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## Description of new non-marine mollusks from Asia.

By

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With plates 8-10 and 41 textfigures.

After the second World War an extensive study of the helminthic diseases was started in Thailand by the University of Medical Sciences in Bangkok and the SEATO Medical Research Laboratory. As even a cursory study of Trematodes is impossible without a profound knowledge of their intermediate hosts, a systematic survey of the aquatic mollusks of the Kingdom of Thailand proved to be necessary. This faunistic study was sponsored by a Research & Development grant from the Walter Reed Army Institute of Research (Grant No. DA-MD-49-193-63-G99). The School of Tropical Medicine and the SEATO US Army Medical Component gave technical assistance and provided the necessary staff.

The survey of non-marine aquatic mollusks of Thailand resulted in the compilation of a faunistic report which is based on an extensive reference collection. Portions of this collection are stored in the US National Museum at Washington, D.C., the remainder is kept in the SEATO Medical Research Laboratory and will later be handed over to the Thai Applied Science Corporation in Bangkok.

As the description of more than 70 new species, which were found during the survey, is beyond the scope of a faunistic report mainly intended to help parasitologists, these species are described in separate papers. Detailed anatomical data will later be given in monographs which are planned for all genera of parasitological importance in Southeast Asia.

The present author gratefully acknowledges the assistance received from many malacologists. The scientists mentioned below were not only helpful in making material (for comparison) and literature available, but often extended their help to deeply appreciated hospitality in their respective homes and museums:

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Twice during the period of this grant the present author was given the opportunity to study collections in various museums around the world: Zoological Museum in Hamburg; Laboratoire de Malacologie in Paris; Senckenberg Museum in Frankfurt a. M.; Institut Royal des Sciences Naturelles in Brussel; Zoological Museum in Amsterdam; British Museum (Nat. Hist.) in London; U.S. National Museum in Washington, D.C.; Field Museum in Chicago; Museum of the Academy of Natural Science in Philadelphia and the Museum of Comparative Zoology at the Harvard College in Cambridge, Massachusetts. All available material from Southeast Asia was studied, particularly the holo- and paratypes stored in these collections. At least two malacological authorities were consulted before any new species were described. However, the present author bears alone full responsibility for errors and any creation of synonyms.

Four species, a *Camptoceras*, two *Tricula* and a *Pisidium* were submitted to other malacologists for description, as they were considered more competent with regard to these genera.

## Viviparidae.

Several new species of Viviparidae are among the material collected in Thailand. One of these species has been found by PAVIE already but was labeled by BAVAY *V. siamensis* FRAUENFELD; *Mekongia siamensis*, however, without any doubt, is an other species.

***Mekongia*** CROSSE & FISCHER, 1876.

***Mekongia pongensis*** n. sp.

pl. 8 fig. 1; textfig. 1.

**Diagnosis:** A species of *Mekongia* CROSSE & FISCHER which differs from its closest relatives, *M. bourguignati* (MABELLE) by its thicker shell, deeper suture with violet border and by its obtuse spiral ridges, and from *M. massiei* (MORLET) by its smaller size, higher spire and deeper suture.

**Description:** Shell subglobose, with more or less depressed conic spire and large inflated body whorl. The shell substance of young specimens is very thin, of old solid or even thick; the colour is of a bright green which fades into a sand-colour or lead-grey when the shell grows old. The surface is very delicately striated by spiral lines and lines of growth. Normally there are also

several obtuse spiral ridges which grow very weak on the lower half of the body whorl. Often the whole surface of the shell is malleated and the impressions may be arranged in spiral lines placed in between the ridges. The 5-5½ whorls increase regularly in size; they are very convex and separated by a deep suture. This is bordered on the lower part of the upper whorls by a violet zone. The protoconch may be completely violet. Umbilicus narrow but open. Embryonic shells without keel and chaetae, with very delicate spiral lines only. — The semicircular aperture is somewhat slanting. Peristome not continuous; it is neither lipped nor expanded; its columellar margin covers the umbilicus partly. The insertions are connected by a distinct callus. — Operculum concave, thin, horny, transparent, with subcentral nucleus and concentric lines. Muscle scar hardly elevated; it is glossy and not sharply outlined against the rest of the operculum.

Size: A 17.2-22.3 mm, D 16.1-19.4 mm. Aperture 12-13: 10-11 mm.

Animal. Grey with yellow pigment dots dusted over back and head. Central tooth of the radula with large, blunt central cusp and 3 smaller cusps on either side. Laterals with 4 cusps, the innermost being the largest, marginals with smooth cutting edge; the inner marginals may show rudiments of 4 cusps. — Uterus large, mature females show few (3-7) embryos in the uterus. Oviduct with small albumen gland, no separate receptaculum seminis.

Locus typicus: Lam Than (Maenam Pao) at Kalasin, Thailand.

Distribution: Known from the drainage system of the Mun river, few other tributaries of the Mekong and from the upper reaches of the Maenam Kwae Noi at Nakon Thai, Pitsanulok province.

Material: Holotype SMRL 3191/A, paratypes 3191/60. — 0132/10 - Maenam Pong at Pa Nok Kao, Kon Kaen Prov.; 3192/30 - Lam Chi river at Mahachanachai, Ubon Prov.; 3193/10 - Huai Dom Yai at Det Udom, Ubon Prov.; 3194/3 - Maenam Kwae Noi at Nakon Thai, Pitsanulok; 3195/40 - Maenam Mun at Ubon; 3196/3 - Maenam Pung, 16 km SE of Sakon Nakon; 3197/7 - Maenam Yom at Prae; 3198/20 - Maenam Mun at Rasi Salai, Sri Saket; 3200/10 - Lam Chi river at Ban Tanang Ruen, Ban Pai.

Etiology: The species was named after the Pong river where it was first found.

Relations: The species is closely related to the *Mekongia*-group of *bourguignati-massiei-siamensis* but differs sufficiently from these species to justify a separate name. *M. massiei* (BAVAY) which was collected in the Sedone river near Khong Sedone in Laos, was compared with this species and found different.

### **Anulotaia** n. gen.

Diagnosis: A genus of Viviparidae which differs from *Angulyagra* RAO, its conchologically closest relative, by its much thicker shell, depressed spire, sharper spiral ridges and the small number of cusps on the cutting edge of the outer marginals.

Description: Shell subglobose, rather thick when adult; with greenish periderm. Spire very short, body whorl large. The 4-5 whorls are sculptured with 5-7 strong spiral ridges. The umbilicus is open and surrounded by a distinct carina. — Aperture extended, rather large; peristome thick, somewhat

expanded, blackish without. — Operculum thin, corneous, with low muscle scar. Rhachis with 5 small cusps on either side of the middle cusp. Inner marginals with 7, outer with 5 cusps.

Genotype: *Anulotaia forcarti* n. sp.

Distribution: Mun and Lam Chi river; Mekong river in South Laos and Cambodia.

"*Paludina*" *lagrandierei* BAVAY is closely related to the genotype but before any anatomical data are available that species may only be assigned tentatively to this genus.

### ***Anulotaia forcarti* n. sp.**

pl. 8 fig. 2; textfig. 2.

Diagnosis: A species of *Anulotaia* n. gen. which differs from "*Paludina*" *lagrandierei* BAVAY by its much smaller shell, stronger ridges, expanded aperture and lipped peristome.

Description: Shell subglobose-conoidal, with short, depressed spire; solid, dark green, not transparent, dull, with thick rough periderm which is fibrous at the aperture. Apex obtuse and often corroded. The remaining 4-4½ convex whorls are ornate with strong spiral ridges, one on the periphery, two between periphery and suture and three between periphery and umbilical carina. The ridges are crossed by rather strong and irregular lines of growth. In between the spiral ridges there are delicate spiral lines running parallel to the ridges. The suture is deep. The body whorl measures about ¾ of the height of the shell. — Aperture large, dilated, broadly ovate, angled above, bluish-white within. Peristome not continuous, connected by a distinct callus. The outer and lower margins are well rounded, thick, but not lipped, sometimes somewhat expanded. The base is very much retracted. — Operculum thin, ovate, corneous, with subcentral nucleus and concentric lines. Muscle scar large but low.

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

Animal sand-coloured, with very minute orange and bigger black pigment dots. The latter are particularly strong on the short tentacles and on the proboscis. Sole broad, truncate in front and rounded behind. The eyes are placed in the swollen bases of the tentacles. The mantle edge bears 12 short processes of different length.

Anatomy: Rhachis with 5 (rarely 4) lateral cusps on either side of the larger mesocone. One specimen was observed which showed middle cusps of the central teeth which were smaller than the lateral cusps. Laterals with the formula 2-1-5, M<sub>1</sub> with 7, M<sub>2</sub> with 5 cusps. The radula sac is situated between two posterior lobes of the bucal mass. Between mouth and bucal mass there are two ridges armoured with chitinous plates.

Reproductive organs: The species is dioecious. The testes of the male are placed in the upper part of the branchial cavity. Fine vasa efferentia lead to the tube-like vas deferens. The folded prostate gland is long and curved. The terminal parts end in the right tentacle without forming a genuine verge. — The few small glands of the ovary are placed near the digestive gland. The oviduct

joins on its way to the uterus with a duct of the albumen gland. The receptaculum seminis is curved. The uterus is placed in the upper part of the branchial cavity. It contains in mature state only few eggs and embryos. The embryonic shell is obtusely keeled and shows two spiral ridges with chaetae between periphery and suture. The fine spiral lines are not ciliated.

Locus typicus: Maenam Mun at Rasi Salai.

Distribution: known from the Mun river only.

Material: Holotype SMRL 3121/A, paratypes 3121/20, USNM, SMF and ZMH. — SMRL 3120 - Mun river at Pibun Mangsahan; 0208 - at Ubon; 0207 - at Ban Ta tum; 0209 - at Huai Ka Yung.

Etiology: The species is dedicated to Dr. L. FORCART, Basle.

### ***Siamopaludina* n. gen.**

Diagnosis: A new genus of Viviparidae which differs from *Taia* ANNANDALE by its thinner texture, lack of strong spiral ridges and lack of the thick, porcelainous columella. From *Sinotaia* HAAS it differs by having colour bands and from *Filopaludina* HABE by its normally larger size, thicker periderm and much weaker bands which never form ridges on the postnuclear whorls as seen in *Filopaludina*.

Genotype: *Siamopaludina martensi* (FRAUENFELD).

Distribution: From South China to Taiwan, the Philippines, Thailand, Burma, Indo-China and Indonesia.

Species attributed to this genus: *javanica* (VON DEM BUSCH), *cambodgensis* (MABILLE & LE MESLE), *noetlingi* (KOBELT), *luzonica* (KOBELT) (no local race of *javanica*) and *mutica* (KOBELT). The following species are considered races or synonyms of the genotype: *perakensis* (MARTENS), *penangensis* (MARTENS), *paviei* (MORLET), *thomsoni* (MORLET), *tiranti* (MORLET), *danieli* (MORLET), *sabinae* (MORLET), *cochinchinensis* (MORELET), *vignesi* (JULLIEN), *obscurata* (DESHAYES), *chalanguensis* (DESHAYES) and *lurida* (MORELET). The author has not seen *S. hendrici* (PRASHAD) but from the description it is hardly probable that it is a distinct species from *S. martensi* (FRAUENFELD). The following species cannot be assigned to any species already known from Laos, Cambodia or Thailand. Although very closely related to the genotype it has to be treated as a distinct species.

### ***Siamopaludina maekoki* n. sp**

pl. 8 fig. 3; textfig. 3.

Diagnosis: A species of *Siamopaludina* n. which differs from *S. martensi* (FRAUENFELD) by the thin shell and operculum and by having only three main raised colour bands or ridges on the body whorl.

Description: Shell of average size for the genus, regularly conic, thin, somewhat transparent, olive green, somewhat glossy the purplish apex always eroded, the postnuclear whorls with two weak, hardly raised colour bands and very delicate spiral lines. The two spiral ridges grow stronger and deeper coloured towards the body whorl which shows a third ridge around the angled periphery. Body whorl large; it measures about  $\frac{3}{5}$  of the height of the shell;

base only moderately rounded. There are no ridges on the base but the fine spiral lines are stronger below the periphery than above. The umbilicus is only a narrow chink. — Operculum broadly piriform, rather thin, yellowish brown, glossy within, with dull, roughened, well outlined muscle scar. It is not retractable into the shell when the animal is adult. Aperture piriform or ovate, not expanded, peristome not extended or lipped. It is continuous but appressed to the penultimate whorl.

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

Animal: Blackish grey with numerous orange pigment spots dusted over back and head. Foot of lighter colour, rounded behind and straight in front. Proboscis large, tentacles long and filiform; the eyes are placed at the outside of their bases in distinct swellings. — The rhomboidal rhachis shows 4-5 small cusps on either side of the middle cusp. The laterals and inner marginals have the cusp-formula 3-1-4 or 4-1-4 respectively, the outer marginals have 21-22 cusps. The stomach has longitudinal ridges which are outlined by chitinous plates. The gill is triangular with broad base. The uterus of the females contains averagely 8 large mature embryos, but no eggs were found. The conic embryonic shell is sharply keeled and sculptured with delicate spiral lines of which two are stronger and bear delicate chaetae.

Locus typicus: Ban Mae Chai, 2 km west of Fang, Chiang Mai Province.

Distribution: Known from the northernmost parts of the province of Mae Hongson, Chiang Mai, Chiang Rai and Nan, North Thailand.

Material: Holotype SMRL 2941/A, paratypes 2941/30, USNM, SMF and ZMH. — 2940/5 - Wat Chom Kam, Mae Hongson; 2942/5 - Samun irrigation canal near Nan; 2944/5 - Maekok river at Chiang Rai; 2901/10 - Wieng Pa Pao, N of Chiang Mai.

Etiology: The species was named after the Maekok river where it was found first.

Relationship: *Siamopaludina martensi* (FRAUENFELD) is without doubt the closest relative but it seems that the Indian and Burmese species, *crassispinalis* and *microchaetophora* ANNANDALE, are closer related to this species than to *Filopaludina bengalensis*, to which they were formerly assigned.

### ***Sinotaia* HAAS, 1939.**

This genus is now restricted to the genotype *S. quadrata* (BENSON, 1842) and related species, which have no colour bands and whose spiral ridges, if present, are of the same colour as the shell. Two new species from Thailand are tentatively assigned to this genus.

#### ***Sinotaia mandahlbarthi* n. sp**

pl. 8 fig. 4; textfig. 4.

Diagnosis: A species of *Sinotaia* HAAS, which differs from the genotype, *S. quadrata* (BENSON) by its much thicker shell and its strong spiral ridges like those of many *Taia* species. The ridges, however, are not coloured like those of *Taia* and *Siamopaludina*.

Description: Shell of moderate size for the family, solid, or when old, rather thick like a *Mekongia*; slenderly conical or globosely conoidal; ground

colour milky-blue; shell covered with a thick periderm of olive-green colour but which turns brownish with age; apex always eroded. Of the  $6\frac{1}{2}$  hardly convex whorls only 3 or 4 remain. The suture is, in spite of the moderately convex whorls, rather deep. The whorls are sculptured with two strong spiral ridges between suture and periphery, one on the periphery and two on the base. Peripheral and basal ridges are only seen on the body whorl. Umbilicus either completely closed or a narrow chink only. Young specimens may show a very weak carina around the umbilicus. Under strong magnification very delicate, wavy spiral lines may be seen which are crossed by the fine lines of growth. The body whorl measures about  $\frac{3}{4}$  of the height of the shell. — Aperture of moderate size, about  $\frac{3}{5}$  of the height of the body whorl. It is of piriform shape, angled above and rounded at the base. It is hardly extended; peristome thick, not expanded, continuous, appressed to the penultimate whorl and with a blackish margin when the animal is fully adult. — Operculum corneous, moderately thick (much thinner than that of *Siamopaludina*), brownish, concentric, with subcentral nucleus. It is thicker than that of *Mekongia*, *Filopaludina* or *Anulotaia*.

Size: A 26-34 mm; D 21-27 mm.

Animal sand-coloured with blackish pigment dots which form rings on the tentacles and a reticulate pattern on back and head. Furthermore there are tiny yellow pigment spots dusted over back and head and embedded under the skin of the proboscis and the tentacles. The pigmentation is very weak compared with that of other species of Viviparidae. The proboscis is dark grey. The mantle edge is almost smooth with very short, distantly placed processes only. The uterus contains only few fully grown embryos (2-5) and about 20 eggs in all stages of development. — The radula is typical for the family. The rounded-rhomboidal rhachis has a broad cutting edge with a low, broad middle cusp and 4 smaller cusps on either side of it. The laterals have the formula 4-1-5, the inner marginals 3-1-3 and the outer marginals have 14 small cusps on the cutting edge. There are about 98 rows of teeth.

Locus typicus: Huai Mae Un, a tributary to the Songkram river near Sri Songkram, Nakon Panom Province, NE-Thailand.

Distribution: Known from the Mekong river and several Thai tributaries to the Mekong. Localities see below.

Material: Holotype SMRL 2976/A, paratypes 2976/20, USNM, ZMH and SMF. 2971/10 - Huai Tuai at Ta Uthen, Nakon Panom Province; 2972/7 - Maenam Songkram at Ta Uthen; 2973/23 - Maenam Songkram at Wanon Nivat, Sakon Nakhon; 2974/1 - Mekong river at Nakon Panom; 2975/7, USNM, SMF and ZMH - Maenam Kham at Tat Panom, Nakon Panom; 2977/10, USNM, SMF and ZMH - Maenam Songkram at Sri Songkram.

Etiology: This species is dedicated to Dr. G. MANDAHLE-BARTH, Director of the Bilharziasis Laboratory in Copenhagen.

Relations: This species shows great similarity with "*Vivipara*" *quadrata guangdongensis* KOBELT from Canton, a race which was erroneously placed by YEN (1939) in the synonymy of *Taia polyzonata* (FRAUENFELD). — Young specimens of this species look similar to *Anulotaia lagrandierei* (BAYAT). The spiral ridges of *lagrandierei*, however, are sharper and the whorls are more rounded, the umbilicus is open and the carina around the umbilicus is well developed.

***Sinotaia arturrolli* n. sp.**

pl. 8 fig. 5; textfig. 5.

**Diagnosis:** A species of *Sinotaia* HAAS which differs from *S. mandahlbarthi* n. sp. by its thin operculum, smaller size and strong spiral ridges. The whorls are more convex and the suture is therefore deeper.

**Description:** Shell of middle size for the family, conical, moderately thick but somewhat transparent, of bluewhite ground colour but covered with a strong, green, glossy periderm; sculptured with strong spiral ridges. On the upper whorls there are two ridges between suture and periphery and the peripheral ridge is normally seen above the suture. On the body-whorl there are 3 (2-4) weaker spiral ridges between periphery and umbilical carina. The 5 convex whorls increase regularly in size. The body whorl measures about  $\frac{3}{5}$  of the height of the shell. Beside the spiral ridges there is a dense sculpture of fine, irregular spiral lines which are crossed by the lines of growth. The spiral lines are also seen on the spiral ridges but are a little weaker there. The spiral ridges appear darker than the rest of the shell because of the thicker shell substance. The ridges are not coloured. The narrow but open umbilicus is surrounded by a carina. — Aperture ovate, angled above, rounded outside and below. Peristome not continuous, connected by a bluishwhite callus. Peristome not expanded or lipped, sharp without, not blackish (if so, the colour is caused by mineral deposits, not by shell pigmentation). — Operculum ovate, thin, corneous, transparent, concentric, with subcentral nucleus. Muscle scar hardly elevated, rough.

Size: A 22-26 mm; D 15-19 mm.

Animal greyish, dusted with fine black and yellow pigment dots. Central tooth of radula with 6 (5-7) lateral cusps, the other teeth with 9-10 cusps. — Mantle edge with numerous processes of different size. Mantle covered with black pigmentation of reticulate pattern. A similar pattern is found on the head-foot-mass. The pigmentation of the mantle may be restricted to the edge only. Male reproductive organ not different from that of the type species. Uterus of the females with few embryos and eggs only. Embryonic shells with a ridge on the angled periphery and two ridges between suture and periphery. With very delicate spiral lines and open umbilicus. Chaetae are missing completely.

**Locus typicus:** Maenam Kham south of Tat Panom, Nakon Panom Province, NE-Thailand.

**Distribution:** Known from the type locality only.

**Material:** Holotype SMRL 3125/A; paratypes 3125/20, USNM, ZMH and SMF.

**Etiology:** The species is dedicated to Dr. ARTUR ROLL (Hannover) in grateful acknowledgment of his valuable help.

***Cipangopaludina* HANNIBAL, 1912.**

This genus was established for *Viviparus malleatus* (REEVE, 1857), a Japanese species closely related to the Chinese species of this genus, *chinensis* (GRAY, 1834). *C. chinensis* is found in Tonkin and North Laos — *C. laosensis* MORLET



is definitely only a race of above species and has been introduced into Malaya. The Burmese species of this genus, *lecythis* (BENSON, 1836) was not found in Thailand. The only Thai species of this genus is closely related to *chinensis* and *lecythis*, but differs sufficiently to justify a separate name.

***Cipangopaludina annandalei* n. sp.**

pl. 8 fig. 6; textfig. 6.

**Diagnosis:** A species of *Cipangopaludina* HANNIBAL, which differs from its closest relatives, *lecythis* BENSON and *chinensis* GRAY by its much smaller size, less rounded whorls and less inflated body whorl. From *chinensis* it differs furthermore by its lack of a periomphalic carina and from *lecythis* by its operculum. The operculum is reddish-brown (not yellowish-corneous), much thicker than that of *lecythis* and shows a distinct muscle scar on the inner surface.

**Description:** Shell rather small for the genus, thin, globosely conoidal, of milky-white ground colour but covered with a strong, olive-green periderm. There are no colour bands present. Under strong magnification tiny waved spiral lines can be seen which are crossed by the fine lines of growth. These spiral lines around the umbilicus are stronger. The four moderately convex whorls increase regularly in size and are separated by a well marked suture. The apex, which is normally corroded, is of a dark violet colour. The large, well rounded body whorl measures  $\frac{3}{4}$  of the height of the shell; umbilicus narrow and without a periomphalic carina. — Aperture rather large but less so than in *C. chinensis*. It is of piriform shape, slanting and oblique. It is only moderately expanded and of milky-blue colour within. Peristome continuous but appressed to the penultimate whorl. It is somewhat extended and blackish in aged specimens. The operculum is rather thick and hardly transparent. It is of reddish-brown colour, ovate, concentric with subcentral nucleus and large, rough, low but well delimited muscle-scar.

**Size:** A 29-34 mm, D 23-26 mm. Aperture: A 18-20 mm.

Animal of blackish-grey colour with only fine yellowish pigment spots dusted over head, back and also the margins of the broad sole. The tentacles are long, filiform; the eyes are placed at their bases in distinct sockets. — The mantle edge shows few large, distantly placed processes.

**Radula:** The rhachis is longer than those of *lecythis* and *malleata*. The formula of the cusps on the cutting edge is similar: C 4-1-4, L 3-1-3, M 3-1-3, the outer marginals have 16 cusps (those of *lecythis* 12, those of *malleata* 9 only). The uterus contains 12-15 rather small embryos.

**Locus typicus:** Maekok river near Chieng Rai, N-Thailand.

**Distribution:** Known from the province of Chieng Rai only.

**Material:** Holotype SMRL 231/A, paratypes 231/20, coll. BRANDT, SMF, USNM and ZMH. — SMRL 233/4 - On river at Ban Pong near Ngao.

**Etiology:** The species is dedicated to the memory of NELSON ANNANDALE whose publications contributed so much to our knowledge of Viviparidae in Asia.

## Bithyniidae.

Three genera are represented in Thailand, *Hydrobioides* NEVILL, *Wattebledia* CROSSE and *Bithynia* LEACH. Only *Bithynia* and *Wattebledia* present new species, *Hydrobioides* was found in many local forms but none of them justifies a description.

### ***Bithynia* LEACH, 1818.**

The typical subgenus is not represented in Thailand, only *Digoniostoma* ANNANDALE and *Gabbia* TRYON. Both new species are assigned to the latter subgenus. A third species, which was already known but reported under a wrong name, originates from Malaya.

### ***Bithynia (Gabbia)* TRYON, 1865.**

The following species was described as a variety of *Paludomus baccula* REEVE and later reported as *Digoniostoma pulchellum* (BENSON). As it is generally accept that names of varieties like minor or minuta should enjoy protection like names of subspecies and as the description was completely insufficient, it seems to be justified to redescribe that species under above name.

### ***Bithynia (Gabbia) minuta* (GHOSH, 1929).**

pl. 8 fig. 7

1929 *Paludomus baccula* var. *minuta* GHOSH, J. Fed. Malay States Mus., 14: 334 [non *Paludomus baccula* REEVE].

1940 *Digoniostoma pulchellum*, — LAIDLAW, Bull. Raffles Mus. Singapore, 16: 133 [non BENSON].

Diagnosis: A species of *Bithynia (Gabbia)* TRYON, which differs from *Bithynia (Digoniostoma) pulchellum* (BENSON) with which it was confounded, by the closed umbilicus or very narrow and curved umbilical chink which is not surrounded by a carina. From its northern neighbour of the same subgenus, *B. (G.) wykoffi* n., it differs by its larger size, more elongate spire and much deeper suture.

Description: Shell below average size for the genus but rather large for the subgenus, conic, with  $4\frac{1}{2}$  very convex whorls. These are separated by a deep suture and increase regularly in size. The body whorl is not inflated and measures  $\frac{2}{3}$  of the height of the shell. The colour of the shell is vitreous, dirty-whitish or bright-corneous. Under strong magnification strong spiral lines can be seen which are crossed by minute lines of growth. There may be 2 or 3 varices marking the intervalles of growth. The umbilicus is either covered by the columellar callus of the peristome or is a chink-like narrow opening beside the peristome. — Aperture regularly ovate or piriform, it is only moderately extended; peristome thick but not lipped. It is hardly expanded. It is continuous and appressed to the penultimate whorl. — Operculum ovate, thick, whitish, slightly transparent, calcareous, concentric, with subcentral, spiral nucleus.

