatostriata</i> (<i>um</i>) H. & A. ADAMS, <i>Laemodonta</i>	213	<i>rotula</i> BENSON, <i>Gyraulus</i>	242
— <i>Plecotrema</i>	213	— <i>Planorbis</i>	242
<i>punctigera</i> (<i>um</i>) H. & A. ADAMS, <i>Laemodonta</i>	213	— <i>Planorbis</i> (<i>Gyraulus</i>)	242
— <i>Plecotrema</i>	213	<i>rubella</i> BLANFORD, <i>Assimineae</i>	145
<i>punctulata</i> REEVE, <i>Melania</i>	165	<i>rubida</i> PEASE, <i>Neritilia</i>	17
<i>pygmaea</i> PRESTON, <i>Alocinma</i>	62	— <i>Neritina</i>	17
— <i>Bithynia</i>	62	— <i>Neritina</i> (<i>Neritilia</i>)	17
— <i>Bithynia</i> (<i>Gabbia</i>)	62	<i>rubiginosa</i> (<i>us</i>) MICHELIN, <i>Lymnaeus</i> 229	
<i>pyramis</i> BENSON, <i>Melania</i>	164	— <i>Lymnaea auricularia</i>	230
<i>Pythia</i>	215	— <i>Lymnaea</i> (<i>Radix</i>) <i>auricularia</i> ..	229
<i>Pythia</i> (<i>Trigonopythia</i>)	216	<i>rubropunctata</i> TRISTRAM, <i>Melania</i> ..	165
<i>quadrasi</i> MOELLENDORFF, <i>Cylindrotis</i> 217		<i>rudis</i> LEA, <i>Melania</i>	167
— <i>Lymnaea</i>	231	<i>rugosa</i> BROT, <i>Melania</i>	163
— <i>Stenothyra</i>	127	<i>rugosa</i> HANLEY, <i>Glauconomya</i>	334
<i>quadrata</i> SOWERBY, <i>Cerithidea</i>	193	<i>rustica</i> (<i>us</i>) LEA, <i>Contradens</i>	291
— <i>Cerithidea obtusa</i>	193	— <i>Nodularia</i>	291
<i>Radina</i>	170	— <i>Uniandra contradens</i>	291
<i>Radix</i>	229	— <i>Unio</i>	291
<i>rapax</i> DOHRN, <i>Plecotrema</i>	214	<i>rusticoides</i> BRANDT, <i>Uniandra contradens</i>	290
<i>rattai</i> CROSSE & FISCHER, <i>Mekongia</i> 44		<i>saccata</i> PFEIFFER, <i>Auriculastra</i>	222
— <i>Paludina</i>	44	<i>sagittarius</i> LEA, <i>Ensidents</i>	288
<i>recurvata</i> EYDOUX, <i>Corbicula</i>	322	— <i>Unio</i>	288
<i>reducta</i> BRANDT, <i>Pachydrobia zilchi</i> 80		<i>saigonensis</i> CROSSE & FISCHER, <i>Planorbis</i>	239
<i>regia</i> CLESSIN, <i>Corbicula</i>	320	<i>Salasiella</i>	206
<i>regularis</i> PRIME, <i>Corbicula</i>	319	<i>salwenianus</i> GOULD, <i>Anodon</i>	267
		<i>sandai</i> REINHARDT, <i>Corbicula</i>	314
		<i>sanguina</i> SOWERBY, <i>Neritina</i>	314
		<i>savinieri</i> MORLET, <i>Melania</i>	163
		<i>Scabies</i>	281

<i>scabra</i> LINNAEUS, <i>Helix</i>	53	<i>siamensis</i> FRAUENFELD, <i>Bellamyia</i>	42
— <i>Littorina</i>	53	— <i>Mekongia</i>	40
— <i>Littorinopsis</i>	53	— <i>Paludina</i>	42
<i>scabra(um)</i> MÜLLER, <i>Buccinum</i>	163	— <i>Vivipara</i>	40
— <i>Thiara</i>	163	<i>siamense(is)</i> LEA, <i>Bithinia</i>	59
<i>scabrella</i> MOUSSON, <i>Melania</i>	163	— <i>Bithynia</i>	59
<i>scalariformis</i> TENNISON WOODS, <i>Melania</i>	165	— <i>Bithynia (Digoniostoma)</i>	58, 59
<i>scalarina</i> DESHAYES, <i>Canidia</i>	203	— <i>Digoniostoma</i>	59