Size A 4.2-5.0 mm; D 2.8-3.1 mm.

The animal is of light greyish colour with darker patches on the back and sand-coloured pigment spots dusted over head and back. The yellow pigmentation is very pale, not orange coloured like that of other *Bithynia* species. Although the species lives in the dark, it is not completely albinotic. The thin and filiform tentacles are moderately long. The eyes are placed in distinct swellings at their bases. Whether they are functional could not be made out as only specimens in alcohol were available for description. The short, truncate proboscis is a little bit darker coloured than the rest of the animal. — Radula: rhachis with 7 cusps on the cutting edge and 3-4 basal cusps on either side, laterals with the cusp formula 3-1-3, marginals with 14 or 16 cusps respectively.

*Locus typicus*: Batu Caves in Malaya near Kuala Lumpur, Selangor State.

*Distribution*: Known from the type locality only.

*Habitat*: In ponds in the dark part of the cave.

*Material*: SMRL 12021/30, USNM, ZMH and SMF.

This species was first recorded by GHOSH as a small variety of *Paludomus baccula* REEVE, whose size PRESTON gave as 17:11 mm. Later LAIDLAW identified this species as *Bithynia pulchella* BENSON with which it has a certain similarity. This identification was backed by TOMLIN and by RENSCH. There is no doubt that this *Bithynia* is an endemic species of the Batu Caves. The species which lives in the ponds outside the caves is *Bithynia (Digoniostoma) laevis* (MORELET) which seems to be synonymous with *B. siamensis* LEA.

***Bithynia (Gabbia) walkeri* n. sp.**

pl. 8 fig. 8; textfig. 7.

*Diagnosis*: A species of *Bithynia (Gabbia)* TRYON which differs from all other species of *Gabbia* from Thailand by its much larger size. It differs from *B. longicornis* by having a simple middle cusps which is not tripartite and by having several basal cusps. It differs from *B. moreletiana* NEVILL by its longer spire and lower aperture.

*Description*: Shell of middle size for the genus but relatively large for the subgenus; corneous, transparent, somewhat glossy, smooth, but under strong magnification delicate wavy spiral lines can be seen, which are crossed by minute lines of growth. The  $4\frac{1}{2}$  whorls increase rather rapidly in size; they are rather convex and separated by an impressed suture. The body whorl is inflated and measures about  $\frac{3}{4}$  of the height of the shell. It is regularly rounded and shows no trace of a carina; umbilicus always completely closed. — Aperture rather large, ovate, angled above and well rounded below, without any trace of angle at the basal margin. Peristome thickened but not lipped, continuous, appressed to the penultimate whorl. — Operculum ovate, pointed above, nearly white, calcareous, transparent, concentric, with excentric, spiral nucleus.

Size: A 7.2-8.5 mm; D 4.1-5.3 mm. Aperture 5.0 : 3.8 mm.

Animal grey with blackish patches particularly on the mantle and with fine orange pigment spots dusted over the back and head area. Penis short, blade-like, with a lateral appendage. — Rhachis rounded-rhomboidal, with

7 cusps on the cutting edge and 5 basal cusps on either side. Formula of the cusps of the laterals 1-1-2, the outer marginals have 14-18, the inner marginals 8-11 cusps.

*Locus typicus*: Propaya tap-water supply station, Supanburi, Thailand.

*Distribution* Known from the type locality and from the town-moat of Uthong only.

*Material*: Holotype SMRL 3602/A; paratypes 3602/7. — 3601/3 - Uthong, town-moat, Supanburi Province.

*Habitat*: In clean still water with rich vegetation.

*Relationship*: This species is closely related to many known species. From *longicornis* BENSON it differs by the dentition of the rhachis. *B. longicornis* has a tripartite middle cusp and two basal cusps only. *B. shuttleworthi* FRAUENFELD and *tonkiniana* MORLET are considered synonyms of *longicornis*. *B. moreletiana* NEVILL has a different shape, more inflated body whorl and only  $3\frac{1}{2}$  whorls. The other Asian species with completely closed umbilicus are slenderer and have a more elongated spire. The two localities are artificial ponds and may suggest an import to Thailand.

*Etiology*: Dedicated to the late Dr. BRYAN WALKER who published the first monograph on Asian Bithyniidae.

***Bithynia (Gabbia) wykoffi* n. sp.**

pl. 8 fig. 9; textfig. 8.

1950 *Bithynia* spec., — SUVATTI, Fauna Thailand: 52.

1962 *Allocimma* [sic!] sp., — ITO & al., Jap. J. Med. Sci. Biol., 15 (5/6): 250, pl. 2 fig. 16.

1964 *Alocinma pygmaea*, — HABE, Nature and Life in Southeast Asia, 3: 53, pl. 2 fig. 2 [non PRESTON].

*Diagnosis*: A species of *Bithynia (Gabbia)* TRYON, which differs from its closest relatives, *pygmaea* PRESTON, by its larger size and more inflated body whorl and from *tonkiniana* (MORLET) by its smaller size and by its aperture not being constricted.

*Description*: Shell rather small for the family, ovate-conoidal, with short, conic spire and large, more or less inflated body whorl which may measure more than  $\frac{4}{5}$  of the height of the shell, horny, olive or sand-coloured, somewhat glossy with fine lines of growth and delicate spiral lines. Umbilicus completely closed. The four whorls are convex and are separated by a deep suture. — Aperture about  $\frac{3}{4}$  of the height of the body whorl, ovate, angled above, not expanded. Peristome continuous, appressed to the penultimate whorl, moderately thickened but without lip and not reflected. The outer margin is not sinuous. — Operculum ovate, angled above, thick, calcareous, concentric with subcentral nucleus. The nucleus is paucispiral.

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

*Animal* sand-coloured, with greyish foot and fine yellow pigment spots dusted over back and head. Tentacles long and thin, proboscis truncate, much shorter. — The central tooth of the radula is rhomboid; cutting edge with 4-5 small lateral cusps. Laterals with 2-1-4 cusps, marginals with 12-14 and 22-24

respectively. — The verge of the male reproductive organ is short, straight, fusiform (in alcohol) with a finger-shaped, short appendage.

*Locus typicus*: Paddy-field 2 km N of Uthong, Supanburi Province, western Central Thailand.

*Distribution*: From the Province of Petchburi in the north of the peninsula and Kanchanaburi in the west through Central Thailand to the provinces of Nakon Ratchasima and Prachinburi (in the east), and Chiang Mai in the north of Thailand.

The species has not yet been found east of Nakon Ratchasima and north of Petchabun. As it is known from a swamp at the Thai-Cambodian border it will definitely be found in Cambodia also. Near Fang the distribution attains the Burmese border and it is therefore probable that the species is also found on Burmese territory.

*Material*: Holotype SMRL 3708/A; paratypes 3708/50, USMN, ZMH and SMF.

At the time of the description 37 localities were catalogued with about 8000 specimens. About 120,000 specimens were collected for parasitologic study.



Textfig. 1-9. Radula, half-row. — 1) *Mekongia pongensis* n. sp. (SMRL 3191); 2) *Anulotaia forcarti* n. sp. (3121); 3) *Siamopaludina maekoki* n. sp. (2941); 4) *Sinotaia mandahlbarthi* n. sp. (2976); 5) *Sinotaia arturrolli* n. sp. (3125); 6) *Cipangopaludina anandalei* n. sp. (231); 7) *Bithynia (Gabbia) walkeri* n. sp. (3602); 8) *B. (G.) wykoffi* n. sp. (3708); 9) *Wattebledia baschi* n. sp. (12026).

**Relationship:** The closest relatives of this species are known from Burma, Ceylon and India. *B. wykoffi* differs from *stenothyroides* by its larger aperture and the lack of the angle at its base. From *pygmaea* PRESTON it differs by its larger size and swollen body whorl. *B. evezardi* BLANFORD is a small species of *Digoniostoma* with all the characteristics of that subgenus. Typical *B. orcula* BENSON are larger than this species but there are small varieties (*minor* and *parvula* NEVILL) which are unknown to the author. *B. inconspicua* DOHRN from Ceylon is slenderer and more conical. *B. travancorica* BENSON is much broader. The closest relative may be *B. globula* (LEA) (= ? *dibrugharensis* PRESTON) from Bengal and Assam, but that species has a much thicker and expanded peristome.

**Etiology:** This species is dedicated to Dr. DALE E. WYKOFF in acknowledgment of his valuable support of this survey. During his parasitological study in Thailand, Dr. WYKOFF contributed considerably to our knowledge of the local molluscan fauna.

### ***Wattebledia* CROSSE, 1886.**

When CROSSE established this genus, only one of its species was known, the genotype *crosseana* WATTEBLED. In 1902 MOELLENDORFF described a second species, *siamensis*, from Thailand. In 1956 VAN BENTHEM JUTTING described a third species from Java and reported the genotype from the same island as several other authors had already done before. A careful study of the specimens from Java proved this species to be also new and undescribed. *Wattebledia crosseana* is only known from Vietnam, Laos and Thailand and is also to be expected in Cambodia. As it is not found in Central Thailand, South Thailand, Malaya and Sumatra, its occurrence on Java would have been a surprise.

### ***Wattebledia cribbsiana* n. sp.**

pl. 8 fig. 10.

- 1934 *Bithynia crosseana*, — RENSCH, Trop. Binnengewässer, 5: 225 [non WATTEBLED, 1884].
- 1948 *Wattebledia crosseana*, — ABBOTT, Bull. Mus. comp. Zool., 100: 281 [non WATTEBLED].
- 1951 *Bithynia crosseana*, — THIENEMANN, Arch. Hydrobiol., Suppl., 19: 535 [non WATTEBLED].
- 1956 *Wattebledia crosseana*, — VAN BENTHEM JUTTING, Treubia, 23: 346, fig. 51 [non WATTEBLED].

**Diagnosis:** A species of *Wattebledia* CROSSE which differs from the genotype *crosseana* WATTEBLED by its much smaller size and from *siamensis* MOELLENDORFF by its shallower suture and less sinuous outer margin of the peristome.

**Description:** Shell comparatively small, conoidal-ovate with large ovate body whorl and conoidal spire. The colour is greyish corneous, the surface is rather smooth except for the very delicate lines of growth and minute spiral lines. It is somewhat glossy but mostly covered by a thin layer of organic deposit. The  $4\frac{1}{2}$  whorls are moderately convex and separated by a rather shallow suture. The body whorl measures  $\frac{7}{10}$  of the height of the shell. The

umbilicus is completely closed. — The aperture is rather large and measures more than  $\frac{2}{3}$  of the height of the body whorl. It is piriform and somewhat extended at the outer margin. The peristome is thick but not lipped; it is continuous but appressed to the penultimate whorl. The typical upper and basal incisions are very shallow and the outer margin is much less sinuous than in *crosseana* and *siamensis*. — The operculum is piriform, calcareous, concentric, with a subcentral, spiral nucleus. It covers the aperture completely and is not retractable.

Size: A 4.8-5.3 mm; D 3.2-3.5 mm.

The soft parts and the radula are unknown as only completely desiccated specimens were available for description.

Locus typicus: Armenian Sportsground, Soerabaia, Java.

Material: Holotype ZMA and 10 paratypes, leg. C. TH. CRIBBS, July 1926. — Ranoe Klingdoengan, Java; Limnolog. Sunda Expedition, leg. 27 November 1928, 1 specimen. — Rawah Galapan, south of Kediri, Java, leg. A. G. FORSTMAN, 19. September 1927, 4 specimens. — Rawah Bening, south of Kediri, Java; leg. A. G. FORSTMAN, 19. September 1927, 4 specimens.

Distribution: This species is known from East Java only. The known localities are situated between Soerabaia and Kediri.

### ***Wattebledia baschi* n. sp.**

pl. 8 fig. 11; textfig. 9.

Diagnosis: A species of *Wattebledia* CROSSE, which differs from its Thai neighbour, *siamensis* MOELLENDORFF, by its much smaller size, stouter shape and less convex whorls.

Description: Shell very small, thin, transparent, corneous, dull, with 4-4½ regularly increasing whorls. These are somewhat convex but less so than in *siamensis* MOELLENDORFF. The surface is almost smooth except for the very delicate lines of growth. The body whorl is large; it measures about  $\frac{3}{4}$  of the height of the shell. At the base the body whorl shows a short, curved carina beside the chinked or closed umbilicus. — The aperture is rather large; it is ovate and angled above and regularly rounded below. The peristome is somewhat thickened, particularly so at the appressed parietal margin and at the columella. The upper margin shows a shallow incision and the base a very deep one. These parietal and basal incisions of the peristome are much deeper than those of any other species of the genus, but the outer margin of the peristome between these two incisions is much less sinuously produced than that of the other species. — Operculum ovate, pointed above, thick, calcareous, concentric, with a small, subcentral, spiral nucleus.

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

The animals were so desiccated that only data on the radula can be given. This differs considerably from those of the other species of the genus. The rhachis is rounded-rhomboidal with 13 squarish cusps on the cutting edge, but there are no basal cusps. The laterals have the formula 2-1-4, the inner marginals have 18, the outer marginals 32-40 small cusps.

Type locality: Trench along the road at Kampong Padang, Malau, 12 km north of Kanga, Perlis, North Malaya.

Distribution: Known from the type locality only. As this locality is situated only few miles south of the Thai border, the Thai provinces bordering Malaya were carefully surveyed for this species, but only *Wattebledia siamensis* was found.

Material: Holotype SMRL 12026/A, paratypes 12026/10, USNM, SMF, Coll. BRANDT and BASCH.

Etiology: The species is dedicated to Dr. PAUL BASCH, University of California, who found it in April 1965.

### Delavayidae ANNANDALE, 1924.

No species of the genera now assigned to this family have ever been reported from Thailand. "*Pachychilus*" *parvum* LEA was erroneously placed in the genus *Pachydrobia* CROSSE & FISCHER. Only few of the more than thirty species of Delavayidae found by the SMRL collecting team in the Mekong and its tributaries had been previously reported from Cambodia or Laos. Most of them were undescribed.

### ***Pachydrobia*** CROSSE & FISCHER, 1876.

Three species of this genus which were found in Thailand, were already known from Cambodia: *paradoxa* CROSSE & FISCHER, *spinosa* and *variabilis* POIRIER. At last 5 new species of this genus can be contributed to the fauna of Thailand.

### ***Pachydrobia crooki*** n. sp.

pl. 8 fig. 12; textfig. 10.

Diagnosis: A species of *Pachydrobia* CROSSE & FISCHER which differs from the type species *paradoxa* CROSSE & FISCHER by its larger size and more slender shape and its stronger costulation.

Description: Shell slender, ovoidal-conic, white, but covered with a green periderm, young specimens thin and diaphanous, old specimens not transparent, but less thick than *P. wykoffi*, somewhat shining. Protoconch smooth and glossy, the remaining whorls covered with close-set sharp riblets, the costulation getting stronger and more obtuse towards the body whorl. The 6-7 whorls are somewhat convex and they increase regularly in size. The body whorl measures about  $\frac{1}{2}$  the size of the shell. The ribs on the body whorl are stronger below the suture than at the base. The front is only slightly less rounded than the back, never flattened like that of *wykoffi*. There is an obtuse tubercle on the back below the suture but it may sometime be missing. The riblets are crossed by very feeble and irregular spiral lines. — Aperture large, semicircular, not extended. Peristome very thick, connected by a strong parietal callus showing the lines of growth. — Operculum semicircular, thin corneous, transparent, paucispiral with lateral and basal nucleus.

Size: A 9.5-13 mm; D 5.7-6.5 mm.

The animal is sand-coloured with dark pigment spots dusted over back and head. The tentacles are of medium size, the eyes are placed in the bases



in moderate swellings. Proboscis short, about  $\frac{2}{3}$  of the length of the extended tentacles. The foot is elongately triangular, truncate in front and obtusely pointed behind. There is no omniphoric or suprapedal groove. — The rhachis of the radula shows a broadly triangular cutting edge. There are 4 minute cusps on either side of it. Each wing bears 4 small basal cusps. The cusp formula of the laterals is  $2+1+5$ , the marginals have 14 or 17 small cusps respectively. There are 52 rows. — The verge of the male reproductive organ is flattened, sharply bent or curved and pointed at the end. It is simple without appendages and has a single duct.

*Locus typicus*: Mekong at Bandan in East Thailand.

*Distribution*: Known from the Mekong between Ban Khum 12 km north of Bandan to the island of Khong in South Laos.

*Material*: Holotype SMRL 3435/A; paratypes 3435/100, USNM, SMF and ZMH. — SMRL 3431/30 - 2 km south of Bandan, Mekong.

***Pachydrobia munensis* n. sp.**

pl. 8 fig. 13.

*Diagnosis*: A species of *Pachydrobia* CROSSE & FISCHER which differs from *P. harmandi* POIRIER by its thinner texture and narrower and weaker costulation.

*Description*: Shell of medium size for the genus, elongately ovate-conoidal, comparatively thin, transparent, olive coloured, glossy. The 6-7 somewhat convex whorls increase regularly in size. With exception of the two first whorls, they are sculptured with narrow, obtuse ribs which become obsolete on the body whorl towards its base. The body whorl is not flattened in front and there is no spine or tubercle on the back. — Aperture large and obliquely semicircular, bluish white within. Peristome thick but hardly expanded, continuous, appressed to the penultimate whorl, with fine lines of growth on the lip. — Operculum semicircular, thin, corneous, transparent, paucispiral with lateral and basal nucleus.

*Size*: A 7.3-9.4 mm; D 4.2-5.1 mm.

Animal and soft parts like those of *P. crooki* n., rhachis of radula with 7 cusps on the cutting edge and 3 basal cusps on either side.

*Locus typicus*: Mun river near Ban Ta Tum, Surin Province.

*Distribution*: Mun river, a tributary to the Mekong in East Thailand.

*Material*: Holotype SMRL 447/A, paratypes 447/10. — SMRL 448/10 - Mun river at Huai Ka Yung, Sri Saket Province.

***Pachydrobia zilchi* n. sp.**

pl. 8 fig. 14; textfig. 11.

*Diagnosis*: A species of *Pachydrobia* CROSSE & FISCHER which differs from all other species of this genus by its two prominent bosses on the ventral side of the body whorl.

*Description*: Shell of medium size for the genus, rather solid, but not thick, transparent, glossy, with olive green periderm, irregularly ovoid-conoidal,

the  $4\frac{1}{2}$  whorls are somewhat convex, the protoconch is smooth, the postnuclear whorls are densely ribbed, the body whorl is only coarsely striate. The first  $2\frac{1}{2}$  whorls form a regular cone, the next whorl is strongly inflated and forms a shoulder above the periphery, the body whorl is flattened in front and the ventral part is slanting backwards. There is a strong tubercle on the back a little to the right from the dorsal line. On the periphery of the body whorl there is a strong boss placed left from the ventral line and another boss is seen at the base between dorsal and left side line. The last whorl measures about  $\frac{3}{4}$  of the height of the shell. The umbilicus is closed. — Aperture large; it measures about  $\frac{4}{5}$  of the height of the body whorl. It is regularly ovate with an angle above. The peristome is extremely thick, continuous, attached to the penultimate whorl, with concentric lines of growth on the lip. — Operculum thin, brown, transparent, semilunar, paucispiral, with a lateral nucleus placed near the base.

Size: A 8.5-10.5 mm; D 7.5-8.3 mm; d 5.6-6.3 mm.

The sand-coloured animal is dusted with black pigment spots. The tentacles are relatively long and pointed. The puckered proboscis is darker than the head and measures about  $\frac{2}{5}$  of the tentacles. The verge is blade-shaped, sharply bent, simple, with a single duct and no appendages. — The rhachis of the radula has 7 cusps on the cutting edge which is triangular. There are 3 basal cusps on either side. Laterals have the formula  $2+1+4$ , the marginals have 11-14 or 15-16 cusps respectively.

Locus typicus: Mun river at Ubon Ratchatani, East Thailand.

Distribution: Known from the Mun river only.

Habitat: The species were collected buried in the sand.

Material: Holotype SMRL 460/A, paratypes 460/1000, USNM, SMF and ZMH. — 459/50 - Maenam Mun at Ban Ta Tum, Surin Province; 3437/40 - Mun river at Rasi Salai, Sri Saket Prov.

***Pachydrobia siamensis* n. sp.**

pl. 8 fig. 15; textfig. 12.

Diagnosis: A species of *Pachydrobia* CROSSE & FISCHER which differs from the genotype by its smaller size, stouter shape and normally stronger sculpture. The delicate spiral lines of *P. paradoxa* are in this species completely missing.

Description: Shell rather small for the genus, ovate-conoidal, hardly transparent, of a bright olive-colour or yellowish or bright greenish, somewhat glossy when young, but dull and with corroded periderm when old. The conic apex is pointed, the 6 whorls are rather convex and separated by a moderately deep suture. They increase regularly in size; the body whorl is large and measures about  $\frac{2}{3}$  of the height of the shell. The less convex apical whorls are smooth, the remaining whorls are sculptured with thick, obtuse, radial ribs, which become obsolete near the peristome and on the lower half of the body whorl. There are about 28 ribs on the penultimate whorl and 18 on the first half of the body whorl. The ventral face of the body-whorl is only a little flattened. — Aperture large and somewhat extended, ovate, angled above. The

peristome is thick and continuous and appressed to the penultimate whorl. The columellar callus covers the umbilicus. — Operculum ovate or semicircular, thin, corneous, paucispiral, with lateral and basal nucleus.

Size: A 5.7-7.6 mm; D 4.1-5.2 mm; d 3.2-3.8 mm; Aperture: A 2.5-3.2 mm; D 2.1-2.8 mm.

The animal is sand-coloured, dusted with very delicate greyish-black pigment spots. Foot elongately triangular, truncate in front and obtusely pointed behind. Tentacles filiform, of medium size, the eyes are placed at the outer side of the hardly swollen bases of the tentacles. The dark proboscis is rather long and measures about  $\frac{1}{2}$  the length of the tentacles.

Radula: Rhachis different from that of the other species, rather broad and low, with very large cutting edge with large triangular mesocone and smaller, but still large cusps on either side of it. Instead of the basal cusps there are 4 finger-shaped, obtuse processes on either side of the plate. Laterals with the cusp formula  $1+1+5$ , marginals with 18 or 16 cusps respectively. There are about 56 rows of teeth.

The male reproductive organs show a small, simple, somewhat flattened, coiled verge, placed in the neck behind the right tentacle. It has no appendages and a simple duct.

Locus typicus: Maenam Kwae Noi at Ban Kao Pun, north of Kanchanaburi.

Distribution: Known from the lower reaches of the Maenam Kwae Noi and the upper reaches of the Mae Klong only.

Material: Holotype SMRL 446/A, paratypes 446/50, USNM, ZMH, SMF and ASRCT. — SMRL 3444/10 - Mae Klong at Kanchanaburi.

### ***Pachydrobia wykoffi* n. sp.**

pl. 8 fig. 16; textfig. 13.

Diagnosis: A species of *Pachydrobia* CROSSE & FISCHER which differs from *P. paradoxa* CROSSE & FISCHER by its larger size, thicker shell and stouter shape. It is shorter and thicker than *P. crooki* and much larger than *P. munensis*. It differs from *P. fischeriana* POIRIER by its costulation and the lack of minute spiral lines.

Description: Shell ovate-conoidal, thick when adult, only young specimens are transparent and glossy, adult specimens are covered with a yellowish-green or brown periderm which may often be worn off. The  $5\frac{1}{2}$  somewhat convex whorls increase regularly in size. The large, oval body whorl measures  $\frac{3}{4}$  of the height of the shell. The apical whorls are smooth, the postnuclear whorls are sculptured with irregular, dense ribs which faint away on the flattened ventral side of the body whorl but are stronger and less densely set on the back side. The rudiment of a tubercle may be present on the dorsal side of the body whorl immediately below the suture. — Aperture ovate, angled above and regularly rounded below. It is milky-blue within. Peristome continuous, very thick. — Operculum semicircular, corneous, transparent, paucispiral with basal nucleus.

Size: A 11-12 mm; D 7-8 mm; d 5.0-5.5 mm.

Animal sand-coloured, void of any black or orange pigmentation. — The radula is similar to that of *P. crooki*, but the rhachis has 7 cusps on the cutting edge and 3 basal cusps only. — The verge is large, finger- or blade-shaped, with a single duct and no appendages.

Type locality: Mekong river, sand-bank 2 km S of Nakon Panom.

Distribution: Mekong between Nakon Panom and Tat Panom.

Material: Holotype SMRL 3433/A, paratypes in USNM, ZMH, SMF and SMRL. — SMRL 3431/50 - Mekong at Tat Panom, S of Nakon Panom.

### ***Paraprososthenia* ANNANDALE, 1919.**

Only one recent species of this genus was formerly known, *P. gredleri* (NEUMAYR), unless we unite *Parapyrgula* ANNANDALE & PRASHAD with this genus. There is still some doubt whether the species from the Mekong are congeneric with the above mentioned Burmese species or with the species assigned to *Hydrorissoia* BAVAY. As long as we have not sufficient anatomical data of these species the establishment of a new genus is not justified.

### ***Paraprososthenia schuetti* n. sp.**

pl. 8 fig. 17.

Diagnosis: A species of *Paraprososthenia* ANNANDALE which differs from the genotype, *P. minuta* ANNANDALE, by its somewhat larger size, bigger and more obtuse tubercles and the lacking of the third row of tubercles on the body whorl.

Description: Shell small, elongate-conoidal or cylindrical, vitreous, glossy, transparent, moderately thin, with  $6\frac{1}{2}$  hardly convex whorls which are separated by a simple, shallow suture. The apical whorls are smooth, the others are ornate with two rows of obtuse tubercles, about 10-12 in each row on the penultimate whorl. There is no third row on the body whorl but a very obtuse keel instead. The body whorl measures about  $\frac{1}{2}$  the size of the shell. The fine lines of growth are crossed by delicate and irregular spiral lines. — The aperture is comparatively large, about  $\frac{1}{2}$  the size of the body whorl; it is somewhat expanded. The peristome is retracted above and below thus forming a sinus at the outer margin; outer margin somewhat thickened but not lipped; continuous and appressed to the penultimate whorl or connected by a strong parietal callus. — Operculum unknown as only dead shells were collected. — Animal and soft parts unknown.

Size: A 7.5-9.3 mm; D 2.8-3.3 mm.

Locus typicus: Mekong river at Bandan, Ubon Province in East Thailand.

Distribution: Known from the type locality only.

Etiology: This species is dedicated to my friend Dr. HARTWIG SCHÜTT who contributed considerably to our knowledge of Rissoacea.

Material: Holotype SMRL 3382/A, Paratypes 3382/10, ZMH, USNM and SMF. The holotype is the only fresh specimen, however, without animal and operculum. All paratypes are bleached.

***Paraprososthenia vivonai* n. sp.**

pl. 8 fig. 18.

**Diagnosis:** A species of *Paraprososthenia* ANNANDALE which differs from *P. schuetti* n. by having three solid ridges ornate with tubercles on the middle and four rows on the body whorl, one of them below the periphery.

**Description:** Shell elongately turreted, white, vitreous, covered by a very thin yellowish periderm when young. The 7 moderately convex whorls increase slowly and regularly in size. Protoconch smooth, postnuclear and middle whorls sculptured with two strong spiral ridges and a third weak line just above the suture. The latter is stronger on the body whorl. A fourth ridge on the body whorl just below the periphery is much weaker than the three above it. These ridges have a wavy profile through superimposed weak tubercles. The body whorl measures about  $\frac{1}{2}$  the size of the shell. — Aperture large, rhomboidal, somewhat larger than half the size of the body whorl. Peristome not very much thickened, connected by a parietal callus. The outer margin with two obtuse angles which correspond with the two upper spiral ridges. It is somewhat recurved above and below and produced in the middle of the outer margin. — Operculum and animal unknown.

Size: A 7.8-8.3 mm; D 2.9-3.2 mm.

Locus typicus: Mekong at Bandan, East Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 3443/A; paratypes 3443/5.

Etiology: The species is dedicated to Col. STEFANO VIVONA, former Director of the U.S. Army Medical Component of SEATO.

***Paraprososthenia schlickumi* n. sp.**

pl. 8 fig. 19.

**Diagnosis:** A species of *Paraprososthenia* ANNANDALE which differs from all other species of this genus by its small size and weak sculpture.

**Description:** Shell very small, cylindrical or turreted, elongate, whitish, vitreous, glossy, transparent (all collected specimens were dead and more or less bleached), thin. The 5 whorls are hardly convex and are separated by a rather shallow suture. The apex is sometimes alloiostroph but it is mostly corroded. With exception of the protoconch all whorls are sculptured with two spiral rows of tubercles which are strongest on the body whorl. Under strong magnification very delicate spiral lines can be seen. The body whorl measures a little more than  $\frac{1}{2}$  the height of the shell. The umbilicus is covered by the columellar callus. — Aperture ovate, slightly angled above; peristome not thickened, hardly expanded, not continuous, connected by a parietal callus. — Operculum and soft parts unknown.

Size: A 3.2-3.8 mm; D 1.2-1.6 mm.

Locus typicus: Mun river (pronounced „moon“) at Pibun Mangsahan, Ubol Province, East Thailand.

Material: Holotype SMRL 3381/A; paratypes 3381/5, USNM and SMF.

**Distribution:** Known from the type locality only. The population from which these specimens originate must live in the Mun river between Ubon and Pibun Mangsahan, as this species was never found in Ubon or near that town.

**Etiology:** This species is dedicated to Dr. RICHARD SCHLICKUM, Cologne, a malacologist who contributed so much to our knowledge of Prosobranchia, particularly fossil Rissoacea.

***Paraprososthenia davis* n. sp.**

pl. 8 fig. 20.

**Diagnosis:** A species of *Paraprososthenia* ANNANDALE which differs from all other known species of the genus from East Asia by having several solid spiral ridges without any traces of tubercles.

**Description:** Shell small, elongate-conic, whitish, somewhat glossy, transparent. The  $5\frac{1}{2}$ -6 hardly convex whorls are separated by a shallow suture. The protoconch is smooth, the other whorls are sculptured with three very sharply raised spiral ridges, the middle ridge being the strongest. On the base of the last whorl there are normally three more spiral ridges. The first ridge below the suture may be very weak and the ridges on the lower half of the body whorl may be sometimes nearly obsolete. The fourth spiral ridge may sometimes be seen on the penultimate whorl just above the suture. Umbilicus only a narrow chink. The body whorl measures about  $\frac{1}{2}$  of the shell or a little less. — Aperture ovate or nearly circular, comparatively small, not expanded. Peristome continuous, appressed to the penultimate whorl, moderately thick. The aperture measures about  $\frac{3}{5}$  of the size of the body whorl. — Operculum and animal unknown.

**Size:** A 5.6-5.8 mm; D 2.0-2.2 mm.

**Locus typicus:** Mekong river at Bandan in East Thailand.

**Distribution:** Known from the type locality and Mun river.

**Material:** Holotype SMRL 3384/A; paratypes 3384/6. — SMRL 3449/7 - Mun river at Tana Falls.

**Etiology:** The species is dedicated to Dr. GEORGE M. DAVIS, 406 Medical Laboratory in Japan.

***Paraprososthenia taylori* n. sp.**

pl. 8 fig. 21; textfig. 14.

**Diagnosis:** A species of *Paraprososthenia* ANNANDALE which differs from *P. schuetti* n. by its solid spiral ridges and the flattened lip of the peristome.

**Description:** Shell small, elongate-conoidal, white, vitreous, glossy, transparent. Young specimens are covered with a very thin yellowish periderm which is missing when the shell becomes adult or is reduced to rests between the spiral ridges. The 7 whorls are hardly convex and separated by a very shallow suture. The apical whorls are mammilate and smooth, the first postnuclear whorl has two, the third whorl three, the fourth, fifth and sixth have four spiral ridges of which one or two may sometimes be obsolete. In addition to the four upper ridges there are three additional ridges on the lower half of the body whorl below the periphery. When one or two of these spiral ridges are obsolete the

remaining are much stronger than normal. The two upper spiral ridges carry irregular tubercles which are placed in different distances from each other and are of varying strength. The lines of growth are crossed by delicate spiral lines. The body whorl measures about  $\frac{4}{9}$  of the height of the shell. The umbilicus is rimate. — Aperture obliquely ovate and hardly angled above; peristome continuous and appressed to the penultimate whorl. It is slightly expanded and lipped at the sinuous outer margin. — Operculum thin, corneous, transparent and paucispiral, with a basal nucleus.

Size: A 6.2-7.8 mm; D 2.4-2.9 mm; Aperture about 1.5 1.3 mm.

The animal is sand-coloured, with irregular melanin pigment spots, particularly on the front part of the back, head, tentacles and proboscis. On the front part there are also some yellowish pigment dots, but these are of different consistence from those of *Bithynia* and Viviparidae. The tentacles are relatively long and are only slowly tapering towards the end. The eyes are placed at the outside of the bases of the tentacles in moderate swellings. The proboscis is somewhat tapering towards the end and measures about  $\frac{1}{4}$  of the length of the tentacles. The foot is angled behind and truncate in front. A row of transparent, semicircular sensory (palpating?) cells gives the front part of the foot a serrate appearance.

The central tooth of the radula has a mesocone with 3 denticles; similar to that of *Bithynia longicornis* BENSON there are 4 small cusps on either side of it and 4 basal cusps. The dentition of the other teeth is: L:  $2+1+(7-8)$ ,  $M_1$ : 12-14,  $M_2$ :  $\pm 20$ . Number of rows unknown. As only one specimen was dissected it cannot be said whether the tricuspid mesocone is an aberrant finding, or whether it is typical for the species or even this genus. The central tooth of the radula of *Parapyrgula* ANNANDALE & PRASHAD is triangular and simple, without lateral cusps.

The verge of the male reproductive organ is comparatively large for the size of the animal. It is flattened and curved and bears a tip at the end. There is only a simple duct without appendages.

Locus typicus: Mekong at Bandan in East Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 3383/A; paratypes 3383/7.

Etiology: This species is dedicated to Dr. DWIGHT W. TAYLOR who contributed so much to our knowledge of Rissoacea.

BAVAY described a *Hydrorissoia levayi* (1895 J. de Conch., 43: 92, pl. 6 fig. 6) which has to be placed into this genus. It seems to be similar to this species but is much smaller. *P. davisii* is about that size (5.2 mm) but the spiral ridges are stronger and without any trace of tubercles.

### ***Hubendickia* n. gen.**

Diagnosis: A genus of Delavayidae which differs from its closest relative, *Paraprososthenia* ANNANDALE, by its sculpture consisting of axial ribs and not of spiral ridges or rows of tubercles. From *Pachydrobia* CROSSE & FISCHER, the only other genus of the family with axial ribs, this genus differs by its smaller size and slender shape.

Description: Shell cylindrical or elongate-turreted, rather thin, transparent, somewhat glossy, vitreous; sculptured with axial ribs or smooth and with more or less distinct fine spiral lines. — Operculum thin, corneous, paucispiral and transparent.

The animal is greyish or sand-coloured, with darker pigment spots dusted over back and head. — The central tooth of the radula shows several lateral cusps on either side of the mesocone. This, however, may sometimes be obsolete. There are normally 4 basal cusps on either side of the wings. — The verge of the male reproductive organ shows a simple duct only. It is without lateral appendages.

Genotype: *Hubendickia siamensis* n. sp.

Distribution: Mekong river in Cambodia, Thailand and Laos. Mun river in East Thailand.

Etiology: The genus is dedicated to Dr. BENGT HUBENDICK, Director of the Museum of Natural History in Goteborg, Sweden.

*Pachydrosia sulcata* BAVAY (1895 J. de Conch., 43: 89, pl. 5 fig. 5) belongs to this genus. It has not yet been found in Thai territory.

***Hubendickia siamensis* n. sp.**

pl. 8 fig. 22; textfig. 15.

Diagnosis: A species of *Hubendickia* n. gen. which differs from *H. sulcata* BAVAY by its larger size, heterostroph protoconch, stronger spiral lines and stronger ribs.

Description: Shell of middle size for the family, thin, transparent, elongate-conic or turreted, greyish corneous, with pointed, mostly heterostroph apex. The first three of the  $6\frac{1}{2}$ -7 hardly convex whorls are smooth save for the lines of growth. The remaining whorls are sculptured with strong axial ribs which are crossed by fine but distinct spiral lines. There are 14-16 ribs on the penultimate whorl. The ribs become weaker towards the aperture. The whorls are separated by an impressed but only moderately deep suture. The body whorl measures about  $\frac{4}{7}$  of the height of the shell. There is an obtuse carina around the periomphalic pit. Below this carina the ribs become obsolete. — Aperture comparatively large and wide. It is angled above and well rounded at the retracting base. It measure  $\frac{1}{3}$  of the height of the shell. The peristome is not continuous. It is connected by a very thin callus only. It is expanded at the outer margin and somewhat thickened but hardly lipped. — Operculum oval, paucispiral with  $2\frac{1}{2}$  whorls, thin corneous, with basic nucleus.

Size: A 6.4-7.7 mm; D 2.8-3.4 mm.

Animal sand-coloured with dark grey pigmentation on back, head, tentacles and proboscis. Tentacles long and thin, much longer than the truncate proboscis. The front part of the foot is straight, the hind part tapering to a blunt point. The verge of the male is flat, curved, pointed, simple, with a single duct and no appendages.

The rhomboid central tooth is produced at the lower corners into two pointed wings. These carry 4 basal cusps on either side, the innermost being



the largest. These basal cusps are sitting in well defined sockets. In the middle of the base is a broad, rounded process. The cutting edge shows 7 cusps, the middle cusp being the largest. Laterals 1-1-5, marginals 8 or 9 cusps. Numbers of rows about 60.

Type locality: Maenam Mun at Pibun Mangsahan, Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 3390/A and several thousand paratypes in USNM, SMRL, SMF, THRC and ZMH.

***Hubendickia spiralis* n. sp.**

pl. 8 fig. 23; textfig. 16.

Diagnosis: A species of *Hubendickia* n. gen. which differs from the genotype by its stronger spiral lines, weaker costulation and always homoeostroph protoconch.

Description: Shell elongately turreted, vitreous or somewhat sand-coloured, transparent, of silky lustre but not glossy. The 6-7 whorls are flattened at the periphery but are separated by a rather deep suture. The protoconch is smooth and homoeostroph, the other whorls are sculptured with irregular weak ribs and distinct spiral lines which are crossed by fine lines of growth. The ribs may be somewhat thickened below the suture, they are obsolete on the umbilical area. The body whorl measures about half the height of the shell. — Aperture piriform, angled at the upper insertion and near it at the upper part of the outer margin. The peristome is not continuous. It is connected by a very weak parietal callus and somewhat produced at the outer margin. — Operculum thin, piriform, corneous, paucispiral with basal nucleus.

Size: A 5.5-6.5 mm; D 2.6-3.0 mm.

Animal like that of the genotype but with stronger pigmentation which often reaches up to the digestive gland. The verge of the male is small, coiled, simple. — Central tooth of the radula with 3 (rarely 4) small cusps on either side of the middle cusp and 3-4 basal cusps on each side, the innermost being the largest. Laterals 2-1-5, marginals with 10-12 cusps.

Locus typicus: Mekong river at Bandan, Ubon Province, East Thailand.

Distribution: Known from the Mekong in Thailand only.

Material: Holotype SMRL 3386/A, paratypes 3386/100, USNM, SMF, ZMH. — 3387/10 - 2 km S Bandan, Mekong river; 3399/20, USNM, ZMH and SMF - Ban Kum, 12 km N of Bandan, Mekong river.

***Hubendickia tuberculata* n. sp.**

pl. 8 fig. 24.

Diagnosis: A species of *Hubendickia* n. which differs from all other known species of this genus by its spiral groove below the suture.

Description: Shell of medium size for the genus, turreted, whitish, with yellow periderm, vitreous, transparent, moderately thick. The 6 whorls are somewhat shouldered below the suture and moderately flattened at the periphery.

The first four whorls are increasing regularly in size and form an elongate cone, the last two whorls are of about the same diameter. The first two whorls are smooth, the other four are sculptured with axial ribs, about 15-17 on the penultimate whorl. These ribs are cut by a distinct subsutural groove, separating a spiral row of tubercles from the lower parts of the ribs. The ribs become weaker towards the base of the body whorl. This measures about  $\frac{1}{2}$  the size of the shell. — Aperture comparatively small, about  $\frac{1}{2}$  the height of the body whorl, narrowly piriform. The peristome is connected by a parietal callus. The outer margin is not or hardly produced and only moderately thickened. — Operculum and soft parts unknown.

Size: A 5.2-5.8 mm; D 1.6-1.9 mm.

Locus typicus: Mekong at Ban Kum, 12 km N of Bandan in East Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 3389/A; paratypes 3389/5.

***Hubendickia gochenouri* n. sp.**

pl. 8 fig. 25.

Diagnosis: A species of *Hubendickia* n. gen. which differs from all known species of this genus by its two weak keels on the last whorl.

Description: Shell elongately-cylindrical or turreted, whitish or yellowish, transparent, glossy, moderately solid. The first two or three of the 7 whorls are smooth and somewhat convex, the others are slightly concave or at least flattened at the periphery and sculptured with irregular and obtuse ribs. The ribs are weaker on the periphery. Below and above the periphery of the last whorl there are obtuse keels, the penultimate and antepenultimate whorls somewhat shouldered. The suture is rather deep. The body whorl measures a little less than half the size of the shell. There are irregular traces of a very delicate spiral sculpture. — Aperture ovate or piriform and only moderately expanded; peristome connected by a parietal callus. It is angled above and regularly rounded below. The umbilicus is covered by a columellar callus. — Operculum thin, piriform, corneous, transparent, paucispiral with lateral nucleus. — Animal and soft parts have not yet been studied.

Size: A 7.2-8.6 mm; D 2.6-3.0 mm.

Locus typicus: Mekong at Ban Kum, Thailand.

Distribution: Known from the Mekong in East Thailand only.

Material: Holotype SMRL 3385/A; paratypes 3385/10, USNM, SMF. — SMRL 3394/10, USNM and SMF - Mekong at Bandan.

Etiology: This species is dedicated to Col. WILLIAM S. GOCHENOUR jr., Deputy Director of WRAIR in Washington.

The species is similar to *H. crooki* n. and differs from that species only by its delicate spiral lines, less glossy surface and the carinae caused by the flattening of the ribs on the periphery. It looks like an intermediate link between *Hubendickia* and *Paraprososthenia*.

***Hubendickia coronata* n. sp.**

pl. 9 fig. 26.

**Diagnosis:** A species of *Hubendickia* n. gen. which differs from the genotype and all other known species of this genus by having a sharp sub-sutural spiral ridge which crosses the ribs and forms at the crossings tubercles which may be produced into very short spines.

**Description:** Shell elongately turreted, whitish-vitreous (all specimens were collected dead and may have lost their periderm), moderately thick. The 7 whorls are somewhat flattened at the periphery but the suture is moderately deep. They increase slowly in size, the body whorl measuring about  $\frac{1}{2}$  of the size of the shell. The mammillate protoconch is smooth, the other whorls are sculptured with wavy ribs, about 11-12 on the penultimate whorl. There is a strong spiral ridge below the suture, beginning at the fourth whorl. It crosses the ribs and forms at the crossings tubercles which may sometimes be produced into short, blunt spines. — The aperture is ovate or piriform and only moderately enlarged. The peristome is not continuous. It is connected by a thin parietal callus. The thin columella covers the umbilicus. It is biangulate above, one angle being at the upper insertion, the other angle corresponds with the end of the spiral ridge. The outer margin is rounded and somewhat produced. The aperture measures about  $\frac{3}{5}$  of the height of the body whorl. — Operculum and soft parts unknown.

Size: A 6.6-7.6 mm; D 2.8-3.2 mm.

Locus typicus: Mekong river at Ban Kum, about 12 km north of Bandan, Ubon Province, East Thailand.

Distribution: Known from the type locality only.

Material: Holotype SMRL 3442/A; paratypes 3442/5.

***Hubendickia microsculpta* n. sp.**

pl. 9 fig. 27; textfig. 17.

**Diagnosis:** A species of *Hubendickia* n. gen. which differs from *H. pellucida* (BAVAY) by its smaller size and the spiral lines and from all other known species of this genus by its fusiform shape and complete lack of axial ribs.

**Description:** Shell rather small, elongately fusiform or ovate-conoidal, vitreous or yellowish, transparent, moderately solid, sculptured with fine but distinct spiral lines which are crossed by the delicate lines of growth. The 6 whorls are hardly convex and are separated by a very shallow suture. The protoconch is always homoeostroph. The cylindrical body whorl is tapering towards the base. It measures about  $\frac{5}{8}$  of the height of the shell. The umbilicus is covered by the columella. — Aperture semicircular or obliquely piriform. Its size is about  $\frac{2}{3}$  of the height of the body whorl. The peristome is not continuous but connected by a thick parietal callus. It is thick within, not expanded, angled about and well rounded below. — Operculum thin, corneous, transparent, paucispiral, nucleus near the lower part of the columellar margin.

Size: A 3.6-4.8 mm; D 1.6-1.8 mm.

Animal greyish, with very delicate pigment dots dusted over back and head. Front of foot straight, hind part obtusely pointed. — Central tooth of the

radula of rhomboidal shape, middle cusp on the cutting edge large, with 3 small cusps on either side. There are 5 basal cusps on each wing. Laterals 3-1-4, marginals with 15 or 10 cusps respectively. — Penial complex with small, flattened and curved simple verge.

Locus typicus: Mekong river at Bandan, Thailand.

Distribution: Known from the type locality only.

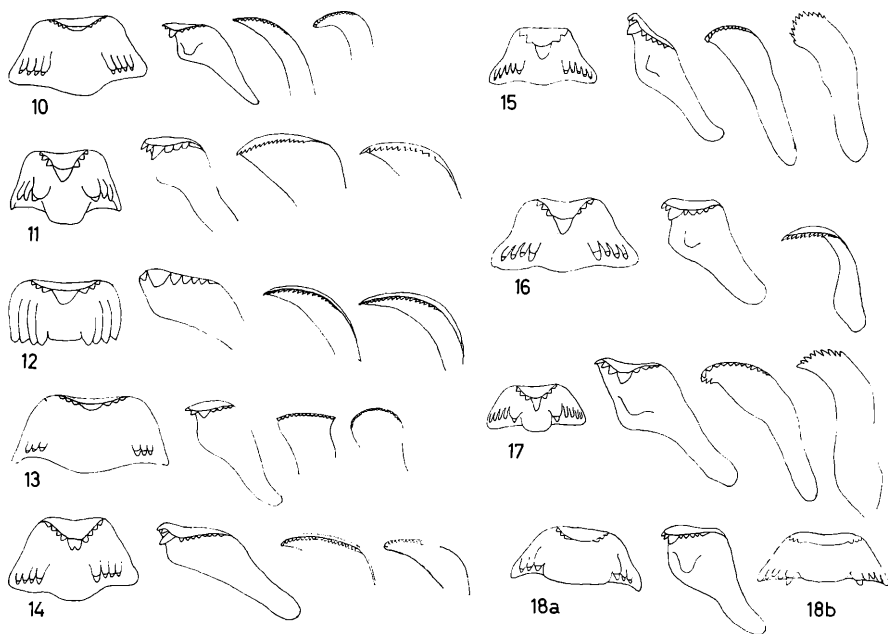
Material: Holotype SMRL 3378/A, paratypes 3378/50, USNM, ZMH and SMF.

***Hubendickia crooki* n. sp.**

pl. 9 fig. 28; textfig. 18.

Diagnosis: A species of *Hubendickia* n. which differs from all other species of this genus by its glossy surface and complete lack of spiral microsculpture.

Description: Shell elongately conoidal or turreted, vitreous, whitish or yellowish, transparent, very glossy; with 7-8 barely convex whorls. The apex seems to be always homoeostroph; the first two whorls are completely



Textfig. 10-18. — 10) *Pachydrobia crooki* n. sp., radula, half-row (SMRL 3435); 11) *P. zilchi* n. sp., radula, half-row (460); 12) *P. siamensis* n. sp., radula, half-row (446); 13) *P. wykoffi* n. sp., radula, half-row (3432); 14) *Paraprososthenia taylori* n. sp., radula, half-row (3383); 15) *Hubendickia siamensis* n. sp., radula, half-row (3390); 16) *H. spiralis* n. sp., rhachis, lateral and inner marginal (3386); 17) *H. microsculpta* n. sp., radula, half-row (3378); 18) *H. crooki* n. sp., (a) rhachis and lateral, (b) rhachis of another specimen (3391).

smooth; the other whorls are sculptured with straight, obtuse ribs which do not reach the suture; these ribs become obsolete on the base of the body whorl. There are 10-12 ribs on the penultimate whorl. The delicate spiral sculpture known from all other species of this genus is completely lacking and therefore the shell is very glossy. The body whorl is always cylindrical and measures  $\frac{5}{8}$  of the size of the shell. The umbilicus is covered by a thin columellar callus. — Aperture ovate, half the size of the body whorl. Peristome not continuous but connected by a thin parietal callus. It is somewhat curved and expanded at the outer margin and delicately lipped. — Operculum ovate, thin, transparent, paucispiral with almost basal nucleus.

Size: A 6.0-6.8 mm; D 2.1-2.8 mm.

Animal grey, with fine sand-coloured dots dusted over head and back and with some larger black pigment spots, particularly near the margin of the foot. The foot is straight in front and rounded behind. The straight anterior line appears serrate by a line of transparent sensual cells. Tentacles long and thin, proboscis about half the length of the tentacles. — Male reproductive organs with a finger-shaped, somewhat flattened verge with a single duct and without appendages. — The radula differs somewhat from that of the type species. The rhachis is rhomboidal or even semilunar in shape. The middle cusps on the cutting edge is very low and broad and regularly curved. There are 3 delicate lateral cusps on the extreme end of the cutting edge. There are 3 basal cusps on either side between the quadrangular middle process and the finger shaped wings. Laterals with 2+1+5, marginals with 12 cusps.

Locus typicus: Mekong at Bandan in East Thailand.

Distribution: Mekong in the Province of Ubon.

Material: Holotype SMRL 3391/A, paratypes 3391/50. — 3392/10 - Mekong 2 km south of Bandan; 3393/20 - Mekong at Ban Kum, 12 km north of Bandan, Ubon.

### ***Hydrorissoia* BAVAY, 1895.**

This genus was established by BAVAY for his *H. elegans* and *levayi*. The anatomical examination of the latter has proved that *levayi* belongs to that group of species described in this paper which are placed tentatively in the genus *Paraprososthenia*. *Hydrorissoia* has a simple, triangular cutting edge on the rhachis like *Pachydrobiella* and *Lacunopsis*, the rhachis of *levayi* has 4-5 small cusps on either side of the cutting edge.

A more intensive survey of the Mekong in Thailand and Laos and of some of its tributaries resulted in the finding of several new species of *Hydrorissoia*. The most important result of this survey, however, was the successful infection of one of these new species with miracidia procured from *Schistosoma* eggs in the stool of a Laotian girl. The miracidia developed into sporocysts of the type of *Schistosoma japonicum*. Cercariae were not obtained as the infected snails died before the sporocysts could mature into cercariae. Among the snails of this species, collected in the Mekong at Khong Island in South Laos, were specimens which harboured sporocysts of exactly the same morphology as those obtained from snails after infection in the laboratory. The species was therefore named *Hydrorissoia hospitalis*.