— <i>Clea (Anentome)</i>	203	— <i>Unio</i>	299
<i>scalaroides</i> POIRIER, <i>Pachydrobia</i> ..	80	<i>siamensis</i> MARTENS, <i>Gyraulus</i>	240
<i>Scaphula</i>	254	— <i>Melampus</i>	225
<i>schepmakeri</i> PETIT, <i>Auricula</i>	228	— <i>Melampus (Micromelampus)</i>	225
<i>Schizocleithrum</i>	289	— <i>Planorbis compressus</i>	240
<i>schlickumi</i> BRANDT, <i>Assimineae</i>	149	<i>siamensis</i> MOELLENDORFF, <i>Wattebledia</i> ..	64
— <i>Hubendickia</i>	92, 98	<i>siamensis</i> MORELET, <i>Dreissena</i>	256
— <i>Paraprososthenia</i>	98	— <i>Laemodonta</i>	214
— <i>Stenothyra</i>	129	— <i>Limnoperna</i>	256
<i>schomburgki</i> MARTENS, <i>Anodonta (Lamproscapha)</i>	264	— <i>Plecotrema</i>	214
<i>schomburgki</i> REEVE, <i>Melania</i>	171	<i>siamensis</i> MORLET, <i>Novaculina</i>	303
<i>schuetti</i> BRANDT, <i>Assimineae</i>	149	— <i>Unio</i>	291
— <i>Hubendickia</i>	92, 95	<i>siamensis</i> PRASHAD, <i>Corbicula</i>	322
— <i>Paraprososthenia</i>	95	<i>siamensis</i> SOWERBY, <i>Limnaea</i>	230
— <i>Stenothyra</i>	122	— <i>Limnaea luteola</i>	230
<i>Schuettiella</i>	154	— <i>Limnaea (Gulnaria)</i>	230
<i>scobinata(us)</i> LEA, <i>Scabies</i>	282	<i>siamica</i> PRIME, <i>Cyrena</i>	310
— <i>Unio</i>	281, 282	<i>Siamopaludina</i>	25
— <i>Unio (Scabies)</i>	282	<i>sieboldii</i> PHILIPPI, <i>Litorina</i>	53
<i>Sculptassimineae</i>	141	— <i>Littorina</i>	53
<i>scutata</i> MOUSSON, <i>Ampullaria</i>	52	<i>similis</i> PRIME, <i>Batissa</i>	312
— <i>Pila</i>	52	<i>singaporinus</i> KÜSTER, <i>Limnaeus</i>	230
<i>Segmentina</i>	245	<i>singularis</i> TAPP. CANEFRI, <i>Melania</i> ..	165
<i>Segmentina (Polypylis)</i>	245	<i>Sinomytilus</i>	306
<i>Segmentina (Trochorbis)</i>	246	<i>Sinotaia</i>	30
<i>semicostata</i> PHILIPPI, <i>Melania</i>	169	<i>sinuosa</i> DESHAYES, <i>Cyrena</i>	310
<i>semidecoratus</i> MORLET, <i>Unio</i>	290	<i>snellemanni</i> SCHEPMAN, <i>Melania</i>	163
<i>semigranosa</i> VON DEM BUSCH, <i>Melania</i> ..	167	<i>soboles</i> FISCHER, <i>Unio</i>	291
<i>semiplicata</i> A. ADAMS, <i>Auriculastra</i> ..	222	<i>sobrius</i> LEA, <i>Neoradina</i>	170
<i>semiquadrata</i> SOWERBY, <i>Unio</i>	295	<i>solemiana</i> BRANDT, <i>Paracrostoma</i> ..	186
<i>sempervivens</i> DESHAYES, <i>Anodonta</i> ..	264	— <i>Brotia (Paracrostoma)</i>	186
<i>Senckenbergia</i>	184	<i>Solenocurtus</i>	305
<i>Septifer</i>	258	<i>Solenotellina</i>	305
<i>Sermyla</i>	168	<i>solidiuscula</i> NEVILL, <i>Neoradina</i>	170
<i>serrulata</i> RÉCLUZ, <i>Neritina</i>	15	<i>solidula</i> PRIME, <i>Corbicula</i>	326
<i>shanensis</i> ANNANDALE, <i>Limnaea</i>	231	<i>somboriensis</i> ROCHEBRUNE, <i>Harmandia</i>	284