Large specimens of *H. gracilis* n. are similar to *hospitalis*. *H. hospitalis*, however, has only one small basal cusp between the large inner basal cusp and the finger-shaped wing, *gracilis* has 3 small cusps between the wing and the large inner basal cusp.

The successful infection of a Delavayidae with miracidia of a human blood-fluke was a surprise as no Delavayidae were found at the Thai foci of Schistosomiasis (Chandee and Pitsanulok). As no other intermediate hosts of *Schistosoma japonicum* but *Oncomelania* species were confirmed, it was assumed that the Southeast Asian *Schistosoma* was not conspecific with *S. japonicum*. A careful comparison of the miracidia of the Laotian *Schistosoma* with that of *S. japonicum* confirmed the assumption that the Thai and Laotian *Schistosoma* is a new and undescribed species. The intermediate host of *Schistosoma* in Thailand is still unknown and must belong to another family as no Delavayidae are known from Pitsanulok and Chandee.

***Hydrorissioia gracilis* n. sp.**

pl. 9 fig. 29; textfig. 19.

**Diagnosis:** A species of *Hydrorissioia* BAVAY which differs from all other species by its slender, turreted or fusiform shape and small size.

**Description:** Shell small, solid but not thick, elongately turreted or fusiform, larger specimens somewhat elongately conical, diaphanous, vitreous or yellowish, glossy, with coarse lines of growth and generally with three spiral ridges, one at the periphery and two between the suture and periphery. The two subsutural ridges may carry obtuse tubercles or one or both may be dissolved into tubercles. The peripheral ridge is often, the subsutural ridges are sometimes obsolete. The  $4\frac{1}{2}$ -5 whorls are somewhat convex and separated by a rather deep suture. The body whorl measures about  $\frac{2}{3}$  of the length of the shell. It is less rounded in front than behind but not flattened. — The aperture is large and eccentric; it measures  $\frac{3}{5}$  of the height of the body whorl; it is of ovate shape, angled above and well rounded below. The peristome is thick, somewhat expanded and connected by a thick callus which covers the umbilicus. — The operculum is extremely thin, diaphanous, whitish, paucispiral with basal nucleus and well flexible.

Size: A 2.1-3.1 mm; D 1.1-1.6 mm.

The animal is of a bright sand-colour with few black dots on back, head, tentacles, proboscis and mantle edge. The eyes are placed at the bases of the tentacles in very moderate swellings. The proboscis is tapering towards the cleft front and is  $\frac{2}{3}$  of the length of the tentacles. — The radula is typical for the genus. The rhachis is rounded rhomboidal, with a low, blunt cutting edge without lateral cusps. On either side of the plate are 4 basal cusps, 2 larger inner cusps and between these and the finger-shaped wings 3 small cusps. The laterals have the formula 2-1-4, the marginals have 11 or 7 cusps respectively.

The male copulatory organs show a finger-shaped, bent verge which is somewhat compressed. There are no appendages and the verge has a single duct only.

**Locus typicus:** Mekong river at Bandan, Ubon Province in East Thailand.

Distribution: Mekong river between Bandan in Thailand and Khong Island in South Laos, but probably also in Cambodia.

Material: Holotype SMRL 3478/A; paratypes 3478/10. — SMRL 16117/15, USNM and SMF - Mekong river at Khong Island, South Laos.

***Hydrorissoia munensis* n. sp.**

pl. 9 fig. 30; textfig. 21.

Diagnosis: A species of *Hydrorissoia* BAVAY which differs from the type species, *elegans* BAVAY, by its olive-green periderm, its lack of spiral ridges on the lower half of the body whorl and its broad, rhomboidal rhachis. From *H. trispiralis* it differs by its darker periderm, its larger size, closed umbilicus and by its rhachis. This has only two small basal cusps between the finger-shaped wings and the large inner cusps on either side.

Description: Shell ovoidal-conic, rather thick, vitreous and diaphanous but covered with an olive-green periderm. The 5 whorls are moderately convex, increase regularly in size and are separated by an incised suture. The large body whorl measures about  $\frac{3}{5}$  of the height of the shell. The sculpture consists of coarse lines of growth which are often produced into wavy riblets, particularly on the penultimate whorl, and of obtuse spiral ridges, one at the periphery and two between periphery and suture. The subsutural ridge is generally dissolved into tubercles. — The aperture is large and ovate; it is angled above and well rounded below. The peristome is thick and connected by a thick callus which also covers the umbilicus. The operculum is ovate, thin, diaphanous, paucispiral with basal nucleus.

Size: A 3.2-3.8 mm; D 2.0-2.3 mm; d 1.4-1.6 mm.

The animal is sand-coloured with black pigment dots. The eyes are placed in moderate swelling at the bases of the filiform tentacles. The proboscis is about  $\frac{1}{3}$  of the length of the tentacles. The male copulatory organs show the typical verge without appendages and with a single duct. — The rhachis of the radula is of a rounded rhomboidal shape. It differs from that of the type species by carrying only 3 basal cusps on either side of the tooth inside the finger-shaped wings. The innermost cusps are the largest. The laterals have only 6, the marginals 7 or 9 cusps respectively.

Locus typicus: Mun at Pibun Mangsahan, Ubon Province.

Distribution: Known from the Mun river (pron. moon) only.

Material: Holotype SMRL 3471/A, paratypes 3471/50, USNM, ZMH and SMF.

***Hydrorissoia trispiralis* n. sp.**

pl. 9 fig. 31; textfig. 22.

Diagnosis: A species of *Hydrorissoia* BAVAY which differs from the type species, *elegans* BAVAY, by its smaller size, stouter shape, blunter apex and by its sculpture which consists of three obtuse spiral lines only.

Description: Shell rather small, thin but solid, transparent, glossy, vitreous or yellowish white, ovoidal-conical, with  $4\frac{1}{2}$  somewhat convex whorls which increases regularly in size and are separated by a well incised suture.

The sculpture consists of coarse lines of growth and three obtuse spiral ridges, one at the periphery and two between periphery and suture. The peripheral spiral ridge is the weakest and may be obsolete. The body whorl is large and oval, its lower half is free of spiral ridges. The body whorl measures about  $\frac{3}{4}$  of the height of the shell. The aperture is large and ovate. It is angled above and well rounded at the base. The peristome is very thick and connected by a thick parietal and columellar callus. The umbilicus is a narrow chink beside the columella. It can be completely closed. The front part of the body whorl beside the parietal callus is less rounded than the back but not flattened. A spiral microsculpture is missing but the lines of growth may be produced to wavy riblet on the upper half of the whorls, particularly so on the spiral ridges. — The operculum is ovate, thin, diaphanous, paucispiral with basal nucleus.

Size: A 2.6-3.3 mm; D 1.8-2.3 mm; d 1.4-1.8 mm.

The animal is sand-coloured with black pigment dots dusted over back, head, proboscis and tentacles. The foot is tapering to the rounded end. The proboscis is broad and trunk-shaped and is of about  $\frac{1}{3}$  of the length of the tentacles. The thin tentacles are of medium size. The eyes are placed at their bases in moderate swellings. The male copulatory organs show a simple, finger-shaped, somewhat flattened verge without appendages and with a single duct. — The radula differs from that of the type species by having a rhomboidal (not triangular) rhachis. The cutting edge consists of a single, triangular cusp. The laterals have 3 inner and 5 outer cusps beside the middle cusp. The marginals have 6 cusps.

Locus typicus: Mekong river at Bandan, Ubon Province.

Distribution: Known from the Mekong around Bandan only.

Material: Holotype SMRL 3472/A, paratypes 3472/30, USNM, ZMH and SMF.

### ***Hydrorissoia hospitalis* n. sp.**

pl. 9 fig. 32; textfig. 23.

Diagnosis: A species of *Hydrorissoia* BAVAY which differs from the type species, *elegans* BAVAY, by its smaller size, lack of spiral ridges on the lower half of the body whorl and by its broad, rhomboidal rhachis. From *H. gracilis* it differs by its slightly larger size, broader body whorl and by its rhachis which has only 2 basal cusps on either side (*gracilis* has 4).

Description: Shell small, elongate, turreted or conical, diaphanous, almost vitreous or slightly yellow, rather solid but not very thick; with coarse lines of growth and normally with three spiral ridges, one at the periphery and two between suture and periphery. The subsutural ridges may carry obtuse tubercles. The upper and the peripheral ridge are often missing, rarely all three. The 5 whorls are moderately convex and separated by an incised suture. The body whorl measures about  $\frac{3}{4}$  of the length of the shell. — Aperture large and ovate. It is angled above and well rounded below; peristome thick and connected by a straight, thick callus which also covers the umbilicus. — Operculum very thin, corneous, flexible, diaphanous, paucispiral.

Size: A 3.0-3.4 mm; D 1.7-1.8 mm.

Animal sand-coloured with black pigment dots. Verge simple, without appendages. — Rhachis with simple, rounded cutting edge and 2 basal cusps



on either side: the inner cusps are much larger than the outer cusps. Laterals with 2-1-4, inner marginals with 9, outer marginals with 6 cusps.

Locus typicus: Mekong at Khong village, Khong Island.

Distribution: Mekong between Bandan and Khong, but probably also Cambodia.

Material: Holotype SMRL 16129/A, paratypes 16129/15, USNM, SMF and ZMH. — SMRL 3479/3 - Mekong at Bandan, Ubon Province.

Parasitology: This species was infected with miracidia from a human blood fluke in Laos. Specimens collected at Khong were found to be naturally infected with sporocysts of *Schistosoma*. This species has not yet been found anywhere near the other foci of Schistosomiasis in Thailand.

### **Wykoffia** n. gen.

Diagnosis: A genus of Delavayidae which differs from *Fenouilia* HEUDE, to which the known species of this new genus were formerly assigned, by the presence of a blade-shaped verge (which is missing in *Fenouilia*) and having the cutting edge of the rhachis serrated (that of *Fenouilia* is simple).

Description: Shell of medium size for the family, rather thick, hardly diaphanous, subglobose conoidal, with short spire and large body whorl. Body whorl generally flattened in front, with more or less strong spiral sculpture which may be reduced to a row of weak tubercles. — Aperture large, thick-lipped. Operculum oval, brown, transparent, paucispiral with basal nucleus.

Animal sand-coloured, with blackish pigment dots. Tentacles rather long and thin. The eyes are placed at their bases in moderate swellings. There are neither omniphoric nor suprapedal grooves. — The rhachis of the radula has a triangular, serrated cutting edge. The rhachis figured by POIRIER (1881: pl. 3 fig. 4a) is definitely not the rhachis of a *Wykoffia* but of a *Lacunopsis*.

Type species: *Lacunopsis tricostata* DESHAYES, 1874.

Other species: *Jullienia acuta* POIRIER, *harmandi* POIRIER and *nodulosa* POIRIER. *Jullienia sinensis* BAVAY seems to be a true *Fenouilia*. *Jullienia* CROSSE & FICHER is a monotypical genus for *Melania flava* DESHAYES.

Distribution: Middle and lower reaches of the Mekong and some of its tributaries in Thailand, Laos and Cambodia.

Etiology: The genus is dedicated to Dr. DALE E. WYKOFF, formerly assigned as parasitologist to SMRL, to whom we owe many valuable informations on the freshwater molluscan fauna of Thailand.

One species of *Wykoffia* which was found rather plentiful in the Mekong at Bandan, but also in Laos, seems to be undescribed.

### **Wykoffia crooki** n. sp.

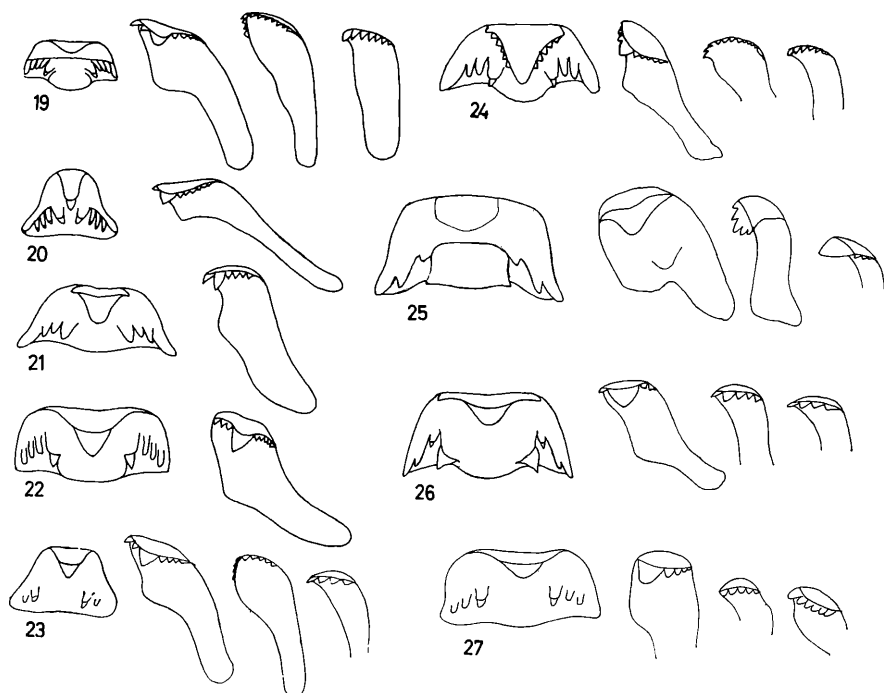
pl. 9 fig. 33; textfig. 24.

Diagnosis: A species of *Wykoffia* n. which differs from its closest relative and compatriot, *harmandi* (POIRIER), by its larger size, by having numerous weak spiral ridges which also cover parts of the ventral face of the body whorl and by having 3 instead of 4 basal cusps on either side of the rhachis.

Description: Shell almost hemisphaerical, with very short, pointed spire and large, inflated body whorl. The 4½ somewhat convex whorls in-

crease rapidly in size and are separated by a shallow, simple suture. The protoconch is smooth, the postnuclear whorls are sculptured with two spiral ridges which are generally dissolved on the body whorl into two spiral rows of tubercles. The body whorl carries a third row of tubercles around the periphery and 5-6 weak spiral ridges below the periphery which also cover the flattened ventral face of the body whorl. The ground colour of the shell is whitish, young shells are vitreous, adult shells are covered with a thick greenish periderm. The ventral part of the body whorl is distinctly flattened and forms with the aperture a plain, placed at  $45^{\circ}$  to the axis of the shell. This flattened ventral part of the body whorl is not separated from the rest of the body whorl by a sharp carina as in most species of *Lacunopsis* but is surrounded at the left side by an obtuse angle only. — Aperture large, semicircular, whitish within. Peristome thick, connected by a thick callus which covers the umbilicus. The regularly curved outer margin is sharp without and lipped within. It is only moderately expanded. — Operculum semicircular, corneous, yellowish or brownish, thin, diaphanous, paucispiral, with basal nucleus.

Size (axial): A 7.8-9.2 mm; D 8.1-9.5 mm; d 4.4-5.2 mm; aperture 7.5 : 5.0 mm.



Textfig. 19-27. — 19) *Hydrorissoia gracilis* n. sp., radula, half-row (SMRL 3478); 20) *H. elegans* BAVAY, rhachis and lateral (3380); 21) *H. munensis* n. sp., rhachis and lateral (3471); 22) *H. trispiralis* n. sp., rhachis and lateral (3472); 23) *H. hospitalis* n. sp., radula, half-row (16129); 24) *Wykoffia crooki* n. sp., radula, half-row (3463); 25) *Lacunopsis fischerpiettei* n. sp., radula, half-row (16211); 26) *L. munensis* n. sp., radula, half-row (3371); 27) *L. conica* n. sp., radula, half-row (16216).

Animal sand-coloured, with blackish pigment dots, particularly on the front part. Foot truncate in front and rounded behind. Tentacles long and round, the eyes are placed in moderate swellings at their bases. The proboscis is less than half the length of the tentacles and is somewhat tapering to the front. — The rhachis is of rounded-rhomboidal shape. The edge is large and triangular and carries on either side 6-7 small cusps. There are 3 basal cusps on either side of the tooth, the innermost cusps being the largest. The laterals have 2 inner and 5 outer cusps beside the large middle cusp. The inner marginals have 11, the outer 6 cusps. — The male copulatory organs show a blade-shaped, sharply bent verge with a simple duct and no appendages. Detailed data on the anatomy will be given in a special monograph on this family.

*Locus typicus*: Mekong river at Bandan, East Thailand.

*Distribution*: Known from the Mekong at Bandan and Cham Passak (Laos) only.

*Material*: Holotype SMRL 3463/A, paratypes 3463/10, USNM and SMF. — SMRL 16172/10, USNM, ZMH and SMF - Mekong rapids at Cham Passak, Laos.

*Etiology*: The species is dedicated to Dr. JAMES R. CROOK, former parasitologist at the SMRL in Bangkok, in grateful recognition of his assistance in this survey.

### ***Lacunopsis* DESHAYES, 1874.**

This genus was originally established for *Lacunopsis monodonta* DESHAYES, *jullieni* DESHAYES and *tricostata* DESHAYES. The latter species was later transferred into the genus *Jullienia* CROSSE & FISCHER, now *Wykoffia*. Three more species were added to this genus by POIRIER and four by BAVAY. Not all of these species may survive a careful revision of the genus. The following two species, however, cannot be confounded with any known species of this genus.

### ***Lacunopsis fischerpiettei* n. sp.**

pl. 9 fig. 34; textfig. 25.

*Diagnosis*: A species of *Lacunopsis* DESHAYES which differs from all other species of this genus by its large, expanded aperture and *Clypeolum*-like shape.

*Description*: Shell depressed, cap-shaped, very similar in shape to *Neritona*, *Clypeolum* and *Neripteron*; with small spire and very large, expanded body whorl. The ground colour of the shell is bluish-white, but except the septum the shell is covered by a thick, oliv-green periderm. The  $3\frac{1}{2}$  whorls are somewhat convex and are separated by an impressed suture; they increase very rapidly in size. The protoconch is smooth, the other whorls are sculptured with strong lines of growth which are crossed by still stronger and irregular spiral grooves. The interspace between these lines is roughened and there are few irregular tubercles on the upper whorls generally arranged in two spiral rows. The area near the peristome and edge of the facial plane have radial obtuse ribs similar to those of certain species of *Cardium*. The front part of the last whorl is transformed into a slanting, round plain which consists of the aperture and the septum formed by the columella and parietal part of the penultimate whorl. The plain is somewhat concave and is covered with a por-

celainous, bluish-white, glossy layer of nacreous shell substance. — The aperture is semicircular and placed in the right half of the facial plain. The peristome is expanded, rounded, sharp outside and callous within. It continues at the base in a regular bow into the sharp edge which separates the ventral plane from the other part of the body whorl. Above it does not transgress into the edge but forms a short, sharp beak. The porcelainous layer is very thin near the peristome. — The operculum is elongate-oval to semicircular. It is very thin, diaphanous, corneous, paucispiral, with basal nucleus. When fresh it is of olive or lemon colour.

Size: A (axial) 12.0 mm; A (of the spire) 7.8 mm; D 16 mm; A (of the facial plain) 16-18 mm; D 17 mm; Aperture 9 : 7 mm (inside).

The animal is of a bright orange colour, quite different from the colour of the other species of this genus. Head, proboscis, back and bases of the tentacles are dusted with greyish pigment dots. The foot is truncate in front and rounded behind. It is lemon coloured. The tentacles are long and pointed. The eyes are placed on distinct sockets about  $\frac{1}{3}$  of the length of the tentacles. The proboscis is broad and truncate in front.

The radula is typical for the genus but differs slightly from those of the other species. The rhachis is of rhomboidal shape with a simple, triangular cutting edge placed on a sort of squarish socket. The basal flap carries 2 minute cusps, one on either lower corner. Between the wings of the rhachis and the basal square are 2 more cusps, the inner ones being much smaller than the outer. The laterals are not "shoe-shaped" like those of other species of the genus but of the shape of a hatchet. The cutting edge is simple, triangular, that of *harmandi* has several cusps like that of *monodonta* and that of *levayi* BAVAY being serrated. The inner marginals have 5, the outer marginals a pointed corner and 3 small cusps.

Locus typicus: Mekong at Bandan, East Thailand.

Distribution: Mekong between Bandan and Cambodia.

Material: Holotypus SMRL 3467/A, paratypes 3467/3. — SMRL 16211/1 - Mekong at Sène on Khong Island, Laos; 16212/3 - Mekong at Khong, Khong Island, Laos.

Habitat: The species seems to live on rocks in deep water, as the only live specimen was found on a bolder dredged in the deep water in the middle of the Mekong. The other specimens were found dead at the bank of the Mekong.

Etiology: It gives me great pleasure to dedicate this beautiful new species to Dr. E. FISCHER-PIETTE, Paris, as a token of gratitude for his help during my stay in Africa and the Far East.

### ***Lacunopsis munensis* n. sp.**

pl. 9 fig. 35; textfig. 26.

Diagnosis: A species of *Lacunopsis* DESHAYES which differs from its closest relative, *sphaerica* BAVAY, by its more rounded spire, lack of red tint in the protoconch and by its equally rounded body whorl which is not flattened below the suture. From *L. ventricosa* POIRIER this species differs also by its much smaller size.

Description: Shell rather small for the genus, subglobose, moderately thick, barely transparent, with distinct lines of growth and very feeble and

irregular spiral lines which are only visible under strong magnification and are often completely missing. The compressed spire is convex, the apex somewhat eroded. The shell consists of  $3\frac{1}{2}$  slightly convex whorls which increase rapidly in size. They are separated by a shallow suture. The apex is always pale and never shows the reddish tint typical for *sphaerica* and *conica*. The colour of the rest of the shell is of an olive-green. Body whorl large and inflated. It is not flattened in front; umbilicus completely covered. — Aperture large, ear-shaped or semicircular; it is distinctly expanded. Peristome well rounded at the outer margin; the upper and basal margin are almost parallel. It is not continuous but connected by an incised line which separates the columellar and parietal area from the ventral part of the body whorl. The columella forms a very short septum which carries in the middle of its edge a blunt, small tooth. The colour of the septum and of the aperture within is of a milky-white. — The operculum is elongate-oval, thin, brownish, corneous, diaphanous, paucispiral, with basal nucleus.

Size: A 5.0-5.5 mm; D 6.0-6.5 mm; d 3.2-4.0 mm.

Animal greyish, with few darker pigment spots dusted over back, head, proboscis and tentacles. Sole of the foot of lighter grey, truncate in front and rounded behind. Tentacles filiform of moderate length; the eyes are placed in moderate swellings at the bases of the tentacles.

The radula has 85-89 rows of teeth. The rhachis shows a simple, triangular cutting edge placed on a broad, winged socket. Between the basal flap and the finger-shaped wings of the face there are 3 basal teeth on either side. The innermost teeth are the largest, the middle cusps are placed much higher than the other cusps. The laterals have one inner and two outer cusps beside the large middle cusp; the inner marginals have 4, the outer marginals 5 cusps on the cutting edge.

The male copulatory organ shows a simple, blade-like verge without appendages and with a single duct.

Locus typicus: Mun river at Ubon Ratchatani, Thailand.

Distribution: Known from the Mun river only.

Material: Holotype SMRL 3371/A, paratypes 3371/30, USNM, ZMH and SMF.

### ***Lacunopsis conica* n. sp.**

pl. 9 fig. 36; textfig. 27.

Diagnosis: A species of *Lacunopsis* DESHAYES which differs from all known species of this genus by its conical shape which is similar to that of *Lithoglyphopsis dugasti* (BAVAY).

Description: Shell small, subglobose-conoidal, with pointed spire and large, semiglobose body whorl. The ground colour is whitish but the shell is covered with a greenish periderm. The sculpture consists of strong lines of growth which are crossed by very feeble spiral lines which are somewhat stronger below the suture. The smooth apex is reddish, caused by a layer of red substance on the inner surface of the apical whorls; however, this reddish layer may sometimes be missing. The  $3\frac{1}{2}$  whorls are convex, more so than in any other species of the genus. They increase rapidly in size and are separated by

a simple, but well impressed suture. The body whorl is large and inflated; it measures almost  $\frac{4}{5}$  of the length of the shell. The aperture is large, drawn downwards like that of *Natica*. The peristome is well rounded; it is not continuous but connected by a sinuous line which separates the broad and thick columella from the ventral face of the body whorl. In the middle of the oblique edge of the columellar septum is a tooth-like, obtuse tubercle. — Operculum brownish, corneous, transparent, paucispiral, with basal nucleus.

Size: A 5.5-6.2 mm; D 4.5-5.0 mm; H 3.7-4.2 mm.

Animal greyish, with few darker pigment dots. Tentacles rather short, proboscis broad and blunt. — Rhachis with a triangular, smooth cutting edge and 3 basal cusps of different size. Laterals with 1 large and 4 small cusps, inner marginals with 5, outer marginals with 6 cusps.

Locus typicus: Mekong branch, at the rapids 2 km south of Khone, South Laos.

Distribution: Only known from the type locality.

Habitat: This species was found at the same locality together with *L. sphaerica* BAVAY. Only few specimens of *sphaerica* were found, *conica* however, was not rare. It is, therefore, a surprise, that LEVAY did not find this species which seems now to be plentiful at the type location of *sphaerica*. It lives on rocks, feeding on algae.

Material: Holotype SMRL 16216/A, paratypes 16216/30.

Relationship: The species belongs to the group of *sphaerica* and *ventricosa*. *L. ventricosa* is much larger and broader, in shape similar to *Neritina*. This species is longer and similar in shape to *Clithon* or even *Natica*. *L. sphaerica* BAVAY, probably only a small form of *ventricosa*, has a relation of A:D = 1:1, this species of 4:3. *L. sphaerica* shows an obtuse swelling below the suture. Thus the last whorl between the suture and the swelling is somewhat concave.

### Stenothyridae.

Both known recent genera are represented in Thailand, *Gangetica* by one, *Stenothyra* by fourteen species. Only three of these species have a wider distribution: *S. glabrata* A. ADAMS, *moussoni* MARTENS and *polita* A. ADAMS. *S. hybocystoides* BAVAY is known from Cambodia and Laos also. The species described and reported from Indo-China have not yet been found on Thai territory.

### ***Stenothyra* BENSON, 1856.**

The Thai species of this genus can be divided into two groups, that which lives in brackish water, or in the tidal area, and another group which is found in the middle and upper reaches of rivers, far away from the area of tidal influence. No species have been found in both areas.

### ***Stenothyra wykoffi* n. sp.**

pl. 9 fig. 37; textfig. 28.

Diagnosis: A species of *Stenothyra* BENSON which differs from all other species of this genus found in Thailand by its slender, ovate or *Pupa*-like shape (similar to that of *Macrogonaxis*), the very high body whorl and short, dome-

shaped spire. It differs from all freshwater species except *S. fasciata* n. by having a weak brown colour patch on the neck.

**Description:** Shell small, slender, pupa-like, with long, nearly cylindrical body whorl and short, dome-like spire. The 4 whorls increase irregularly in size and are separated by a shallow but rather well marked suture. The shell is rather thin, transparent and glossy when fresh. The colour is yellowish-corneous; the neck shows a weak, brownish patch which may be extended as a delicate band over the last half of the body whorl. There is no sign of any spiral sculpture. The body whorl measures  $\frac{4}{5}$  of the size of the shell. It is regularly rounded at the base and shows a narrow umbilical slit above the aperture. The body whorl is compressed ventro-dorsally. — Aperture regularly rounded, with a feeble angle above and slightly retracted at the outer margin, with a small callous parietal tubercle within. Peristome continuous, appressed to the last whorl, somewhat thickened and contracted. — Operculum corneous, transparent, with two almost parallel short ridges on the inner surface and a long, semicircular lower ridge parallel to the margin.

**Size:** A 2.85-3.20 mm; D 1.5-1.7 mm.

**Animal:** When fully extended the sole of the animal is pointed behind and shows a narrowing in the first third. The front part is extended into two pointed pseudopodia. The colour is of a sandy grey, with fine darker greyish pigment dots dusted over back, head and proboscis. The tentacles are long, round and pointed, the eyes are placed at their bases in minute swellings. The typical filament on the end of the back is long and thin. — The middle tooth of the radula has 4 basal cusps on either side and the typical 5 cusps on the cutting edge. There are 44 rows of teeth with 7 teeth in each row. — The verge is curved, simple, with a single duct and a minute, bent stylet at the tip.

**Locus typicus:** Maenam Mun at Rasi Salai, Sri Saket.

**Distribution:** Known from the type locality only.

**Material:** Holotype SMRL 4052/A, paratypes 4052/10, USNM, ZMH and SMF.

**Etiology:** The species is dedicated to Dr. DALE E. WYKOFF.

**Relationship:** The closest relative is without doubt *S. fasciata* n. which differs only by its larger and more conical shell and puckered end part of the last whorl. The brown patch on the neck of *fasciata* is stronger.

### ***Stenothyra fasciata* n. sp.**

pl. 9 fig. 38.

**Diagnosis:** A species of *Stenothyra* BENSON, which differs from *S. hybocystoides* BAVAY by its smaller size, more ovoidal shape, brownish bordered suture near the aperture, brown patch on the neck and contracted aperture.

**Description:** Shell small, conoidal-ovate in a frontview, nearly regularly ovoid when viewed from the back; young specimens thin, transparent, glossy, corneous, old specimens sand-coloured or milky, dull. With exception of the very feeble lines of growth without any sculpture, only the neck shows very fine puckered lines running parallel to the peristome. The 4 convex whorls are separated by a rather deep suture. The penultimate and last whorl are regularly rounded at the right side but inflated at the left side. The body whorl is also "bossed" at the left side, but less so than in *korati* and *jiraponi*. It measures

about  $\frac{3}{4}$  of the height of the shell. The suture of the last half of the body whorl is bordered by a feeble brown band. The neck shows a distinct, but weak brownish patch of varying size and shape. — Aperture oval, slanting and constricted; peristome continuous, appressed and rather thick. Inside at the parietal margin is a fine lip which is thickened to a feeble denticle above. The rimate umbilicus is placed beside the columellar margin of the aperture. — The operculum is typical for the genus. Its shape is oval; it is paucispiral with subcentral nucleus. The inner surface carries two short, high, diverging ridges and a long, semicircular, low ridge parallel to the margin. It is thin, transparent and corneous.

Size: A 2.3-3.2 mm; D 1.8-2.1 mm.

The animal is sand-colored with very fine pigmentation dusted over the back and head. The sole of the foot is tapering to the blunt end. The front ends are produced into short pseudopodes. The tentacles are long and thin. The eyes are placed in moderate swellings at the outer side of the bases of the tentacles. The back carries at the end the typical filiform process. — The central tooth of the radula has 4 small and 1 large cusps at the cutting edge and 4 basal cusps at either side. The shoe-shaped laterals have a large mesocone, one endocone and 10-11 ectocones. The inner marginals have 10-11 large endo- and 10 smaller ectocones, the outer marginals show 10 small pointed cusps. — The verge is simple. It shows no appendages and has a single duct. Below the end of the duct a short, curved stylet is placed.

Locus typicus: Maenam Songkram at Wanonivat, Sakon Nakhon.

Distribution: Known from several tributaries to the Mekong: Maenam Songkram; Maenam Kham at Tat Panom; Maenam Mun at Pibun Mangsahan, Ubon Province; Huai Dom Yai at Det Udom, Ubon Province.

Material: Holotype SMRL 4046/A; paratypes 4046/50, ZMH, SMF and USNM. — 4047/3 - Maenam Mun at Ban Ta Tum, Prov. Sri Saket; 4048/4 - Huai Dom Yai at Det Udom, Ubon Prov., 4050/2 - Huai Tuai at Ta Uthen, Prov. Nakhon Panom; 4053/30 - Maenam Songkram at Sri Songkram, Prov. Nakhon Panom; 4993/15 - Maenam Kham at Tat Panom, Prov. Nakhon Panom.

### ***Stenothyra crooki* n. sp.**

pl. 9 fig. 39; textfig. 29.

Diagnosis: A species of *Stenothyra* BENSON, which differs from *S. roseni* n. sp. by having only the second whorl sculptured with pitted spiral lines and by its less convex whorls and therefore less deep suture. From all other species it differs by its short, depressed shape.

Description: Shell small, subglobose, with large, inflated body whorl and very short spire. The body whorl is compressed ventro-dorsally and distinctly "bossed" on the left side. The base is regularly rounded with a rimate umbilicus above the eccentric aperture. The colour is yellowish or very lightly brownish corneous. The shell is transparent and with exception of the second whorl smooth and somewhat glossy; the second of the 4 whorls is sculptured with 5-7 spiral lines which consist of narrowly placed minute pits. The 4 whorls increase rapidly in size. The suture between the whorls of the spire is rather deep, the suture between the penultimate and last whorl is very shallow. The



body whorl measures about  $\frac{4}{5}$  of the height of the shell. — The aperture is small, somewhat contracted, about  $\frac{2}{5}$  of the size of the body whorl, almost circular, only at the upper insertion of the peristome is a very weak angle. Peristome continuous, appressed to the penultimate whorl, with a minute parietal tooth within. — Operculum round, with two short, straight, almost parallel ridges and a long, lower semicircular ridge parallel to the margin on the inner surface. Corneous, paucispiral, with subcentral nucleus.

Size: A 2.1-2.9 mm; D 1.7-2.2 mm.

Animal sand-coloured with darker greyish pigment spots dusted over back and head area. On the long, pointed tentacles there are few large pigment patches. Verge simple, with a single duct and a minute, horny stylet at the tip. — Rhachis of the radula with 5 cusps on the cutting edge and 4 basal cusps on either side.

Locus typicus: Huai Nam Un, a tributary of the Maenam Songkram, near Sri Songkram, Province of Nakon Panom.

Distribution: Known from the Maenam Songkram and the Huai Nam Un near Sri Songkram only.

Material: Holotype SMRL 4991/A; paratypes 4991/10, USNM, ZMH and SMF. — 4996/5 - Maenam Songkram at Sri Songkram, Nakon Panom; 4997/4 - Maenam Songkram at Wanonivat, Sakon Nakon.

Etiology: The species is dedicated to Dr. JAMES CROOK, former parasitologist at the SMRL in Bangkok.

### ***Stenothyra roseni* n. sp.**

pl. 9 fig. 40.

Diagnosis: A species of *Stenothyra* BENSON which differs from *S. crooki*, by its brownish colour patch on the neck similar to that of *S. fasciata* or *wyckoffi*, smaller size and by its sculpture of spiral lines, which cover all whorls.

Description: Shell very small, depressed, with short spire and large, inflated body-whorl. Olive-brown, transparent and glossy (*crooki* is yellowish corneous, hardly transparent and dull when adult), covered with spiral grooves which are solid lines and not composed of spiral rows of pits as with most other species of *Stenothyra*. The 4 whorls increase rapidly in size; they are somewhat flattened above and separated by an impressed suture. The last whorl is larger than  $\frac{3}{4}$  of the size of the shell; it is distinctly "bossed" at the left side and compressed ventro-dorsally. The surface of the body whorl is very feebly malleated. There is a feeble brownish patch on the neck near the peristome. The umbilicus is rimate. — The aperture is somewhat eccentric, rounded and contracted. It measures hardly more than  $\frac{1}{3}$  of the height of the body whorl. The peristome is continuous, thickened and appressed to the penultimate whorl. — Operculum with the typical two short and high semiparallel and the long, low, semicircular ridge on the inner surface.

Size: A 2.3-2.6 mm; D 1.8-2.0 mm.

Animal sand-coloured, dusted with minute darker greyish pigment dots, particularly on the front part of the back and head area. Proboscis large, with two strong and one weak colour ring. The long, pointed tentacles are heavily pigmented, the patches, however, are irregular and do not form rings or segments. The eyes are placed in minute swellings in the bases of the tentacles.

The anatomy of the male reproductive organs shows a small, finger-shaped verge without glands or appendages and with a single duct. At the tip of the verge, there is a minute horny stylet. — The radula is similar to that of *S. crooki* n. with a rhachis which has 5 basal cusps on either side.

Locus typicus: Maenam Songkram N of Wanoniwat, Province of Nakhon Phanom.

Distribution: Maenam Songkram and Maenam Kham, tributaries to the Mekong.

Material: Holotype SMRL 4994/A, paratypes 4994/5 and USNM. — SMRL 4054/1 - Kham river at Tat Panom.

Etiology: I dedicate this species to Dr. LEON ROSEN, Pacific Research Section in Honolulu, Hawaii.

***Stenothyra jiraponi* n. sp.**

pl. 9 fig. 41.

Diagnosis: A species of *Stenothyra* BENSON which differs from all other Thai freshwater *Stenothyra* by its large size. From *S. koratensis* it differs furthermore by its lack of spiral sculpture.

Description: Shell depressed, subglobose-conoidal, with short, often truncate spire. Of yellowish-corneous or reddish-brown colour; transparent, glossy, without any spiral lines or pits, but with a very delicate spiral sculpture which can be seen under very strong magnification only. The  $4\frac{1}{2}$  convex whorls increase rapidly in size. The truncate apex is covered and closed by a secondary layer of shell substance. The body whorl is large and inflated and distinctly "bossed" at the left side. It is depressed dorso-ventrally and measures about  $\frac{3}{5}$  of the height of a complete and  $\frac{4}{5}$  of the height of a truncate shell. The umbilicus is rimate. — The constricted aperture is almost circular or obliquely oval; it has a minute callus at the parietal wall. Its size is about  $\frac{2}{5}$  of the height of the body whorl. The peristome is continuous and appressed to the penultimate whorl. — The operculum is ovate or subcircular. It can not be retracted into the shell. On the inner surface there are the two typical subparallel and the lower semicircular ridges.

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.

The animal is sand-coloured with blackish-grey pigment dots dusted over head and back. The eyes are placed in moderate swellings in the bases of the long and filiform tentacles. The proboscis is rather large. At the end of the back there is the typical filiform process.

The male reproductive organs show a curved, somewhat flattened verge without appendages and with a simple duct. The tip ends in a slightly curved, horny stylet. — The radula has a rhachis of the "*koratensis*-type", i. e. it has one large inner and 3 smaller outer basal cusps on either side.

Locus typicus: Maenam Songkram, north of Wanoniwat, Province of Sakon Nakhon.

Distribution: Known from the Songkram river and Kham river in East Thailand only.

Material: Holotype SMRL 3417/A, paratype 3417/30. — SMRL 3419/20 - Maenam Songkram at Sri Songkram; 5002/10 - Maenam Songkram at Ta Uthen, both localities in the Province of Nakhon Phanom.

***Stenothyra koratensis* n. sp.**

pl. 9 fig. 42.

**Diagnosis:** A species of *Stenothyra* BENSON, which differs from its compatriot and only *Stenothyra* reported from the Mekong, *hybocystoides* BAVAY, by its more conic spire, smaller average size, deeper suture, the spiral sculpture on the first two whorls and the contracted aperture.

**Description:** Shell small, ovate-conoidal, with moderately short, conic spire and rather large, inflated body-whorl. Brownish or yellowish horn-coloured, seldom olive-coloured or reddish-brown. Thin, transparent, shining, without brownish patches. The first 3 of the 4-4½ whorls increase regularly in size, the last is suddenly inflated. The suture is rather deep. The first two whorls are ornate with few lines of pitted spiral rows, sometimes also the third whorl, very rarely the sculpture extends over the whole shell. The body whorl is compressed dorso-ventrally and shows a more or less distinct "boss" at the left side-line. The right sideline is regularly curved. The body whorl measures about ⅔ of the height of the shell. From the boss at the left side, the side-line is slanting in a nearly straight line to the base of the shell. The rimate umbilicus is placed beside the columellar margin of the aperture. — Aperture subcircular, oblique, slanting, constricted. Peristome continuous, appressed at the penultimate whorl, at the parietal margin somewhat thickened within and beside the weak angle above with a delicate denticle. Size about ⅔ of the height of the body whorl. — The operculum has the shape of the aperture. It is paucispiral with subcentral nucleus. The two short diverging ridges on the inner surface are rather high, the long, semicircular ridge parallel to the margin is low.

Size: A 2.3-2.9 mm; D 1.6-2.0 mm.

Animal sand-coloured, with very fine darker pigment spots dusted over back and head-foot mass, particularly over the proboscis. The tentacles are long and slender and show numerous pigment spots. The front of the foot is indented in the middle and at the ends are produced into motile, short pseudopodes. The end of the foot is bluntly rounded; it carries a long, filiform process on the back, typical for the genus. The eyes are placed in moderate swellings at the outer side of the bases of the tentacles.

The radula is typical for the genus. The cutting edge of the central tooth has 5 cusps, a large middle and two smaller lateral cusps on either side of it. There are 3-4 basal cusps on each side of the plate, the innermost cusps being hardly larger than the others. The laterals show 9(-10) large endo- and 10 smaller ectocones. The marginals have 12 cusps on the cutting edges. The laterals, therefore, differ from those of other described radulae of *Stenothyra* by showing no large middle cusps.

The verge is simple; it shows no appendages and has only a single duct. The pointed end carries a minute, curved stylet. — Detailed anatomy will be given in a later paper on the *Stenothyrae* of Asia.

**Type locality:** Huai Takrong at Nakon Ratchasima, a tributary to the Mun river.

**Distribution:** Known from the Mekong between Nakon Panom and Bandan in Thailand but it will certainly be found in Cambodia and Laos also. It has been found in almost all tributaries to the Mekong; Maenam Loei, Maenam Songkram, Huai Mae Un, Maenam Kham, Maenam Mun, Lam Chi, Lam Choen, Maenam Pong, Huai

Tuai, Lam Dom Yai, Huai Mak and Gaeng Yang. Furthermore it was found in several rivers of the drainage system of the Chao Praya and Salween rivers: Maenam Kwae Noi at Nakon Thai; Maenam Kaek near Pitsanulok; Maenam Moei at Mae Sot and Maenam Kwae Yai, Kanchanabury. — Of all fresh-water species of *Stenothyra*, *S. koratensis* seems to have the widest distribution. When this paper was compiled about 20.000 specimens were collected and 33 localities known.

**Material:** Holotype SMRL 416/A; paratypes from the type locality 50 specimens each in USNM, ZMH, SMF and in the collection of the author. Furthermore there are about 5000 paratypes from 32 other localities.

**Etiology:** The name was derived from Korat, the old name of the provincial town of Nakon Ratchasima.

***Stenothyra spiralis* n. sp.**

pl. 9 fig. 43.

**Diagnosis:** A species of *Stenothyra* BENSON which differs from all other known species of this genus by its two strong spiral ridges on the postnuclear whorls.

**Description:** Shell small, slenderly conic, with  $4\frac{1}{2}$  somewhat convex whorls, shining transparent, thin, with two obtuse but strong spiral ridges on the postnuclear whorls, one above and one below the periphery. The second one is therefore only visible on the body whorl. Body whorl neither „bossed“ nor greatly inflated, but somewhat compressed ventro-dorsally. Umbilicus rimate. The body whorl measures hardly more than  $\frac{1}{2}$  the height of the shell. — Aperture small, oblique, nearly circular, somewhat constricted, about  $\frac{2}{5}$  of the height of the body whorl. Peristome continuous, feebly angled above, not thickened within. — Operculum of the shape of the aperture, thin, transparent, corneous, paucispiral with subcentral nucleus. In the middle of the inner surface with two subparallel short, high ridges and another ridge, lower, longer and semicircular parallel to the margin.

**Size:** A 2.5-2.7 mm; D 1.3 mm; d 1.1 mm.

**Locus typicus:** Mun river at Rasi Salai, Province of Sri Saket, East Thailand.

**Distribution:** Mun river and Songkram river, both tributaries to the Mekong.

**Material:** Holotype SMRL 3421/A; paratypes 3421/60. — SMRL 4998/4-Songkram river at Wanonivat, Sakon Nakon Province.

***Stenothyra schuetti* n. sp.**

pl. 9 fig. 44.

**Diagnosis:** A species of *Stenothyra* BENSON which differs from *S. roseni* by its slender shape and its sculpture which consists of spiral rows of small pits.

**Description:** Shell very small, turreted-conoidal, corneous, somewhat glossy, transparent; the 4 convex whorls increase regularly in size and are separated by a rather deep suture. The body whorl is not greatly inflated; it measures about  $\frac{3}{5}$  of the height of the shell and is only moderately bossed on the left side. It is regularly rounded on the right side and somewhat compressed ventro-dorsally. The whole shell is covered with spiral lines consisting of small pits. Beside the columellar margin of the aperture is a narrow but distinct umbilicus. — Aperture nearly circular, small, constricted, slanting, somewhat oblique. Peristome continuous, not thickened. — Operculum typical for the genus,

with a long low, semicircular ridge parallel to the margin and two high, short, diverging ridges in the middle of the inner surface. It is paucispiral with subcentral nucleus, transparent and corneous. — Soft parts and radula unknown.

Size: A 1.8-2.3 mm; D 1.2-1.3 mm.

Type locality: Maenam Songkram at Wanonivat, Sakon Nakhon.

Distribution: Known from the Songkram river only.

Material: Holotype SMRL 3416/A, paratypes 3416/6. — SMRL 4999/4 - Maenam Songkram at Sri Songkram, Nakhon Phanom Province.

Etiology: This species is dedicated to Dr. H. SCHÜTT.

This species is easily identified. Only one species of *Stenothyra* from freshwater shows a sculpture on the whole shell, apart from the rare exceptions of *koratensis* and that is *roseni*. That species, however, is very short and broad, *schuetti* slender. The sculpture of *roseni* consists of continuous grooves, that of this species of spiral rows of small pits. Completely sculptured specimens of *koratensis* are larger, the body whorl is more inflated and more distinctly bossed.

### ***Stenothyra krungtepensis* n. sp.**

pl. 9 fig. 45; textfig. 30.

Diagnosis: A species of *Stenothyra* BENSON which differs from *S. moussoni* MARTENS, with which it often lives together, by its smaller size, more conoidal shape, deeper suture and lack of the brown patch on the neck.

Description: Shell small, ovate-conic, thin, transparent, smooth, glossy, greyish or yellowish horn-coloured, without any traces of spiral lines. The 4 convex whorls increase rather regularly in size; they are separated by a deep suture; the apex is pointed and the body whorl is not very much inflated. It is regularly rounded on both sides and does not show a „boss“ on the left side-line. It measures about  $\frac{3}{5}$  of the height of the shell. The rimate umbilicus is placed beside the columellar margin of the aperture. — The aperture is nearly circular; it is constricted and somewhat oblique. The peristome is continuous and appressed. It shows a feeble thickening within at the parietal wall. This thickening is above produced to a delicate denticle. — The operculum has the shape of the aperture. It is thin, transparent, corneous and paucispiral with a subcentral nucleus. There is the typical semicircular ridge parallel to the margin and the two diverging ridges on the inner surface.

Size: A 2.3-3.2 mm; D 1.2-1.8 mm.

Animal greyish with few fine pigment dots distributed over the back and head. The foot is tapering to the blunt end which carries the typical filiform process. The front ends (cephalic processes) are produced into pointed, triangular pseudopodes. The round tentacles are long and thin and pointed at the ends. The eyes are placed at the outer base of the tentacles in minute sockets. The proboscis is trunk-shaped and strongly pigmented, but does not show any ring-shaped zones of pigmentation. — Radula: Central tooth with 5 cusps on the cutting edge and 3 basal cusps on either side of the plate, the innermost on each side are larger than the outer two cusps. The shoe-shaped lateral with a large mesocone, 3 small, pointed endo- and 6 rounded ectocones. Inner marginal with 11 endo- and 8 ectocones, the outer marginal with 12 equal cusps on the cutting edge.

The verge is placed in the neck near to the middle line. It is coiled, simple, without appendages, has a single duct and a short, bent stylet at the end.

*Locus typicus*: Klong Premprachakon along Rama V Road in Bangkok.

*Distribution*: In klongs of the tidal area in almost fresh-water in and around Bangkok and Thonburi and in the province of Nakon Patom.

*Habitat*: It lives in slightly brackish water together with *moussoni* and *glabrata* but also in almost completely fresh-water together with a typical fresh-water fauna. The animals move considerably fast. They feed on water plants, algae and decaying organic substance and were never seen burying in the mud as other species of this genus may do. They are easily kept in completely freshwater in tanks. Specimens from the type locality have been found shedding two species of cercariae, one xiphidio-cercaria and one amphistome cercaria.

*Material*: Holotype SMRL 417/A and 50 paratypes each in ZMH, USNM and SMF. — SMRL 417/100 - Klong Premprachakon in Bangkok, loc. typ.; 423/50 - Klong Bang Sue Noi, Bangkok-Dusit; 424/50 - Klong Sam Sen, Bangkok-Dusit; 425/50 - Klong Premprachakon at Bangkok-Bang Sue; 426/60 - Klong Bang Sue, Bangkok-Bang Sue; 427/40 - Klong around troop-area, Bangkok-Dusit; 428/60 - Klong Bang Pra, Thonburi; 429/60 - Klong Toy, Thonburi; 430/100 - Klong Bang O, Thonburi; 431/80 - Klong Bang Plu, Thonburi; 432/70 - Klong Bang Rag, Thonburi; 433/100 - Klong Bang Yikkan, Thonburi; 434/60 - Klong Ta Win, Thonburi; 435/80 - Klong Bang Chak, Thonburi; 4038 - Klong Dao Id, Thonburi; 3413 - Ban Khun Gaeo, Nakon Chai Sri; 4039/50 - Wat Gaeo, Ban Kun Sri, Thonburi; 4090/20 - Klong Bang Prakon, Thonburi; 4971/20 - Klong around Turf-Club in Bangkok.

*Etiology*: Called after Krungtep, the Thai name for Bangkok.

### ***Stenothyra schlickumi* n. sp.**

*Diagnosis*: A species of *Stenothyra* BENSON which differs from *S. mandahlbarthi* n. by smaller size, less pointed spire and larger and less densely set pits in the spiral rows.

*Description*: Shell small, rimate, ovoidal-conic, corneous, transparent, somewhat glossy, the 4 whorls increase regularly in size; the 1. is flattened above thus forming an obtuse apex, the 2. and 3. whorls are convex, separated by a deep suture, the body whorl is large but not inflated nor compressed ventro-dorsally separated from the penultimate whorl by a much less deep suture. The outer lines of the body whorl are regularly rounded and not „bossed“ as it is typical for many species of this genus. The first two whorls are rather smooth, the penultimate and last whorl are sculptured with spiral lines of pitted rows, the pits are wide-set on the penultimate whorl and closer-set and smaller on the body whorl, particularly on the lower half of the whorl. There are about ten spiral rows of pits on the penultimate whorl. On the neck there is a brown patch similar to that of *S. moussoni* MARTENS. — Aperture small, round, constricted, about  $\frac{1}{3}$  of the height of the body whorl. Peristome continuous, attached to the penultimate whorl, neither thickened nor lipped. — Operculum round, corneous, moderately thick with a semicircular ridge parallel to the margin and two short, higher and straight ridges in the middle of the inner surface, somewhat diverging from each other. — Soft parts unknown.

*Size*: A 1.8 mm; D 1.1 mm.

*Locus typicus*: 2 km south of Palian, Trang Province.

*Distribution* Known from the type locality only.

**Habitat:** Drainage trench of the mangrove swamp along the road to Yong Star Custom House. The animals live in the mud on the ground of that trench and feed on decomposing organic matter.

**Material:** Holotype SMRL 5018/A, paratypes 5018/40.

**Etiology:** This species is dedicated to Dr. W. R. SCHLICKUM, Cologne.

***Stenothyra labiata* n. sp.**

**Diagnosis:** A species of *Stenothyra* BENSON which differs from all other species of this genus from Thailand by its thick external lip.