<i>siamensis</i> BLANFORD, <i>Paludomus</i>	161	<i>soricina</i> HOMBRON & JACQUINOT, <i>Auricula</i>	223
<i>siamensis</i> BRANDT, <i>Cylindrotis</i>	218	<i>souverbiana</i> WATTEBLED, <i>Corbicula</i> ..	326
— <i>Ferrissia (Pettancylus)</i>	250	<i>sowerbyana</i> PFEIFFER, <i>Cassidula</i>	221
— <i>Hubendickia</i>	92, 93	<i>sowerbyana</i> RÉCLUZ, <i>Clithon</i>	13
— <i>Modellnaia</i>	301	— <i>Nerita</i>	13
— <i>Morrisonietta</i>	209	— <i>Neritina</i>	13
— <i>Pachydrobia</i>	74, 77	<i>spadicea</i> MORELET, <i>Limnaea</i>	230
— <i>Rehderiella</i>	71	— <i>Limnaea (Radix)</i>	230

<i>speciosa</i> DESHAYES, <i>Paludina</i>	21	<i>sula</i> THEOBALD, <i>Unio</i>	261
— <i>Filopaludina sumatrensis</i>	21	<i>sulcata</i> ANTON, <i>Nerita</i>	8
<i>Sphaerassiminea</i>	144	<i>sulcata</i> BAVAY, <i>Hubendickia</i>	92
<i>sphaerica</i> POIRIER, <i>Lacunopsis</i>	108	<i>sulcata</i> BORN, <i>Terebralia</i>	195
<i>sphaericula</i> DESHAYES, <i>Mekongia</i> ..	45	<i>sulcata</i> CLESSIN, <i>Corbicula</i>	315
— <i>Paludina</i>	45	<i>sumatranum</i> MARTENS, <i>Pisidium</i>	332
<i>spinescens</i> LESSON, <i>Melania</i>	163	— <i>Pisidium</i> (<i>Odhneripisidium</i>)	332
<i>spinosa</i> BRANDT, <i>Stenothyra</i>	131	<i>sumatrensis</i> BROT, <i>Melania</i>	182
<i>spinosa</i> TEMCHAROEN,		<i>sumatrensis</i> DUNKER, <i>Filopaludina</i> ..	20
<i>Clea</i> (<i>Anentome</i>)	202	— <i>Paludina</i>	21, 22, 24
<i>spinulosa</i> LAMARCK, <i>Melania</i>	163	<i>sumatrensis</i> LEA, <i>Uniandra</i>	289
— <i>Melania</i> (<i>Plotia</i>)	163	<i>sumatrensis</i> PHILIPPI, <i>Ampullaria</i> ..	49
<i>spiralis</i> BRANDT,		<i>sumatrensis</i> SOWERBY, <i>Cyrena</i>	310
<i>Assiminea</i> (<i>Sculptassiminea</i>)	143	<i>superbus</i> LEA, <i>Physunio</i>	294
— <i>Brotia binodosa</i>	176	— <i>Unio</i>	294
— <i>Hubendickia</i>	92, 93	<i>supoti</i> BRANDT, <i>Limnoperna</i>	256
— <i>Mekongia sphaericula</i>	46	<i>sutrangensis</i> MORLET, <i>Unio</i>	273, 275
— <i>Morrisonietta</i>	208	<i>suturalis</i> PHILIPPI, <i>Melania</i>	165
— <i>Stenothyra</i>	122	<i>swainsoni</i> LEA, <i>Mekongia</i>	42
<i>spirodelus</i> WESTERLUND, <i>Segmentina</i>	245	— <i>Paludina</i>	42
<i>Sprickia</i>	289	<i>swainsoniana</i> LEA, <i>Paludina</i>	42
<i>stelzneri</i> DOHRN, <i>Planorbis</i>	239	— <i>Vivipara</i>	42
<i>Stenothyra</i>	115	<i>swinhoei</i> H. ADAMS, <i>Limnaea</i>	231
<i>stomatodonta</i> ROCHEBRUNE, <i>Canidia</i>	201	— <i>Limnaea</i> (<i>Radix</i>) <i>auricularia</i> ..	231
<i>striatella</i> DESHAYES, <i>Corbicula</i>	317	— <i>Radix</i>	231
<i>strictocosta</i> MARTENS, <i>Melania</i>	182	<i>sykesi</i> DEGNER, <i>Melania</i>	163
<i>strigillata</i> RÉCLUZ, <i>Neritina</i>	15	<i>taenia</i> GMELIN, <i>Alectrion</i> (<i>Zeuxis</i>) ..	374