**Description:** Shell of medium size for the genus, ovate-conoidal, of corneous ground colour but covered with a brown, rather dull periderm; the  $5\frac{1}{2}$  whorls are very convex and separated by a deep suture which is a little less deep between the last two whorls. The apex is smooth, the other whorls are sculptured with densely placed spiral rows of small pits. On the upper whorls and around the periomphal rima these rows may change into continuous spiral grooves. On the postnuclear whorls there is generally a sharp spiral ridge which, however, may often be obsolete. Body whorl large but not greatly inflated, somewhat compressed ventro-dorsally; it measures about  $\frac{5}{8}$  of the height of the shell. — Aperture rather large, about  $\frac{2}{5}$  of the height of the body whorl, only somewhat constricted, obliquely ovate. Peristome continuous, appressed to the penultimate whorl, somewhat expanded and with a thick external lip or varix. — Operculum ovate, corneous, transparent, with the typical inner ridges, two high, straight, diverging, one semicircular, parallel to the margin.

**Size:** A 3.4-4.2 mm; D 1.9-2.2 mm.

Animal sand-coloured, with few dark pigment spots. The eyes are placed at the bases of the long, filiform tentacles. The foot is pointed posteriorly and produced into two pointed pseudopodes anteriorly. The back carries the typical filiform process at the end. The trunk-shaped proboscis shows two dark rings. — The rhachis has 5 cusps at the cutting edge and 4 basal cusps on either side. — The coiled verge is placed at the right side of the neck. It is simple, has only one duct and carries no appendages. Its pointed tip shows a corneous stylet.

**Locus typicus:** Creek 40 km north of Ranong, S Thailand.

**Distribution:** Known from the type locality only.

**Material:** Holotype SMRL 4990/A, paratypes 4990/10.

***Stenothyra mandahlbarthi* n. sp.**

pl. 9 fig. 47.

**Diagnosis:** A species of *Stenothyra* BENSON which differs from its compatriots *S. krungtepensis* n. and *moussoni* MARTENS by its pitted spiral sculpture and from *S. polita* A. ADAMS by its smaller size, glossy surface and vitreous shell.

**Description:** Shell ovate-conoidal, thin, diaphanous, vitreous, glossy, sculptured with 9-16 spiral rows of small pits. These pitted spiral lines are generally missing below the suture and on the base of the body whorl. The  $5\frac{1}{2}$  whorls are convex and separated by a deep suture; the suture between body whorl and penultimate whorl is as deep as the suture between the upper whorls.

They increase regularly in size; the body whorl is neither greatly inflated nor "bossed" at the left side; it is only moderately compressed ventro-dorsally. — Aperture oblique, oval, small, constricted, not exserting; peristome continuous, with a very delicate callus within and a minute denticle above; appressed to the penultimate whorl. — Operculum ovate, thin, glossy, corneous, paucispiral with subcentral nucleus; with two high, straight, converging ridges and a low semi-circular ridge parallel to the margin.

Size: A 2.8-3.3 mm; D 1.4-1.8 mm.

Animal sand-coloured, dusted with fine greyish-black pigment spots. Foot in front extended into two triangular pseudopodes, pointed posteriorly and with the typical filiform process on the posterior part of the back. — The radula is of the "*krungtepens*-type" with 5 cusps at the cutting edge and 3 basal cusps on either side of the rhachis. — Male reproductive organs with a simple verge with one duct and without appendages. The pointed tip of the verge carries a small corneous stylet.

Type locality: Bang Khon Kao near Nakon Chai Sri, Nakon Pathom Province, Central Thailand.

Distribution: Known from the Provinces of Thonburi, Nakon Pathom and Suratthani.

Material: Holotype SMRL 4061/A; paratypes 4061/50, USNM, ZMH, SMF and TASC. — SMRL 4062/15, USNM/10 - Paknam Bandon, Suratthani Province; 0439/50, USNM, SMF and TASC - Ban Khun Sri, Thonburi.

Etiology: The species is dedicated to Dr. G. MANDAHL-BARTH of the Bilharziasis Laboratory in Copenhagen.

Variability: A certain percentage of specimens shows a weak sculpture; this may be missing completely in specimens from the Thonburi locality. These specimens differ from those of *S. krungtepens* by its averagely larger shell, more pointed apex and more conic shape.

### ***Stenothyra annandalei* n. sp.**

pl. 9 fig. 46.

Diagnosis: A species of *Stenothyra* BENSON which differs from *S. moussoni* MARTENS, with which it is found together, by its much smaller size, more slender shape, lack of brownish patch on the neck and distinctly opened umbilicus.

Description: Shell small, conic, corneous, transparent, glossy; without any traces of spiral lines or grooves. The 4 convex whorls are separated by a rather deep suture. The whorls increase regularly in size. The body-whorl is well rounded on both sides but not bossed. It is only somewhat compressed ventro-dorsally. It measures  $\frac{3}{5}$  of the height of the shell. The base shows a shallow but distinctly opened umbilicus which is surrounded by a very feeble carina. — Aperture obliquely oval, with a feeble angle at the upper margin. Peristome continuous, appressed at the penultimate whorl, inside neither thickened nor with a denticle. — Operculum ovate, thin, corneous, transparent, paucispiral with subcentral nucleus. The inner surface shows the two short, subparallel high ridges in the middle and the semicircular, low ridge parallel to the margin. — Soft parts still unknown.



Size: A 1.8-2.0 mm; D 1.1-1.2 mm.

Locus typicus: Creek with brackish water along the highway near Ban Don Makok, Glaeng District, about 51.5 km east of Rayong.

Distribution: Only known locality.

Material: Holotype SMRL 3424/A, paratypes 3424/3.

Etiology: This species is dedicated to the memory of Dr. NELSON ANNANDALE from the Zoological Survey of India.

This very rare species — in three days only four specimens were collected — is closely related to *S. krungtepensis*, but differs from that species by its still smaller size, more slender shape, more conic spire and the open umbilicus.

### ***Gangetica* ANCEY, 1890.**

#### ***Gangetica tigertti* n. sp.**

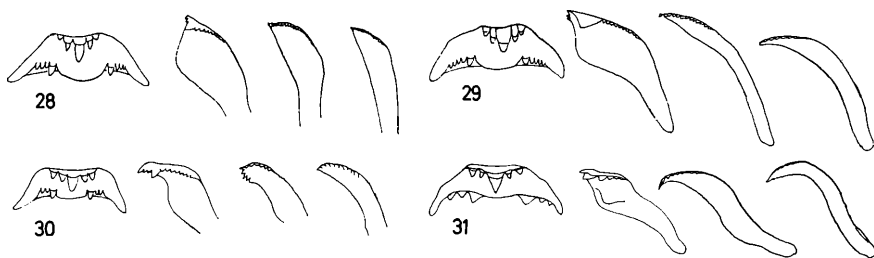
pl. 10 fig. 48; textfig. 31.

Diagnosis: A species of *Gangetica* ANCEY, which differs from its geographical neighbour, *burmanica* PRASHAD, by its regularly ovate aperture and by its lacking of the shallow incision at the base of the peristome.

Description: Shell small, ovate-conic, smooth, greyish corneous, translucent; the  $4\frac{1}{2}$  convex whorls increase regularly in diameter; body whorl large, more than half the size of the shell, somewhat inflated, with a rimate umbilicus. — Aperture ovate, about half the size of the body whorl, somewhat angulate above and regularly rounded below. Peristome thin, connected, appressed to the penultimate whorl, without any trace of incision at the base, but slightly sinuous at the outer margin. — Operculum with two diverging ridges on the inner surface and a very low semicircular ridge parallel to the margin.

Size: A 2.4-2.7 mm; D 1.7-1.8 mm.

Animal: Back and head grey, the long and slender foot lighter greyish, pointed behind, without filiform process. In front the foot is transformed into two pointed pseudopodia. There are only few minute dark colour spots and some patches on the mantle lobe. The proboscis is long and truncate, the tentacles are long and filiform; the eyes are placed in small stalks at the outside of the bases of the tentacles.



Textfig. 28-31. Radula, half-row. — 28) *Stenothyra wykoffi* n. sp. (SMRL 4052); 29) *St. crooki* n. sp. (4992); 30) *St. krungtepensis* n. sp. (417); 31) *Gangetica tigertti* n. sp. (4031).

**Anatomy:** Rhachis of the radula with a large middle tooth and two small cusps on either side of the cutting edge and with four basal cusps on either side. The penis is small, coiled or bent with a single duct and without appendages.

**Locus typicus:** Trench along the road at Ban Don Makok, Glaeng District, Rayong Province.

**Distribution:** Known from the type locality only.

**Habitat:** The trench belongs to the drainage of Klong Phlo; it has freshwater during the rainy season and slightly brackish water during the rest of the year.

**Material:** Holotype SMRL 4031/A; paratypes 4031/50, USNM, ZMH and SMF.

**Etiology:** This species is dedicated to Col. WILLIAM D. TIGERTT, M. C., former Director of the Walter Reed Army Institute of Research in grateful recognition of his support.

**Relationship:** This species differs from *G. burmanica* by the characteristics pointed out in the diagnosis and from *G. miliacea* (NEVILL) by its thinner, not angulate peristome and lack of gibbosity.

### Assimineidae.

Only a few species of this subfamily have been reported from Thailand, *Assiminea brevicula* PFEIFFER, *Paludinella carinata* LEA and *P. fasciata* MORELET. Some authors have considered the last two species to be synonymous, but their specific validity is beyond any doubt. Eleven more species have been found in Thailand, among which *A. woodmasoniana* NEVILL, *javana* THIELE, *borneensis* ISSEL, *nitida* PEASE, *hidalgoi* GASSIES, *pyramis* PFEIFFER and *philippinica* BOETTGER are widely distributed in East and Southeast Asia. Some species, however, seem to be new as they could not be identified with any known Asian species, but the present author was not able to study type material of all *Assiminea* species from Asia.

***Assiminea* FLEMING, 1828.**

***Assiminea abbotti* n. sp.**

pl. 10 fig. 49; textfig. 32.

**Diagnosis:** A species of *Assiminea* FLEMING which differs from its closest relative, *A. microsculpta* NEVILL, by its darker colour, its slenderer shape and by having strong spiral threads around the umbilical pit.

**Description:** Shell ovate-conoidal, brown, thin, transparent, hardly glossy; the  $5\frac{1}{2}$ -6 whorls increase regularly in size; they are moderately convex and separated by a rather shallow suture. The first whorl is smooth, the second whorl is sculptured with fine spiral lines; on the remaining whorls these spiral lines are produced to strong spiral threads which are crossed by still stronger riblets. The riblets are weaker on the body whorl, particularly so on the lower half, but the spiral lines get stronger again around the almost closed umbilicus. — Aperture ovate, angulate above; peristome sharp, not expanded, disconnected, columellar margin somewhat thickened and nearly covering the umbilicus. — Operculum thin, corneous, ovate, paucispiral with subcentral nucleus, transparent.

**Size:** A 1.9-2.4 mm; D 1.2-1.4 mm.

Animal grey, with blackish pigmentation dots dusted over back, head and proboscis. There are no tentacles and the moderate swellings in which the eyes are placed cannot be called stalks. The penis is simple without appendages and with one duct only. — The rhachis of the radula is squarish in shape with a low process in the middle of the lower margin. It has 5 cusps on the cutting edge (*microsculpta* has 7) and 4 diagonally placed basal cusps on either side. The formula of the laterals is 2(-3)-1-3, the marginals have 5 cusps on the cutting edges.

Locus typicus: Mud-flat near Yong Star Custom House at Palian, Trang Province.

Distribution: Known from the type locality only.

Material: Holotype SMRL 4917/A, paratypes 4917/5.

This species is very similar to *A. microsculpta* NEVILL and would have been considered to be a race of that species were it not found together with it. *A. abbotti* is constantly darker, has less convex whorls and therefore a shallower suture. The most important difference is the sculpture around the umbilical pit. There are no spiral threads around the umbilicus in *microsculpta*. The difference in the dentition of the rhachis lies within the limits of variability.

### ***Assiminea microscopica* n. sp.**

pl. 10 fig. 50; textfig. 33.

Diagnosis: A species of *Assiminea* FLEMING which differs from all known species of this genus by its minute size.

Description: Shell very small, globose to subglobose conoidal, whitish, but covered with a brown, dull periderm; moderately thick, not transparent. The 4 rapidly increasing whorls are moderately convex and separated by a simple, rather shallow suture. The apex is smooth, the other whorls show strong, wavy lines of growth. There are neither threads nor grooves seen. The apical whorls are mostly eroded and the top of the shell is covered by a secondary layer of shell substance. The body whorl is somewhat inflated and about  $\frac{2}{3}$  of the size of the shell when truncate and about  $\frac{1}{2}$  of the size of a complete shell. The umbilicus is partly covered by the columellar callus. — The aperture is rather large; it is angulate above. The peristome is slightly thickened, not continuous but connected by a thin, glossy parietal callus. The columellar callus is brownish and glossy. — The operculum is ovate, thin, paucispiral, transparent with eccentric nucleus.

Size: A 1.2-1.9 mm; D 1.0-1.7 mm.

Animal grey with dark pigmentation dusted over head, back and proboscis. The eyes are placed in very short rounded stalks. — The rhachis is squarish with a long, handle-shaped process at the lower margin. There are 3 cusps on the cutting edge and 1 basal cusp on either side of the plate. The lateral has 6, the marginals have 9 cusps.

Locus typicus: Klong Yai Pin at Bang Gra Dan; Laem Ngob District; Trad Province.

Distribution: Known from the type locality only. The animal lives under decaying vegetation at the banks of this slightly brackish river.

Material: Holotype SMRL 4109/A, paratypes 4109/6.

***Paludinella*** O. BOETTGER, 1887.

***Paludinella daengsvangi*** n. sp.

pl. 10 fig. 51; textfig. 34.

**Diagnosis:** A species of *Paludinella* BOETTGER which differs from all compatriots of this genus by its ovoidal shape, flat whorls and shallow suture.

**Description:** Shell small, ovoidal-conic, whitish but with brown or olive-coloured periderm, transparent, glossy, smooth, except the very delicate lines of growth. The 6 whorls are almost flat and are separated by a very shallow, marginate suture. The body whorl is tapering to the base. It measures about  $\frac{3}{5}$  of the size of the shell. The umbilicus is completely closed. The shape of the shell is very similar to certain species of *Ena* or *Zebrina*. — The aperture is piriform and angulate above. The peristome is sharp, not expanded, thickened within, not continuous but connected by a very thin parietal callus. The thickened columella covers the umbilicus. — Operculum ovate thin, paucispiral, corneous, transparent, with eccentric nucleus.

Size: A 3.0-3.8 mm; D 1.7-2.4 mm.

The grey animal is dusted with blackish pigment dots. The eye-stalks are very short, the proboscis is flaplike, cleft in the middle. The verge is simple, without appendages and with a single duct. — Rhachis rounded triangular, without basalcusps and with 9 cusps on the cutting edge the middle one being the largest. The lateral and inner marginals have 6-7, the outer marginals 27-29 cusps.

**Locus typicus:** Klong Premprachakon in Bangkok, Thailand.

**Distribution:** Bangkok, Thonburi, Chachoengsao Prov., Thailand.

**Material:** Holotype SMRL 440/A, paratypes 440/20 and USNM. — SMRL 441/10 - Sam Sen, Bangkok; 442/5 - Klong Bang Sue Noi, Bangkok; 4107/10 - Bank of Maenam Bang Pakon, Chachoengsao Province.

**Etiology:** The species is dedicated to Prof. SAVASTI DAENGSVANG in Bangkok.

***Paludinella thonburi*** n. sp.

pl. 10 fig. 52.

**Diagnosis:** A species of *Paludinella* BOETTGER which differs from its compatriot *P. daengsvangi* n. by its conic shape, open umbilicus and delicate axial sculpture.

**Description:** Shell rather small, conic, short, light chestnut-brown, transparent, without spiral threads or grooves, but with very delicate, oblique riblets. The umbilicus is narrow but open. The 5 whorls increase regularly and rather rapidly in size. The first two whorls are smooth, the other whorls are sculptured by delicate, obtuse riblets which are crossed by still finer lines of the spiral sculpture. These very delicate spiral lines are irregular and may sometimes be missing completely. The body whorl has about  $\frac{3}{5}$  of the size of the shell. The whorls are rather convex and separated by a deep suture. — The aperture is fig-shaped, not expanded; the peristome is sharp, somewhat thickened at the base and the columella, not connected by a parietal callus. — Operculum ovate, with excentric nucleus and few whorls, corneous, transparent, without calcareous layer.

Size: A 2.0-2.4 mm; D 1.7-1.9 mm.

The animal is grey with fine black pigmentation dusted over back and head area. The eye-stalks are short and tipped, the eyes are placed inside the broader base but there is normally a distinct pigment spot on the end of the tips. The penis is strong, curved, simple with one duct only and no appendages. — The radula shows a rhomboidal rhachis with broader base. The cutting edge has 7 cusps; there are no basal cusps. The lateral has also 7, the inner marginal 8 and the outer marginal about 25 cusps.

Type locality: Klong Mun (pron. moon) in Thonburi, Thailand.

Distribution: Known from several localities in Thonburi and Satun Province in Thailand.

Material: Holotype SMRL 4948/A, paratypes 4948/20, USNM and SMF. — SMRL 4947/3 - Klong Bang Phlu, Thonburi; 4949/3 - Nipa-palm swamp 2 km N of Satun.

### Tornidae.

A brackish water prosobranch which was found at several localities in Thailand in abundance, has to be placed in this family but deserves its own genus. Representatives of this family are easily identified by their pectinobranch gill and their pallial processes, similar to those of Valvatidae. The animals, however, are not hermaphrodites as are those of *Valvata*. Furthermore the rhachis of Tornidae differs considerably from that of Valvatidae. It can also not be confounded with *Clenchiella* which is a genuine Hydrobiidae.

### ***Chamlongia*** n. gen.

Diagnosis: A genus of Tornidae which differs from the only other known non-marine genus of this family, *Phaneta* H. ADAMS, by its smaller size, lack of spiral lines and rounded whorls.

Description: See under that of the monotype.

### ***Chamlongia harinasutai*** n. sp.

pl. 10 fig. 53; textfig. 35.

Diagnosis: Like that of the genus.

Description: Shell very small, depressed, subglobose, thin, transparent, corneous, glossy, with very low and hardly elevated spire and large, inflated body whorl. The  $3\frac{1}{2}$  whorls increase rapidly in size; they are distinctly convex and separated by a deep, simple suture. The umbilicus is wide and surrounded by a very weak carina which is normally obsolete in adult specimens. With exception of the delicate lines of growth there is no sculpture to be seen. — The aperture is nearly circular and comparatively large. The peristome is thin, interrupted, not expanded and shows no trace of a lip. — The operculum is very thin, oval, corneous, transparent, with subcentral nucleus and  $3\frac{1}{2}$  whorls.

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. Proboscis truncate, heavily pigmented. Tentacles long and filiform, blunt at

the ends and covered with ciliate epithelium. Mantle edge with two filiform processes at the right and one at the left side. The gill can not be extended. Tentacles and processes have pigment segments of the same size and pattern. —

Radula with rhomboidal rhachis with pointed wings and a blunt process in the middle of the lower margin. Cutting edge straight with 7-8 cusps on either side of the middle cusp. There is one large basal cusp on each wing. Formula of the cutting edge of the lateral is 4-1-5, marginals with 25 and more cusps.

The animals are dioecious, with males and females of about the same percentage. The females are oviparous. The males do not show a verge or an accessory copulatory organ. Copulation and egg-depositing has not yet been observed but the females seem to lay their eggs in round, single capsules, often attached to the shells of other specimens.

Type locality: Brackish water trench along the highway between Rayong and Chantaburi, 2 km east of Glaeng, near the bridge of the Klong Don Makok. The water is slightly brackish, in the rainy season often completely fresh. The species can be kept in a tank in fresh water. The trench belongs to the drainage system of the Maenam Prasae into which the Klong Don Makok opens.

Distribution: In creeks and trenches of the tidal area of the Maenam Chantaburi between Chantaburi and Tachalaeb; Maenam Prasae in the Glaeng District and Maenam Tapi near Bandon (Province of Suratthani). It will probably be found at more localities and as it is known from South Thailand may also be found in Malaya.

Material: Holotype SMRL 4111/A; paratypes 4111/100, USNM, ZMH and SMF. — SMRL 4112/40 - 5 km S of Chantaburi; 4113/20 - 7 km S of Chantaburi; 4115/20 - Paknam Bandon, east of Bandon, Suratthani Province.

Etiology: Genus and species are dedicated to Prof. CHAMLONG HARINASUTA, Dean of the Faculty of Tropical Medicine of the University of Medical Sciences in Bangkok, as a sign of gratitude for his valuable assistance in the work of the present author.

This species can not be confounded with any other prosobranch species from Thailand. The local species of *Clenchiella*, probably identical with "*Valvata*" *microscopica* NEVILL and "*Valvata*" *minutissima* WATTEBLÉ is smaller and completely flat and the pallial processes are missing.

### Iravadiidae.

Syn.: Fairbankiidae.

Operculum and radula prove that *Fairbankia* and *Iravadia* are so closely related that not even separated subfamilies for these genera seem justified.

***Fairbankia*** BLANFORD, 1868.

***Fairbankia rohdei*** n. sp.

pl. 10 fig. 54; textfig. 36a, b.

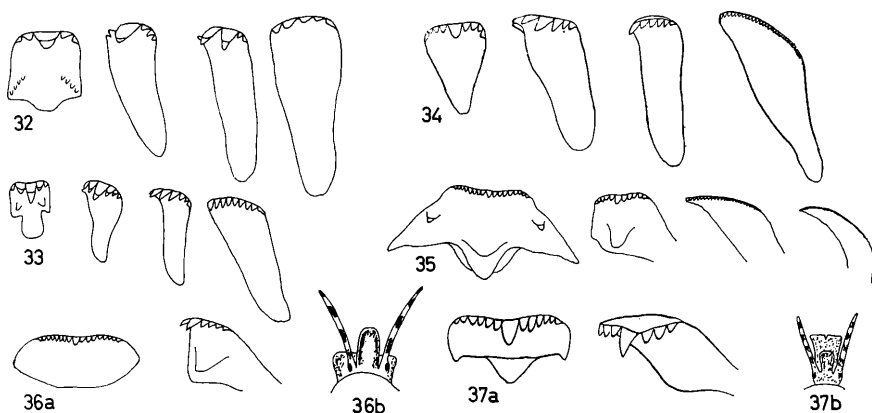
Diagnosis: A species of *Fairbankia* BLANFORD which differs from *F. cochinchinensis* BAVAY & DAUTZENBERG by its smaller size, cylindrical shape and truncate spire.

Description: Shell small, turreted when young, cylindrical when adult, truncate; the complete shell has 7-8 whorls of which normally three to four remain. The ground colour is whitish but the shell is covered with a brownish

periderm. The nuclear whorls are smooth, the other whorls are sculptured with distinct but feeble spiral lines. These lines are hardly impressed in the shell but distinct only on the periderm. These spiral lines show fine cutaneous spines. These are worn off when the shell grows old. The spines of the subsutural spiral line are stronger than those of the other spiral lines. The whorls are convex and separated by a deep suture. They increase slowly and regularly in size. The body whorl measures more than half the height of the (truncate) shell. The umbilicus is either closed or rimate. The spiral lines are crossed by delicate and wavy lines of growth which are stronger around the umbilical pit. After removal of the periderm the shell shows four weak spiral ridges on the upper half of the whorl. The subsutural ridge is the strongest. The lower half of the body whorl is free of spiral sculpture. Parallel to the outer margin of the peristome a thick varix is seen. — Aperture ovate or semilunar, with a distinct angle at the upper margin; bluish white within. Peristome continuous, appressed to the penultimate whorl, not continuous in young specimens. Sharp outside but with a thick callous lip within. — Operculum ovate, thin, transparent, corneous, concentric, with subcentral nucleus. There is a curved ridge on the inner surface.

Size: A 5.3-5.8 mm (truncate), complete specimens 8 mm; D 2.8-3.1 mm.

Animal light grey, foot straight in front and rounded behind, narrower in the middle. Tentacles long and filiform, each with three blackish segments of pigmentation. Back, head and particularly proboscis with dark pigment dots. Proboscis truncate, about half the length of the tentacles. The eyes are placed in very moderate swelling at the outer side of the bases of the tentacles. The animals are dioecious, males and females seem to be found in about the same percentage. The females are oviparous, the males have a simple, prong-like verge without appendages and with a simple duct. — Radula with a broad,



Textfig. 32-37. — 32) *Assiminea abbotti* n. sp., radula, half-row (SMRL 4917); 33) *A. microscopica* n. sp., radula, half-row (4109); 34) *Paludinella daengsvangi* n. sp., radula, half-row (4107); 35) *Chamlongia barinasutai* n. sp., radula, half-row (4111); 36) *Fairbankia rohdei* n. sp., (a) radula, half-row, (b) head of animal (4011); 37) *Ira-vadia reticulata* n. sp., (a) rhachis and lateral, (b) head of animal (3454).

low, irregularly ovate rhachis without basal cusps and without basal process. The cutting edge shows 7-8 cusps on either side of the middle cusp, laterals with the formula 1-1-4, marginals with 22-24 cusp.

*Locus typicus*: Nipa-palm swamp along the road from Chantaburi to Tachalaeb, km 7; Chantaburi Province, Thailand.

*Distribution*: Tidal area of Trad and Chantaburi Province.

*Habitat and biology*: Brackish water mud flats. Feeding on decaying organic matter.

*Material*: Holotype SMRL 4011/A, paratypes 4011/10, USNM and SMF. — SMRL 4012/10 - km 8 from Chantaburi to Tachalaeb; 4013/10 - Klong Yai Pin at Bang Gra Dan, Trad; 4079/5 - km 5 from Chantaburi to Tachalaeb.

*Etiology*: The species is dedicated to Dr. K. ROHDE, parasitologist in the Department of Zoology at the University of Malaya in Kuala Lumpur.