<i>stungtrangensis</i> FISCHER & DAUTZENBERG,		<i>taia</i> ANNANDALE & RAO, <i>Segmentina</i>	246
<i>Unio</i>	275	<i>Tarebia</i>	167
<i>subampullacea</i> NEVILL,		<i>tavoyensis</i> GOULD, <i>Parreysia</i>	280
<i>Ampullaria turbinis</i>	49	<i>taylori</i> BRANDT, <i>Paraprososthenia</i>	86, 88
— <i>Pachylabra turbinis</i>	50	<i>Telescopium</i>	195
<i>subcancellata</i> BOETTGER, <i>Melania</i> ..	163	<i>telescopium</i> LINNAEUS, <i>Trochus</i>	196
<i>subcarinata</i> WATTEBLÉ, <i>Bithinia</i> ..	60	— <i>Potamides</i> (<i>Telescopium</i>)	196
<i>subciliata</i> KOBELT, <i>Sinotaia</i>	34	— <i>Telescopium</i>	196
— <i>Vivipara</i>	34	<i>tenerrimus</i> BRANDT,	
<i>subcircularis</i> BRANDT, <i>Uniandra</i>	293	<i>Pseudodon cambodjensis</i>	270
<i>subclathratus</i> MARTENS, <i>Unio misellus</i>	299	<i>tenuicostata</i> BROT, <i>Canidia</i>	201
<i>subglobosa</i> NEVILL,		<i>tenuis</i> CLESSIN, <i>Corbicula</i>	318
<i>Ampullaria turbinis</i>	49	<i>terae</i> BRANDT, <i>Cyclotropis</i>	156
<i>subgloriosa</i> BRANDT, <i>Brotia binodosa</i>	175	<i>Terebralia</i>	194
<i>subnitens</i> CLESSIN, <i>Corbicula</i>	317	<i>terebralis</i> LAMARCK, <i>Pirena</i>	197
<i>subnodosa</i> METCALF, <i>Ellobium</i>	227	<i>thaiensis</i> HABE, <i>Unio</i>	291
<i>subplicata</i> SCHEPMAN, <i>Melania</i>	182	<i>Theliostyla</i>	7
<i>subrostrata</i> BULLEN, <i>Corbicula</i>	315	<i>theminceiana</i> PETIT, <i>Melania</i>	201
<i>substriata(us)</i> LEA, <i>Indonaiia</i>	285	<i>Thiara</i>	162
— <i>Unio</i>	285	<i>thonburi</i> BRANDT, <i>Paludinella</i>	153
<i>subtile</i> RÖDING, <i>Ellobium</i>	227	<i>tigertti</i> BRANDT, <i>Gangetia</i>	114
<i>subtrigonus</i> SOWERBY, <i>Monocondylus</i>	269	<i>tigrina</i> DOHRN, <i>Limnaea</i>	232
<i>subula</i> QUOY & GAIMARD, <i>Auricula</i>	222	<i>tigrina</i> HUTTON, <i>Melania</i>	165
— <i>Auriculastra</i>	222	<i>tiranti</i> MORLET, <i>Paludina</i>	28
— <i>Marinula</i> (<i>Auriculastra</i>)	222	<i>tjariangensis</i> MARTIN, <i>Melania</i>	168
<i>subulata</i> BRANDT, <i>Manningiella</i>	103	<i>tjibodasensis</i> LESCHKE, <i>Melania</i>	168
<i>succinea</i> DESHAYES, <i>Limnaea</i> ..	229, 232		

<i>togata</i> DESHAYES, <i>Psammobia</i>	305	<i>turrita</i> PFEIFFER, <i>Auricula</i>	227
<i>tongkingensis</i> CLESSIN, <i>Corbicula</i>	321	<i>typica(um)</i> H. & A. ADAMS, <i>Laemodonta</i>	212
<i>tonkiniana</i> MORLET, <i>Corbicula</i>	321	— <i>Plecotrema</i>	212
<i>tornatella</i> LEA, <i>Melania</i>	169	<i>ualaniensis</i> = <i>oualaniensis</i>	10
<i>tornatelliforme</i> PETIT, <i>Ellobium</i>	228	<i>umbilicalis</i> BENSON, <i>Helicorbis</i>	244
<i>Tornus</i>	158	— <i>Hippeutis</i> (?)	244
<i>torquata</i> VON DEM BUSCH, <i>Melania</i>	182	— <i>Hippeutis</i> (<i>Helicorbis</i>)	244
<i>tourannensis</i> EYDOUX & SOULEYET, <i>Neritina</i>	16	— <i>Planorbis</i>	244
<i>trajecta</i> FISCHER, <i>Corbicula</i>	321	<i>umbilicata</i> LEA, <i>Idiopoma</i>	34
<i>Trapezoideus</i>	298	— <i>Paludina</i>	32, 34
<i>triangularis</i> BENSON, <i>Scarabus</i>	216	— <i>Sinotaia</i>	32
<i>triangularis</i> MÖRCH, <i>Neritina</i>	15	<i>undulata</i> GRAY, <i>Littorina</i>	54
<i>tricostata</i> DESHAYES, <i>Lacunopsis</i>	113	— <i>Littorinopsis</i>	54
— <i>Wykoffia</i>	113	<i>Uniandra</i>	289
<i>Tricula</i>	67	<i>unica</i> MABILLE, <i>Limnaea</i>	231
<i>trigona(us)</i> TROSCHEL, <i>Pythia</i>	216	<i>unicarinatum</i> METCALF, <i>Cerithium</i>	194
— <i>Pythia</i> (<i>Trigonopythia</i>)	216	<i>unifasciata</i> MOUSSON, <i>Melania</i>	165
— <i>Scarabus</i>	216	<i>Unionetta</i>	280
<i>Trigonopythia</i>	216	<i>vagulus</i> FISCHER, <i>Unio</i>	269
<i>Triphora</i>	198	<i>varia</i> BULLEN, <i>Melania</i>	163
<i>trispiralis</i> BRANDT, <i>Hydrorissoia</i> 104, 105		<i>variabilis</i> DEFANCE, <i>Brotia</i>	181
<i>trochoides</i> MARTENS, <i>Eyriesia</i> (?)	32	— <i>Melania</i>	181
— <i>Paludina</i>	32	<i>variabilis</i> POIRIER, <i>Pachydrobia</i>	74, 77
— <i>Trochotaia</i>	32	<i>variata</i> FRAUENFELD, <i>Paludina</i>	36
— <i>Vivipara</i>	32	<i>varicosa</i> TROSCHEL, <i>Brotia costula</i>	182
<i>trochoides</i> BENSON, <i>Planorbis</i>	246	— <i>Melania</i>	182
— <i>Segmentina</i> (<i>Trochorbis</i>)	246	<i>variegata</i> HEUDE, <i>Corbicula</i>	314
<i>Trochorbis</i>	246	<i>variegata</i> LESSON, <i>Neritina</i>	15
<i>Trochotaia</i> n. gen.	32	— <i>Neritina</i> (<i>Vittoida</i>)	15
<i>trocheli</i> RÉCLUZ, <i>Neritina</i>	12	<i>velaris</i> HANLEY, <i>Unio</i>	294
<i>truncata</i> GMELIN, <i>Solenotellina</i>	305	<i>ventricosa</i> POIRIER, <i>Lacunopsis</i>	108
<i>truncata</i> SOULEYET, <i>Bithynia</i>	60	<i>ventricosa</i> QUOY & GAIMARD, <i>Paludina</i>	125
<i>truncatula</i> LAMARCK, <i>Melania</i>	164	— <i>Stenothyra</i>	125
<i>tuberculata</i> BRANDT, <i>Hubendickia</i> 92, 94		<i>venustus</i> MORELET, <i>Unio</i>	281
— <i>Irvadiala</i>	137	<i>verbecki</i> BOETTGER, <i>Melania</i>	182
<i>tuberculata</i> MÜLLER, <i>Melania</i>	165	<i>verbecki</i> MARTENS, <i>Conradens</i> (<i>Sprickia</i>)	289
— <i>Melanoides</i>	164, 165	<i>vericunda</i> MABILLE, <i>Corbicula</i>	232
— <i>Nerita</i>	164	<i>verruca</i> BENSON, <i>Ancylus</i>	249
<i>tuberculata</i> SCHUMACHER, <i>Cristaria</i> 278		— <i>Ancylus</i> (<i>Ferrissia</i>)	249
<i>tumida(us)</i> MORELET, <i>Monocondylaea</i> 271		— <i>Ferrissia</i>	249
— <i>Monocondylus</i>	271	— <i>Ferrissia</i> (<i>Pettancylus</i>)	249