***Iravadia* BLANFORD, 1867.**

***Iravadia reticulata* n. sp.**

pl. 10 fig. 55; textfig. 37a, b.

*Diagnosis*: A species of *Iravadia* BLANFORD which differs from all other known species of the genus by its reticulate sculpture.

*Description*: Shell rather small, solid, not transparent, sand coloured or greyish corneous, of whitish ground colour but covered with a rather thick periderm. The apex is always eroded; the remaining 4-5 whorls increase rather slowly and regularly in size. They are moderately convex and separated by a rather shallow, marginate suture. With exception of the embryonic whorls, the whole shell is covered with a network of spiral ridges and ribs. There are two spiral ridges on the upper whorls which are crossed by 14 ribs on the penultimate whorl. These ribs are of equal strength of that of the spiral ridges. There are two spiral ridges above and 4-5 below the peripheral ridges on the body whorl. The crossings of the ribs and the spiral ridges are produced to sharp tubercles. The umbilicus is completely closed. The body whorl measures about  $\frac{3}{5}$  of the length of the shell. — Aperture ovate, whitish within, not expanded; peristome thickened within but sharp without. It is continuous and appressed at the penultimate whorl. There is a strong varix parallel to the outer margin of the peristome. — Operculum ovate, corneous, concentric, with a ridge parallel to the columellar margin and two shorter ridges which are connected in a right angle near the nucleus.

*Size*: 2.9-3.4 mm; D 1.7-2.0 mm.

Animal greyish with black pigment patches. These form regular rings on proboscis and tentacles. The tentacles are long and filiform, the proboscis is truncate and of about half the length of the tentacles. The animals are dioecious. The females are oviparous. The males show a simple verge without any appendages and with a single duct.

*Locus typicus*: Tarua Khlung; Khlung District: Chantaburi.

*Distribution*: In mud-flats near the coast, known from the provinces of Grabi, Ranong; Trang; Chantaburi and Samut Prakan.

*Material*: Holotype SMRL 3454/A; paratypes 3454/20. — SMRL 3451/5 - Grabi, 1 km S of the town; 3452/10 Ranong harbour; 3453/10 2 km S of Palian, Trang Province.



## Thiaridae.

Beside the two widely distributed species of this subfamily, *Brotia costula* (RAFINESQUE) and *B. citrina* (BROT) quite a number of endemic species are found which are very closely related to known species of the subfamily but still sufficiently different to justify a new name.

### ***Brotia*** H. ADAMS, 1866.

This genus was established by H. ADAMS for the monotype *Melania pagodula* GOULD, an endemic species from the Thaungyin river (Maenam Moei) between Thailand and Burma. A second species of this genus and a close relative of the generotype, was described in 1903 by BLANFORD, *Melania binodosa*. This species is not as its author writes — common in large rivers in Siam — but only endemic in the middle and upper reaches of two tributaries to the Maenam Nan. This species has a well defined subspecies which is described below. This subspecies is the proof for the synonymy of *Antimelania* FISCHER & CROSSE for *Melania variabilis* BENSON [non DEFRANCE] = *Melania costula* RAFINESQUE. The rather smooth or modestly sculptured forms were united in this genus and assumed to live in rather quiet water whilst the spinous forms of *Brotia* are supposed to live in rapids and on rocks of waterfalls. This is only partly the fact. The type of *Brotia* was found in the Moei river buried in the sand just as *Antimelania costula*. The smooth typical race of *B. citrina* (BROT) lives in wild water as well as in quiet parts of the mountain brooks, the below described spined form, however, was found in abundance in quiet parts of the only river from where it is known. *Antimelania* cannot even be treated as a subgenus because the limit would run through a well established *rassenkreis*.

About the relationship between *Sulcospira* TROSCHEL and *Brotia*, no judgement can be given as the present author has not yet had the opportunity of collecting *Sulcospira* himself. All Asian species from the continent assigned to this genus either belong to *Paracrostoma* COSSMANN or *Semisulcospira* BOETGER. The latter has not yet been found in Thailand.

### ***Brotia (Brotia) binodosa subgloriosa*** n. subsp.

pl. 10 fig. 56; textfig. 38.

**Diagnosis:** A race of *Brotia binodosa* (BLANFORD) which differs from the typical race by its complete lack of spines and sculpture.

**Description:** Shell elongate-conoidal or turreted, rather large, solid, not transparent, of whitish ground colour but covered by an olive-brown periderm. This is blackened by mineral deposits. The shell is either unicolour or shows a peripheral and sometimes basal band. A subsutural band is rarely observed. The typical form of this new subspecies has neither spines nor tubercle nor spiral ridges. Intermediate forms between this and the typical race may show all stages of development of the armature. The apex is always truncate. The 4-5 remaining whorls are hardly convex and are separated by a shallow suture. The last whorl is large, about half the size of the shell. It is well rounded in adult specimens but shows a feeble keel when the specimens are young. — The ovate aperture is large, about  $\frac{2}{3}$  of the height of the body whorl. It is

milky-blue within. The peristome is sharp, not continuous, connected by a milky-blue callus. At the base it is produced and forms a pointed beak. — Operculum subcircular, dark brown, glossy, multispiral with 4 whorls and sub-central nucleus.

Size: A 38-52 mm (decollated); D 24-29 mm.

Animal blackish, with grey sole. Over back, head and proboscis there are dusted fine yellowish or orange pigment spots which form larger patches or stripes. These are separated from each other by the unpigmented wrinkles. The foot is rounded in front and behind. The tentacles are moderately long, round, tapering, the eyes are placed at the outside of the bases of the tentacles in broad sockets. The proboscis is large and broad and somewhat flattened. Transverse parallel wrinkles divide the pigmentation into parallel stripes. — The central tooth of the radula shows the glabella typical for the genus. There are three small cusps on either side of the big middle cusp. Laterals and marginals with few cusps only.

Of all examined animals two did not show an egg-transfer groove, birth pore or brood pouch. However, no male organs could be detected in these specimens. All other examined and dissected animals were females. The egg transfer groove (ETG) runs at the right side of the body, the birth pore is placed below the right tentacle. The brood pouch is placed in the neck. It is large and contains in mature condition between 40 and 120 embryonic shells. They are conical, the smaller ones show a nutrient sack attached to the digestive gland through the open apex. Mature embryos have the apex closed by a layer of shell material. The body whorl shows an obtuse keel at the periphery and is either unicoloured or has a peripheral and basal band. As the two "non-females" did not show any functioning male gonads it can be assumed that reproduction is always parthenogenetic.

Type locality: Huai Chieng Nam near the bridge of the „Friendship Highway“, 92 km east of Pitsanulok in Central Thailand.

Distribution Kaek river in Thailand, confirmed between km 65 east of Pitsanulok and Huai Chieng Nam. At Ban Palo all stages of intermediate forms between this race and the typical race were found.

Material: Holotype SMRL 495/A; paratypes 495/20, USNM, SMF, ZMH, STMB and coll. BRANDT. — SMRL 3882, Kaek river at Ban Palo, 3 adult and several young specimens; 3883/20 Huai Chieng Nam 91 km east of Pitsanulok.

Relations: The new subspecies of *Brotia binodosa* is similar to *B. costula gloriosa* ANTHONY. It differs, however, by its larger aperture, more produced base of the peristome, its less convex whorls and therefore shallower suture.

Habitats: This race lives on sandy grounds of the river at comparatively quiet parts, sometimes even buries in the sand as observed with *B. costula* (RAFINESQUE) but at Ban Palo it is also found in rapids.

### ***Brotia (Brotia) pseudoasperata* n. sp.**

pl. 10 fig. 57; textfig. 39.

1881 *Melania asperata*, — ROCHEBRUNE. Bull. Soc. philom. Paris, 7: 23 [non LAMARCK].

1891 *Melania asperata*, — MORLET, J. de Conch., 39: 235 [non LAMARCK].

Diagnosis: A species of *Brotia (Brotia)* H. ADAMS which differs from its closest relative, *B. citrina* BROT, by having one or two spiral rows of spines

or at least nodules, from *B. binodosa* (BLANFORD) by its smaller size and thinner texture and from *B. pagodula* (GOULD) by its numerous spines or tubercles.

**Description:** Shell elongately conoidal or turreted, rather thin but hardly transparent, olive-brown with the band formulas 0000, 1000, 1030, 1034, 1004, 0030, 0034 and 0004. The apex is always eroded, the remaining 4-6 whorls are convex and somewhat shouldered. The first whorls are nearly smooth, the postnuclear whorls sculptured with short, blunt ribs which do not attain the suture, the last two or three whorls are ornamented with two spiral rows of spines or nodules between suture and periphery. There is a strong thread on the periphery and 5 (4-6) spiral threads on the lower half of the body whorl. Sometimes there will be an accessory subsutural spiral line. The umbilicus is closed by the columellar callus. — Aperture ovate, with a pointed angle above, of milky-blue colour within. Peristome sharp, thin, not continuous, connected by a thin callus. The outer margin is well curved, the columella twisted and the basal margin produced in the typical manner of the genus. — In spite of the ovate aperture the operculum is almost circular. It is comparatively small and does not close the aperture. It is thin, corneous and shows six narrow whorls with a centrale nucleus.

**Size:** A 30-48 mm; D 11-19 mm. (The largest specimen in the population 3896 has a size of 32 13 mm, that of the population 599 measures 48 19 mm. The specimens of the small population were all adult and mature.)

**Animal:** Back of the foot and head blackish, dusted with sand-coloured and orange-yellow pigment spots which may appear on the proboscis and head arranged in stripes separated by the dark wrinkles. The sole is of lighter grey. It is rounded in front and behind. The tentacles are thin, rather short; the eyes are placed at the outside of their bases in distinct sockets. Only females have been found among the collected material. There is a long egg-transfer groove at the right side of the body with the "birth pore" placed below the right tentacle. The sand-coloured ovaries are placed in the grey digestive gland. The subhaemocoelic brood pouch is large and contains many embryos and eggs of different stages of development. The immature embryonic shell has an open apex to which a lump of nutrient material is attached. Mature embryos have the apex closed. The shape is similar to that of *B. binodosa*, conic, with a subcarinate periphery and often with two or three brown bands. — The rhachis of the radula shows 3 curved cusps on either side of the middle cusp. The glabella is narrow, with almost parallel sides. The laterals have the cusp formula 1+1+2 and 1+1+0.

This species has been confounded with "*Melania*" *asperata* LAMARCK, a species which is probably not even a *Brotia*. The different spiral lines and the rhachis prove that this species is not a spinous form of *Brotia citrina* (BROT).

**Locus typicus:** Maenam San at Ban Gaeng Hai, Dan Sai District, 65 km west of Loei.

**Distribution:** Known from the Maenam San (a tributary of the Heung river) and its tributary, the Huai Kao Man, only.

**Material:** Holotype SMRL 599/A, paratypes 599/30, USNM, ZMH and SMF. — SMRL 3896/20 - Huai Kao Man, 65 km west of Loei.

***Brotia (Brotia) manningi* n. sp.**

pl. 10 fig. 58.

**Diagnosis:** A species of *Brotia (Brotia)* H. ADAMS which differs from *B. binodosa subgloriosa* n. by its smaller size and more slender shape and from *B. citrina* BROT by its larger size and broader shape.

**Description:** Shell elongately conic, solid, hardly transparent, milky-white, covered with an olive-brown periderm, unicoloured or with brown spiral bands. With the exception of the lines of growth the surface is smooth. The 8 slowly and regularly increasing whorls are only moderately convex and are separated by a shallow suture. The body whorl is large and measures about  $\frac{1}{2}$  of the height of the shell. — Aperture piriform, of about  $\frac{3}{5}$  of the height of the body whorl; peristome not continuous, the outer margin is sharp, the whitish columellar margin well curved, the basal margin hardly produced. The colour of the aperture is either bluish-white or purple. — The operculum is of the shape of a three-quarter moon. It is corneous, brown, has  $3\frac{1}{2}$  whorls and a subcentral nucleus.

Size: D 36-48 mm; D 14-20 mm.

The animal is of blackish-colour, dusted with yellowish pigment spots. The eyes are placed at the bases of the moderately long tentacles in distinct swellings. The large proboscis is about half the length of the tentacles.

All of the 32 specimens collected alive were females. The egg-transfer groove ends in a birth-pore below the right tentacle. The broad pouch is placed in the body behind the neck. It is filled with numerous small embryonic shells whose apical whorls are always closed. Their shape is cylindrical without ridges.

**Type locality:** Huai Lan at Ban Dam Pon; Lom Sak District, Petchabun Province.

**Distribution:** Known from Nan Province, Loei Province and Petchabun Province only but definitely distributed over a larger area.

**Material:** Holotype SMRL 3901/A; paratypes 3901/20, USNM, ZMH and SMF. — SMRL 3902/2 - Huai Samian, 20 km NW of Nan.

**Etiology:** The species is dedicated to Dr. GEORGE S. MANNING, parasitologist in the SMRL, Bangkok, in grateful recognition of rendered technical assistance.

***Brotia (Brotia) microsculpta* n. sp.**

pl. 10 fig. 59.

**Diagnosis:** A species of *Brotia (Brotia)* H. ADAMS, which differs from all known species of this subgenus by its sharp spiral microsculpture.

**Description:** Shell of rather small size for the genus, conic, with truncate upper whorls and  $1\frac{1}{2}$ -3 remaining whorls; these are almost flat and separated by a sharp suture; they increase regularly in size. The ground colour is brownish, the thick periderm is of olive-brown colour; it is sculptured with very delicate wavy spiral lines which are crossed by the fine lines of growth. The body whorl shows an obtuse peripheral keel below the middle. Umbilicus completely closed. — Aperture large, about  $\frac{2}{3}$  of the height of the body whorl, of oval shape, angled above, somewhat channeled at the base. Peristome simple, neither thickened nor expanded at the outer margin, not continuous, connected by a thin, milky-blue or brown callus; base effused, columella well curved,

milky-blue and often with a reddish-brown margin. Base sometimes with one or two brown spiral bands. — Operculum broadly oval, multispiral with 6 whorls and almost central nucleus; corneous, dark brown, glossy within and with a dull, elongate muscle scar.

Size: (truncate) A 17-28 mm; D 14-18 mm.

Animal almost black, dusted with minute orange-yellow pigment dots. Sole lead-grey. All six adult animals were females; the subhaemocoelic brood pouch contained 12-20 fully grown embryos and eggs and embryos of all stages of development. The embryos are conical, the apex is truncate and carries an alimentation sack; the suture is bordered with brown and the lower half of the body whorl is generally of brown colour. — Radula with a squarish rhachis which carries a simple glabella. Cutting edge with 5 cusps.

Locus typicus: Maenam Kaek, in Salaeng Luang Botanical Garden, 80 km east of Pitsanulok, Thailand.

Distribution: Known from the Maenam Keek east of Pitsanulok and one of its tributaries only.

Material: Holotype SMRL 3900/A, paratypes 3900/80. — SMRL 3899/20, USNM, ZMH, TASRC and SMF - Kaek river at Sopa Falls, 71 km east of Pitsanulok; 3902/10 - Huai Chieng Nam (branch of Maenam Kaek), at the bridge of the high-way to Lom Sak.

***Brotia (Paracrostoma) solemiana* n. sp.**

pl. 10 fig. 60.

Diagnosis: A species of *Brotia (Paracrostoma)* COSSMANN which differs from *B. huegeli* (PHILIPPI) by its more slender shape, less produced base of the aperture, and its lack of subsutural and periomphalic grooves.

Description: Shell ovate-conoidal, thick, solid, not transparent, white, but covered with a thick brown or olive coloured periderm. The apex is always eroded. The remaining 3-4 whorls are moderately convex and increase regularly in size. The suture is well marked but shallow. Sometimes there are rudiments of spiral ridges on the body whorl but never subsutural or periomphalic grooves. Under strong magnification very delicate wavy spiral lines can be seen. The body whorl measures  $\frac{2}{3}$ - $\frac{3}{4}$  of the height of the shell. — The aperture is rather large; it is slenderly oval with angled upper and slightly produced basal margin. It is milky-blue within. The peristome is not continuous but connected by a callus. Outer margin sharp, columella thick and regularly curved. — The operculum is semicircular, of the shape of a threequarter moon, corneous, brown, somewhat transparent, with  $3\frac{1}{2}$  whorls and a subcentral nucleus.

Size: A 31-38 mm; D 18-21 mm; aperture 19 11 mm.

The animal is blackish-grey with yellow pigment spots dusted over back and head. Proboscis broad, trunk-shaped, with transverse wrinkles. The tentacles are rather short, about twice the length of the proboscis. The eyes are placed in the bases of the tentacles in distinct swellings. All 36 specimens collected alive were females. It has to be assumed that functional males do not exist and that the species is parthenogenetic. The females show a long egg-transfer groove at the right side of the body which ends in a birth-pore below the right tentacle. The subhaemocoelic brood pouch contained numerous em-

bryonic shells of conic shape with closed apical whorls. The shape differs therefore considerably from that of the embryonic shell of *B. pseudosulcospira*. There is a weak angle at the periphery but no cord. — The radula is of the Melanatriinae type with a squarish rhachis which shows a divided glabella of squarish shape. There are 2 cusps on either side of the middle cusp.

Locus typicus: Maenam Pong at Ban Pa Nok Kao, Loei Province.

Distribution: Known from the Maenam Pong only.

Material: Holotype SMRL 546/A, paratypes 546/20, USNM, ZMH and SMF.

Etiology: The species is dedicated to Dr. ALAN SOLEM (Chicago) who contributed so much to our knowledge of the molluscan fauna of Thailand by his publications.

***Brotia (Paracrostoma) pseudosulcospira* n. sp.**

pl. 10 fig. 61; textfig. 40.

Diagnosis: A species of *Brotia (Paracrostoma)* COSSMANN which differs from *B. huegeli* (PHILIPPI) by its much thicker shell, flatter whorls and the lack of periomphalic grooves.

Description: Shell ovate-conoidal, very thick, dark olive-brown, glossy, smooth except for the lines of growth which are crossed, particularly on the upper half of the whorls by very fine, superficial and irregular spiral lines. The apex is always eroded, the remaining whorls are almost flat and separated by a well marked suture. The spire forms a regular cone, the body whorl is large and measures about  $\frac{3}{4}$  of the height of the shell. It is either regularly rounded or shows a very obtuse carina at the periphery, particularly young specimens. — The aperture is ovate, large, about  $\frac{3}{5}$  of the size of the body whorl, angled above and of milky-white colour within. The peristome is sharp, not continuous, connected by a bluish-white callus. The outer margin is well rounded, the columella thick and curved, the base is somewhat produced but less so than in *Brotia* s. str. The umbilicus is covered by the thick columellar callus. — The operculum is semicircular with rather straight columellar margin. It has the shape of a three-quarter moon. It is thin, reddish-brown, glossy, with four whorls and a subcentral nucleus.

Size: A 29-39 mm; D 18-24 mm.

Animal blackish-grey, dusted with minute orange-coloured pigment spots, which are arranged in transverse, parallel stripes, separated by the blackish wrinkles. Tentacles thin, pointed, round, moderately long, tapering; the eyes are placed outside of their bases in distinct sockets. The proboscis is broad, somewhat flattened and tapering towards the cleft front. Foot rounded, sole of brighter grey colour. There is a typical egg-transfer-groove on the right side of the body with a birth pore placed below the right tentacle. There are more than 200 embryos of equal stage of development in the subhaemocoelic brood-pouch of an adult specimen. The reproduction seems to be parthenogenetic as among more than 200 specimens no males were found. There were, however, three specimens without ETG, birthpore and broodpouch. No functioning male reproductive organs or gonads could be found. The embryonic shells are subglobose and consist of  $1\frac{1}{2}$  whorls only. These are ornamented with three distinct spiral threads. They are either unicolored or have a peripheral and basal brown band. — The radula differs from that of *B. binodosa* by hav-

ing only one cusp on each side of the middle cusp on the cutting edge of the rhachis. The lateral has two cusps on each side of the middle cusp, the marginals have a simple triangular or straight cutting edge.

*Locus typicus*: Maenam Kaek in Pitsanulok Province, at Wang Nok Nang Aen, Wang Tong District, Thailand.

*Distribution*: Known from the type locality only, but among populations of the spinous race smooth specimens may be found.

*Material*: Holotype SMRL 491/A, paratypes 491/30, USNM, ZMH and SMF.

***Brotia (Paracrostoma) pseudosulcospira armata* n. subsp.**  
pl. 10 fig. 62.

*Diagnosis*: A subspecies of *B. (P.) pseudosulcospira* n. sp. which differs from the type subspecies by having 3-5 spiral ridges of which the uppermost or two uppermost ridges are ornamented with spines or at least nodules.

*Description*: Shell thick, ovate-conoidal, eroded, with two or three remaining whorls. These are normally somewhat convex or nearly flat like those of the type form. There are spiral ridges, one between the periphery and suture, one on or a little above the periphery and one a little below it. There is normally a forth ridge on the lower half of the body-whorl and sometimes a fifth. The first two ridges are ornamented with strong spines or sharp nodules. The base of the aperture is a little bit more produced than that of the type. Operculum, animal, radula and embryos like those of the type form.

*Size*: A 26-38 mm; D 18-24 mm.

*Type locality*: Maenam Kaek in Pitsanulok Province at the Gaeng Song (rapids), 60 km east of Pitsanulok.

*Distribution*: Known from the Kaek river only.

*Material*: Holotype SMRL 492/A; paratype 492/60, USNM, ZMH and SMF.

**Marginellidae.**

Some estuarine species of this family are reported from Africa. The first species living in fresh-water in the upper reaches of rivers was found in Thailand. As it is not easily to be attributed to any of the known genera, a new genus is proposed.

***Rivomarginella* n. gen.**

A genus of Marginellidae (Volutacea, Prosobranchia) which differs from its apparently closest relative, *Eratoidea* WEINKAUFF, by its smooth inner lip of the peristome and the complete cover of the spire by a secondary layer of glossy enamel shell material.

*Genotype*: *R. morrisoni* n. sp.

*Distribution*: Known from Thailand only.

*Habitat*: Fresh and tidal water zone of rivers and in large lakes.

The description of the genus is identical with that of the genertype as at present only this species is known.

***Rivomarginella morrisoni* n. sp.**

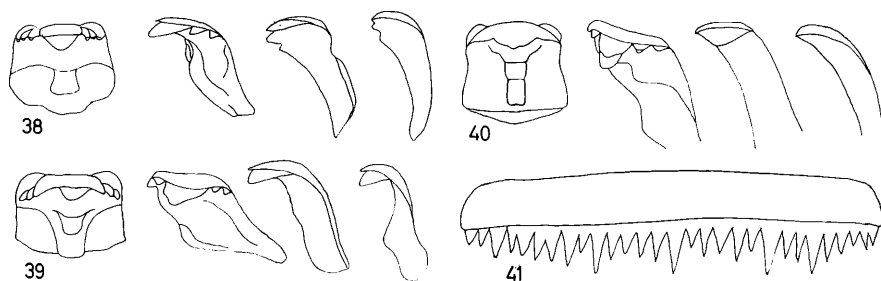
pl. 10 fig. 63; textfig. 41.

Diagnosis like that of the genus.

**Description:** Shell of moderate size for the family, piriform-conoidal, solid, somewhat transparent when fresh, very glossy, sandy-yellowish, either unicoloured or with 1 or 2 olive-coloured bands on the body-whorl. The small, depressed spire is flat and consists of 2 whorls. The body-whorl is very large, reversely conic, regularly rounded behind and somewhat flattened in front. The basic layer of the shell-material is delicately granulated, but this is covered by a secondary layer of enamel-like shell substance. — The aperture is very narrow and elongate, it is angulate above and truncate below with a small siphonal opening. The peristome is very thick outside but only moderately so within. The inner lip is smooth and without any traces of teeth. The peristome is not continuous. The parietal and columellar wall of the aperture form a reverse S. The columella is ornated with 4 slanting spiral columellar folds. — As a true Marginellidae the species has no operculum.

Size: A 9.8-11.3 mm; D 7.2-8.3 mm.

Animal bright-grey, with few large dark pigment dots on the front and back of the foot and on the proboscis. The foot is broadly triangular with rounded cephalic end and is tapering to the bluntly pointed posterior end. The tentacles are moderately long and void of pigmentation. The eyes are placed at the outside of their bases. There are no distinct swellings or sockets. The truncate proboscis is long and cleft in front. It is heavily pigmented. The edges of the mantle are covering almost the whole shell leaving free only a narrow part of the back. The mantle edges are dotted with large black pigment patches. The animal can retreat completely into the shell. — The radula consists of 39 rows of teeth, each row, however, consists of one tooth only. This tooth is comb-shaped with a long, semi-oval or boat-shaped plate and a row of 28-29 cusps of different sizes. The cusps are not turned downwards. There are 7-9 larger cusps with 1-3 smaller cusps inbetween.



Textfig. 38-41. Radula, half-row. — 38) *Brotia* (*Brotia*) *binodosa subgloriosa* n. subsp. (SMRL 495); 39) *B. (B.) pseudasperata* n. sp. (599); 40) *Brotia* (*Paracrostoma*) *pseudosulcospira* n. sp. (491); 41) *Rivomarginella morrisoni* n. sp., radula (967).



The animals are ambisexual. The verge is simple, long, without appendages and with a single duct. It is coiled in the neck beside the middle line of the back.

*Locus typicus*: Maenam Mae Klong near Ban Pong, Ratburi.

*Distribution*: Known from Thailand only: Tonle Luang 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.

*Material*: Holotype SMRL 961/A; paratypes 961/30. — SMRL 956/10 - Klong Rapipat at Ban Ta Luang, Ayutthaya Prov.; 957/30 - Prachin river at Kabinburi; 958/3 - Klong Ban Yikkan at Thonburi; 960/5 Klong Bang O, Thonburi; 959/10 Maenam Nan at Tapan Hin; 962/2 - Klong Prapa in Bangkok; 963/2 - Tale Luang, Patalung.