— <i>Pseudodon</i>	271	<i>verrucosa</i> HINDS, <i>Melania</i>	167
— <i>Pseudodon vondembuschianus</i>	271	<i>versicolor</i> WESTERLUND, <i>Planorbis</i>	244
<i>tumidula(us)</i> LEA, <i>Nodularia</i>	291	<i>versus</i> LEA, <i>Margaron</i> (<i>Unio</i>)	290
— <i>Uniandra conradens</i>	290	<i>vespertina</i> FISCHER, <i>Corbicula</i>	314
— <i>Unio</i>	290	<i>vestita</i> SOULEYET, <i>Nerita</i>	9
<i>tumidum</i> RÖDING, <i>Ellobium</i>	226	<i>vignesi</i> JULLIEN, <i>Paludina</i>	28
<i>turbinis</i> LEA, <i>Ampullaria</i>	49	<i>violacea</i> GMELIN, <i>Nerita</i>	16
— <i>Pachylabra</i>	50	— <i>Neritina</i> (<i>Dostia</i>)	16
— <i>Pila</i>	50		
<i>turgida</i> LEA, <i>Cyrena</i>	310		
<i>turgida</i> PFEIFFER, <i>Cassidula</i>	220		
<i>turriculus</i> LEA, <i>Melania</i>	165		

<i>violacea</i> LAMARCK, <i>Psammotaea</i>	305	<i>woodiana</i> LEA, <i>Sinanodonta</i>	279
<i>virens</i> LINNAEUS, <i>Glauconomya</i>	334	<i>woodmasoniana</i> NEVILL, <i>Assimineae</i>	147
<i>virescens</i> BRANDT, <i>Corbicula</i>	324	— <i>Syncera</i>	147
<i>virgula</i> QUOY & GAIMARD, <i>Melania</i>	164	<i>woodthorpi</i> GODWIN AUSTEN, <i>Margaritana</i>	261
<i>viridis</i> QUOY & GAIMARD, <i>Lymnaea</i>	231	<i>wykoffi</i> BRANDT, <i>Bithynia</i> (<i>Gabbia</i>)	62
— <i>Lymnaea</i> (<i>Radix</i>)	231	— <i>Brotia</i> (<i>Senckenbergia</i>)	184
<i>viridis</i> REEVE, <i>Paludina</i>	36	— <i>Clea</i> (<i>Anentome</i>)	204
<i>vitrea</i> REEVE, <i>Pedalion</i>	259	— <i>Pachydrobia</i>	74, 78
<i>Vitrinella</i>	158	— <i>Stenothyra</i>	123
<i>Vittoida</i>	14	<i>Wykoffia</i>	112
<i>vivonai</i> BRANDT, <i>Paraprososthenia</i>	86, 89	<i>yunnanensis</i> NEVILL, <i>Limnaea</i>	231
<i>vokesi</i> BRANDT, <i>Corbicula</i>	327	<i>zayleymanensis</i> PRESTON, <i>Trapezoides foliaceus</i>	299
<i>vondembuschi</i> LEA, <i>Unio</i>	267	<i>zebrinus</i> DUNKER, <i>Planorbis</i>	234
<i>vondembuschianus</i> LEA, <i>Pseudodon</i>	270	<i>zelebori</i> BROT, <i>Neoradina</i>	170
<i>vulcanus</i> HANLEY, <i>Parreysia</i>	280	<i>zeylanica</i> LAMARCK, <i>Cyclas</i>	309
<i>waigiensis</i> BROT, <i>Melania</i>	165	— <i>Cyrena</i>	310
<i>walkeri</i> BRANDT, <i>Bithynia</i> (<i>Gabbia</i>)	63	<i>ziczac</i> LAMARCK, <i>Neritina</i>	15
<i>waltoni</i> BRANDT, <i>Hydrorissoia</i>	104	<i>zilchi</i> BRANDT, <i>Assimineae</i>	150
— <i>Pharella</i>	304	— <i>Pachydrobia</i>	74, 79
<i>Wattebledia</i>	63	<i>zollingeri</i> BROT, <i>Melania</i>	182
<i>wellesleyensis</i> MORGAN, <i>Ampullaria</i>	52	<i>zonatus</i> CLESSIN, <i>Planorbis</i>	234
<i>weyersi</i> DAUTZENBERG, <i>Cerithidea</i>	193		
— <i>Cerithidea</i> (<i>Aphanistylus</i>)	193		
<i>wilkinsonii</i> TENNISON WOODS, <i>Melania</i>	165		