*Etiology*: The species is dedicated to Dr. J. P. E. MORRISON who was the first to recognize this species as a Marginellidae.

## Pyramidellidae.

### ***Chrysallida*** CHARPENTIER, 1857.

This predominantly marine genus is represented in East Asia by some brackish water species. The only non-marine species from Thailand cannot be attributed to any other known species. The species is tentatively placed in the subgenus *Salasiella* DALL & BARTSCH, 1909.

### ***Chrysallida (Salasiella) eppersoni*** n. sp.

pl. 10 fig. 64.

*Diagnosis*: A species of *Chrysallida (Salasiella)* DALL & BARTSCH which differs from the subgenotype, *C. laxa* DALL & BARTSCH, by its more distant ribs, the delicate spiral sculpture and the complete lack of a fold or denticle on the parietal callus.

*Description*: Shell of average size for the subgenus, elongately turreted, moderately thick, not transparent, dull, of whitish colour but covered by a thick yellowish or olive brown periderm. The 10-12 somewhat convex whorls are separated by a rather deep suture and increase regularly and slowly in size. With the exception of the eroded or truncate apex the whorls are sculptured with strong, obtuse, axial ribs, about 26-28 on the penultimate whorl. These ribs are crossed by delicate, wavy spiral lines. The body whorl shows a very obtuse keel somewhat below the periphery. There are sometimes not more than 5 remaining whorls. The body whorl measures about  $\frac{1}{3}$  of the height of an average shell. The umbilicus is either a narrow chink or completely covered by the columellar callus. — Aperture piriform, not expanded, brownish within; peristome thin and sharp, not extended, not continuous, connected by a thin parietal callus. This does not show any folds or traces of a denticle. The thicker, straight columellar callus is glossy and brownish. — Operculum ovate, extremely thin, cutaneous, paucispiral, with a basal nucleus near the columellar margin.

*Size*: A 10.0-12.5 mm; D 4.0-4.5 mm.

Animal with yellowish brown back and grey foot. With few large black pigment dots and patches and dusted with fine, yellow pigment particles, parti-

cularly at the margin of the foot. Foot rounded behind, narrowed in the first third and truncate anteriorly, with pointed pseudopodia. Head-shield flap-like, with a notch in the middle of the straight front line. The short, elongately triangular tentacles show a groove along the inner side. The eyes are placed closely together on the fore-head between the tentacles and are covered by the connecting fold of the tentacles.

**Anatomy:** Radula and jaw absent. The long, thin proboscis is retractible and only extended when the animal is feeding. The animals are hermaphrodites with the sexual pores placed closely together but without a common atrium. The male reproductive organs show a long and twisted atrium with a strong, muscular atrium-sheath. This is sharply separated from the thinner verge which carries two stalked appendages. The ovotestes are embedded as a whitish gland in the grey digestive gland. It consists of few lobes only. The male duct is long and twisted and is connected by muscle fibre with the strong retractor penis. The oviduct is moderately long, the uterus very small. Vagina with a large, sack-like appendicula. — The mantle lobe is heavily pigmented. There is no gill in the mantle cavity.

**Locus typicus:** Brackish water lagoon at Ban Ampoe, Satahip district, Chonburi Province, East Thailand. The ground consist of silt, not mud, the lagoon is surrounded by nipa-palm and mangrove forests.

**Distribution:** Known from the type locality only.

**Material:** Holotype SMRL 4351/A, paratypes 4351/150, USNM, ZMH and SMF.

**Etiology:** The species is dedicated to Col. J. L. EPPERSON, MSC in grateful acknowledgment of technical help.

### ***Morrisonietta* n. gen.**

**Diagnosis:** A new genus of Pyramidellidae (Cephalaspidea) which differs from its closet relative, *Ivara* DALL & BARTSCH, by its lack of ribs and by its smooth columella. The animal differs from that of above named genus by its obsolete mentum.

**Description:** Shell small, thin, with heterostroph or homoeostroph apex. Whitish but mostly covered with a brownish or olive coloured periderm. The sculpture consists of more or less delicate spiral lines. There are no axial ribs. Umbilicus closed. Aperture ovate, peristome sharp, never expanded. Columella without fold. Operculum thin, corneous paucispiral.

Animal greyish, with large yellowish or sand-coloured pigment spots and smaller blackish dots dusted over head and back. The foot is tapering towards the rounded end. Escutcheon cleft with two pointed mobile pseudopodia. Mentum obsolete in the examined species. The tentacles are rather short and pointed, triangular, with a groove at the inner side. The eyes are placed on the forehead between the tentacles; they are placed so closely together that they form the shape of a coffee-bean. — Radula and jaw are missing. The long proboscis is vermiform and retractable. It is only extended when the animals are feeding. — The animals are hermaphrodites. The genital pores are separated. Penial complex with flagella.

Distribution: Known from several localities around the Gulf of Thailand only.

Habitat: Mud-flats and drainages of the mud-flats near the coast and in klongs in the tidal area, in water with a salinity between 0.5-15‰. In the laboratory the animals were easily kept in completely fresh water.

Genotype: *Morrisonietta krungtepensis* n. sp.

Etiology: The genus is dedicated to Dr. J. E. P. MORRISON, Washington D. C.

***Morrisonietta krungtepensis* n. sp.**

pl. 10 fig. 65.

Diagnosis: A species of *Morrisonietta* n. gen. which differs from all other species of this genus by its large size and the high aperture which measures nearly half the height of the shell.

Description: Shell conoidal-ovate or turreted, with 5 hardly convex, but distinctly shouldered whorls. The nuclear whorls are white, glossy and smooth, the remaining whorls are covered with a brownish periderm and sculptured with distinct spiral lines between the shoulder and the lower suture. The area between shoulder and upper suture is smooth. The second whorl shows 4, the third 6-7, the fourth 10-12 and the body-whorl 14-16 spiral lines. The umbilicus is closed by the milky-blue or brownish columellar callus. — Aperture narrowly ovate and angled above. Peristome sharp, not continuous but connected by a glossy brownish or milky-white callus. It is neither thickened nor expanded and sharp without. — Operculum thin, corneous, paucispiral with subcentral nucleus.

Size: A 5.2-7.0 mm; D 2.1-2.5 mm; aperture 3 : 2 mm.

Animal greyish with small sand-coloured patches and dark grey or blackish pigment dots. Foot broad, tapering to the rounded and obtusely pointed end, straight in front. Eyes placed on the forehead in between the triangular tentacles. Jaw and radula lacking. Proboscis long, retractable. There is no gill in the mantle cavity. The animals are hermaphrodites. With one genital pore but without a genuine common atrium. Penial complex with two appendages.

Locus typicus: Klong Premprachakon in Bangkok-Dusit.

Distribution: Bangkok: Thonburi: Glaeng: Paknam Bandon.

Habitat: Klongs of the tidal area and drainages of the mud flats near the coast. Salinity 0.5-15‰ but the species can also live in fresh-water.

Material: Holotype SMRL 444/A, paratypes 444/20. — SMRL 445/20 - Klong Bang O in Thonburi; 450/15 - Klong Bang Sue Noi, Bangkok; 451/6 - Klong Bang Chak, Thonburi; 452/5 - Ban Kam Sri, Thonburi; 4071/4 - Ban Don Makoh, Glaeng, Rayong Prov.; 4072/4 - Paknam Bandon, Suratthani.

Etiology: Called after Krungtep, the Thai name for Bangkok.

***Morrisonietta spiralis* n. sp.**

pl. 10 fig. 66.

Diagnosis: A species of *Morrisonietta* n., which differs from the genotype by its lesser and coarser spiral ridges, by its smaller size and by having two or three spiral lines between shoulder and upper suture.

Description: Shell slender, conical, thin, with 5 regularly increasing whorls; protoconch whitish and smooth, the other four whorls covered with a brown periderm and sculptured with strong spiral ridges. Body whorl higher than half the shell, tapering to the end of the columella. The whorls are distinctly shouldered below the suture, the shoulder being marked by a very strong and prominent ridge. Between shoulder and upper suture there are normally 2 or 3 weak spiral lines. Between shoulder and lower suture there are 4 spiral ridges on the second and third whorls and 6-7 on the fourth whorl. On the body-whorl there are 11-13 ridges, that on the shoulder being the strongest and those surrounding the closed umbilicus being the weakest. — The aperture is elongate-ovate, angulate above and somewhat canaliculate below. Peristome thin, interrupted, not expanded; columella curved above and straightened below. Operculum thin, corneous, paucispiral, with subcentral nucleus. — Animal unknown.

Size: A 3.4-4.2 mm; D 1.8-2.0 mm.

Locus typicus: Paknam Bandon, Province of Surat Thani.

Distribution: Known from the type locality in Thailand only.

Material: Holotype SMRL 4077/A, paratypes 4077/6.

This species is very closely related to the genotypus and would have been treated as a race of that species only, if both species were not found together. The distinction between these two species is easy. *M. spiralis* is always smaller, has lesser and stronger spiral ridges, that on the shoulder being very prominent. *M. krungtepens* has normally a fine spiral line between the two upper ridges, which is constantly missing in *spiralis*. The space between shoulder and upper suture is smooth in *krungtepens*, but shows 2 or 3 fine spiral lines in *spiralis*.

***Morrisonietta siamensis* n. sp.**

pl. 10 fig. 67

Diagnosis: A species of *Morrisonietta*, which differs from the genotype, *M. krungtepens*, by its more slender shape, the lack of a "shoulder" and the smaller size of the aperture, which has about  $\frac{1}{2}$  the size of the body whorl

Description: Shell small, elongate-turriculate, thin, white, vitreous, but covered with a very thin brownish periderm and mostly with a brown or black deposit. The 6 whorls are regularly convex, without shoulder and separated by a deep suture. They increase regularly in size; the body whorl being about  $\frac{5}{9}$  the size of the shell. The smooth apical whorl is almost homoeostroph; the other whorls are sculptured with regular sharp spiral lines, 8-9 on the penultimate and 22-24 (from suture to umbilical area) on the last whorl. Between these sharp lines there are 2-3 very feeble spiral lines, which are crossed by the delicate lines of growth. The umbilical pit is covered by the columellar callus. — The aperture is elongately ear-shaped, the outer and basal margin regularly rounded, angled above and having the columellar margin sinuous. The aperture is about half the size of the body whorl. The peristome is not expanded, sharp, thin, connected by a sinuous, thin columellar and parietal callus. — The operculum is ovate, thin, transparent, paucispiral, with basal nucleus.

Size: A 5.5 mm; D 2.0 mm (holotype); A 5.2-5.6 mm; D 1.8-2.0 mm.

Animal sand-coloured, with minute greyish pigment spots. Sole spindle-shaped, escutcheon extended in front into two pseudopodia. The tentacles are short, extended-triangular; the eyes are placed on the forehead between the eyes, very closely together. The proboscis is long and retractable. There is no jaw and no radula. The gross anatomy of the soft parts does not show any difference compared with the genotype.

*Locus typicus*: Klong Pong Pueag at Ban Tangquien: Glaeng District, Rayong Province, Thailand.

*Distribution*: Only known from the creeks and Klongs in the mud-flats around Glaeng.

*Material*: Holotype SMRL 1007/A, paratypes 1007/5. — SMRL 4071/5 - Ban Don Makok, 51.5 km E of Rayong.

*Relations*: Nearest relative is without doubt the genotype. This has a broader base, larger aperture, the shouldered whorls and a smooth zone between shoulder and suture. *M. acicula* and *gracilis* are smaller and slendered, *acicula* is shouldered, *gracilis* has much finer sculpture.

### ***Morrisonietta acicula* n. sp.**

pl. 10 fig. 68.

*Diagnosis*: A species of *Morrisonietta* n., which differs from the genotype by its smaller size, very slender shape, the open umbilicus and the sharper sculpture.

*Description*: Shell very slenderly turreted, in shape similar to *Cecilioides*, thin, translucent, the first whorl whitish and smooth, the other 4 whorls covered with a brown periderm and sculptured with regular, sharp spiral lines. One very feeble spiral line may sometimes appear between two of the stronger ridges. There are 5-6 spiral ridges on the second, 7-8 on the third, 15-17 on the fourth and about 29 on the last whorl. Of these 29 ridges the 17 upper ones are much stronger than the 12 around the umbilical pit. The shoulder of the whorls is placed higher than in the genotype and the space between shoulder and suture is not smooth but sculptured with one or two spiral lines. The umbilicus is narrowly rimate. — Aperture small, ovate, angulate above and regularly rounded below. Peristome thin, sharp, not expanded. The columella is brownish and regularly rounded. — Operculum thin, corneous, paucispiral with subcentral nucleus.

*Size*: A 4.8-5.3 mm; D 1.5-1.7 mm.

Animal very similar to that of the type species, but shorter; end of the foot rounded, tentacles shorter. With sand-coloured and blackish pigment dots, particularly on the sides and back of the foot and on the pseudopodes and tentacles. Radula and jaw are missing. The anatomy has not yet been studied.

*Type locality*: Brackish water trench along the road near the bridge over the Klong Don Makok in the mud flats 51 km east of Rayong in the province of Rayong.

*Distribution*: Known beside the type locality from the mud flats of the Mae-nam Chao Praya south of Thonburi and from Paknam Bandon in the Province of Surat Thani.

*Material*: Holotype SMRL 4076/A and paratypes 4076/15. — SMRL 4075/10 - Ban Praya Samut South of Thonburi; 4088/3 - Paknam Bandon, Surat Thani.

***Morrisonietta gracilis* n. sp.**

pl. 10 fig. 69.

**Diagnosis:** A species of *Morrisonietta* n., which differs from the type species by its smaller size and slender shape, from *M. spiralis* by its slender shape and finer spiral lines and from *M. acicula* by its shorter spire and weaker sculpture and from all above species by its greyish colour and lack of a "shoulder" at the whorls below the suture.

**Description:** Shell slender, turreted, thin, translucent, somewhat glossy, greyish, without brown periderm but normally covered with a thick blackish layer of minerals. 4 whorls, somewhat convex, regularly increasing, the body-whorl more than half (in *acicula* less) of the shell high, shoulder not or only on the second and third whorl feebly produced. Protoconch smooth, the other four whorls covered with regular, fine spiral lines, which are crossed by the delicate lines of growth. There are 10-12 spiral lines on the second, 14-17 on the third and 26-29 on the body whorl. The spiral lines around the rimate umbilicus are stronger than those below the suture. — Aperture ovate, angulate above, rounded below, about  $\frac{1}{3}$  of the height of the shell. Columella regularly curved, not straight below. Peristome sharp, not continuous, not expanded. — Operculum thin, corneous, paucispiral, nucleus subcentral.

**Size:** A 3.7-4.6 mm; D 1.5-1.7 mm.

**Animal:** Similar to that of the type species, but the colour shows often a rosy tint, which may be seen through the translucent shell, particularly rendering the protoconch of living specimens a rosy or even reddish tint. This rosy colour is not permanent in the specimens but may disappear. The tentacles show some sand-coloured spots in the distal ends, head and back of the animal show few tiny spots in the pigment patches. Anatomy not different from that of the type species.

**Locus typicus:** Klong Bang O in Thonburi.

**Distribution:** Several klongs in the province of Thonburi.

**Habitat:** Fresh to slightly brackish water; tidal area of the Maenam Chao Praya. Lives on plants.

**Material:** Holotype SMRL 4074/A; paratypes 4074/20, USNM and SMF.

***Morrisonietta bandonensis* n. sp.**

pl. 10 fig. 70.

**Diagnosis:** A species of *Morrisonietta* n., which differs from *M. krungtepens* and *spiralis* by its slender form and very fine spiral sculpture and from *gracilis* and *acicula* by its rounded whorls. From *M. krungtepens*, *spiralis* and *acicula* it differs furthermore by its very thin and diaphanous shell. From *gracilis* it differs by its still weaker sculpture and the narrower, distinctly convex whorls.

**Description:** Shell small, thin, translucent, vitreous, somewhat glossy, slender, turreted, with 6-7 regularly increasing, extremely convex whorls. The protoconch is smooth the other whorls are very delicately sculptured by spiral lines and fine lines of growth. The upper part of the whorls is nearly horizontal and the suture is deep. An area below the suture is free of spiral lines. Um-

bilicus rimate. Body whorl about half the height of the shell. — Aperture a little more than  $\frac{1}{4}$  of the height of the shell, semilunar, above and below well rounded, outer margin and columella straight. Peristome not continuous, not expanded, sharp. — Operculum very thin, translucent, paucispiral. — Animal as in the genus, but with few large pigment patches only.

Size: A 2.9-3.6 mm; D 0.8-1.0 mm.

Locus typicus: Mud flat at Paknam Bandon, Surat Thani Prov.

Distribution: Known from the locus typicus only.

Material: Holotype SMRL 3396/A, Paratypes 3396/3.

Etiology: Named after the town of Bandon.

# Plate 8.

- Fig. 1. *Mekongia pongensis* n. sp.,  $1/1$  (SMRL 3191/A).
- Fig. 2. *Annulotaia forcarti* n. g. n. sp.,  $1/1$  (SMRL 3121/A).
- Fig. 3. *Siamopaludina maekoki* n. g. n. sp.,  $1/1$  (SMRL 2941/A).
- Fig. 4. *Sinotaia mandahlbarthi* n. sp.,  $1/1$  (SMRL 2976/A).
- Fig. 5. *Sinotaia arturrolli* n. sp.,  $1/1$  (SMRL 3125/A).
- Fig. 6. *Cipangopaludina annandalei* n. sp.,  $1/1$  (SMRL 231/A).
- Fig. 7. *Bithynia (Gabbia) minuta* (GHOSH),  $4/1$  (SMRL 12021/A).
- Fig. 8. *Bithynia (Gabbia) walkeri* n. sp.,  $4/1$  (SMRL 3602/A).
- Fig. 9. *Bithynia (Gabbia) wykoffi* n. sp.,  $4/1$  (SMRL 3708/A).
- Fig. 10. *Wattebledia cribbsiana* n. sp.,  $5/1$ . O-Java: Ranoe Klingdoengan.
- Fig. 11. *Wattebledia baschi* n. sp.,  $8/1$  (SMRL 12026/A).
- Fig. 12. *Pachydrobia crooki* n. sp.,  $3/1$  (SMRL 3435/A).
- Fig. 13. *Pachydrobia munensis* n. sp.,  $3/1$  (SMRL 447/A).
- Fig. 14. *Pachydrobia zilchi* n. sp.,  $3/1$  (SMRL 460/A).
- Fig. 15. *Pachydrobia siamensis* n. sp.,  $3/1$  (SMRL 446/A).
- Fig. 16. *Pachydrobia wykoffi* n. sp.,  $3/1$  (SMRL 3433/A).
- Fig. 17. *Paraprososthenia schuetti* n. sp.,  $5/1$  (SMRL 3382/A).
- Fig. 18. *Paraprososthenia vivonai* n. sp.,  $5/1$  (SMRL 3443/A).
- Fig. 19. *Paraprososthenia schlickumi* n. sp.,  $10/1$  (SMRL 3381/A).
- Fig. 20. *Paraprososthenia davisi* n. sp.,  $5/1$  (SMRL 3384/A).
- Fig. 21. *Paraprososthenia taylori* n. sp.,  $5/1$  (SMRL 3383/A).
- Fig. 22. *Hubendickia siamensis* n. g. n. sp.,  $4/1$  (SMRL 3390/A).
- Fig. 23. *Hubendickia spiralis* n. sp.,  $8/1$  (SMRL 3386/A).
- Fig. 24. *Hubendickia tuberculata* n. sp.,  $4/1$  (SMRL 3389/A).
- Fig. 25. *Hubendickia gochenouri* n. sp.,  $4/1$  (SMRL 3385/A).

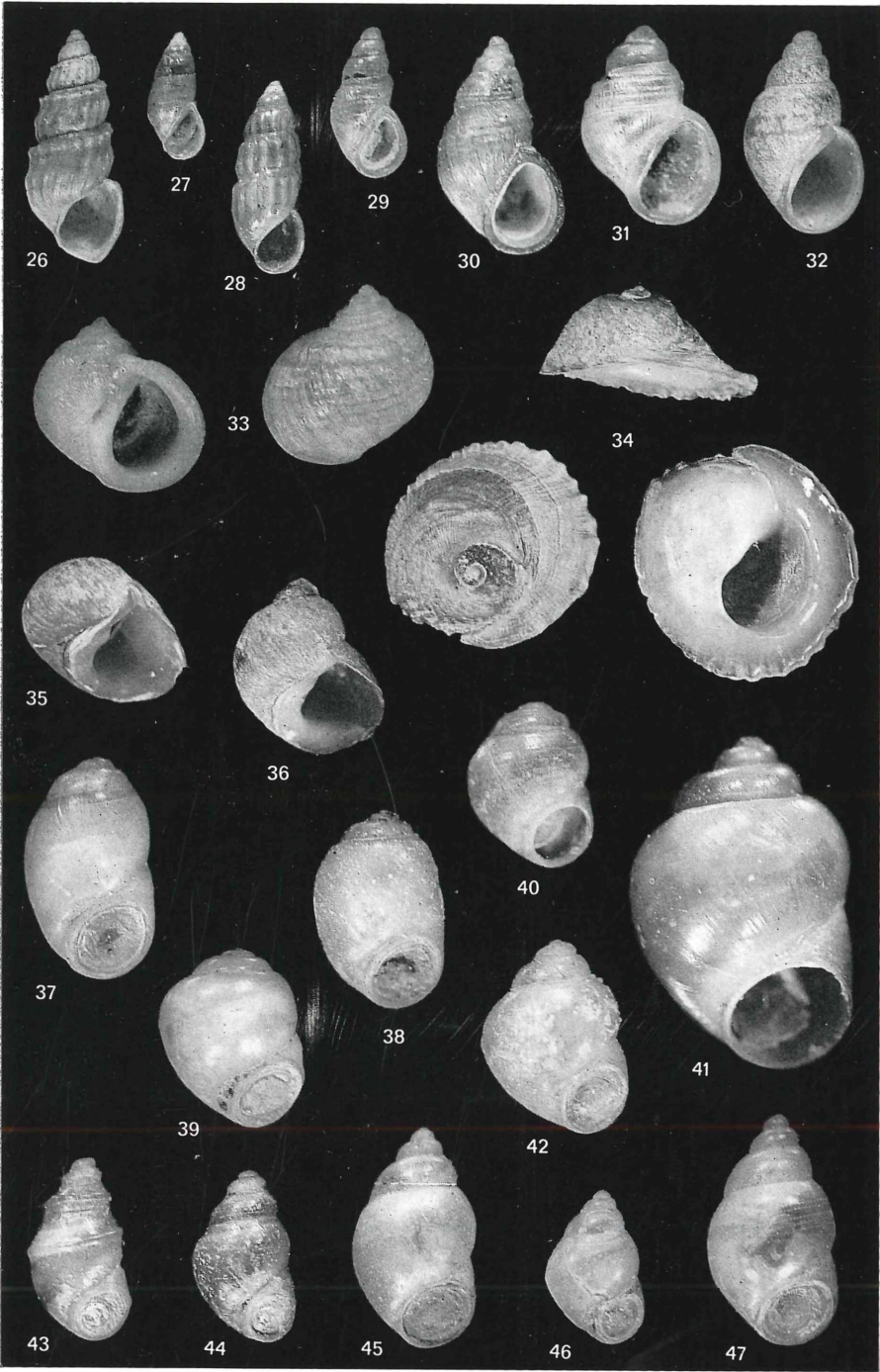




R. A. M. BRANDT: Description of new non-marine mollusks from Asia.

Plate 9.

- Fig. 26. *Hubendickia coronata* n. sp.,  $4/1$  (SMRL 3442/A).
- Fig. 27. *Hubendickia microsculpta* n. sp.,  $4/1$  (SMRL 3378/A).
- Fig. 28. *Hubendickia crooki* n. sp.,  $4/1$  (SMRL 3391/A).
- Fig. 29. *Hydrorissoia gracilis* n. sp.,  $8/1$  (SMRL 3478/A).
- Fig. 30. *Hydrorissoia munensis* n. sp.,  $8/1$  (SMRL 3471/A).
- Fig. 31. *Hydrorissoia trispiralis* n. sp.,  $8/1$  (SMRL 3472/A).
- Fig. 32. *Hydrorissoia hospitalis* n. sp.,  $8/1$  (SMRL 16129/A).
- Fig. 33. *Wykoffia crooki* n. g. n. sp.,  $3/1$  (SMRL 3463/A).
- Fig. 34. *Lacunopsis fischerpiettei* n. sp.,  $2/1$  (SMRL 3467/A).
- Fig. 35. *Lacunopsis munensis* n. sp.,  $4/1$  (SMRL 3371/A).
- Fig. 36. *Lacunopsis conica* n. sp.,  $4/1$  (SMRL 16216/A).
- Fig. 37. *Stenothyra wykoffi* n. sp.,  $10/1$  (SMRL 4052/A).
- Fig. 38. *Stenothyra fasciata* n. sp.,  $10/1$  (SMRL 4046/A).
- Fig. 39. *Stenothyra crooki* n. sp.,  $10/1$  (SMRL 4991/A).
- Fig. 40. *Stenothyra roseni* n. sp.,  $10/1$  (SMRL 4994/A).
- Fig. 41. *Stenothyra jiraponi* n. sp.,  $10/1$  (SMRL 3417/A).
- Fig. 42. *Stenothyra keoratensis* n. sp.,  $10/1$  (SMRL 416/A).
- Fig. 43. *Stenothyra spiralis* n. sp.,  $10/1$  (SMRL 3421/A).
- Fig. 44. *Stenothyra schuetti* n. sp.,  $10/1$  (SMRL 3416/A).
- Fig. 45. *Stenothyra krungtepensis* n. sp.,  $10/1$  (SMRL 417/A).
- Fig. 46. *Stenothyra annandalei* n. sp.,  $10/1$  (SMRL 3424/A).
- Fig. 47. *Stenothyra mandahlbarthi* n. sp.,  $10/1$  (SMRL 4061/A).

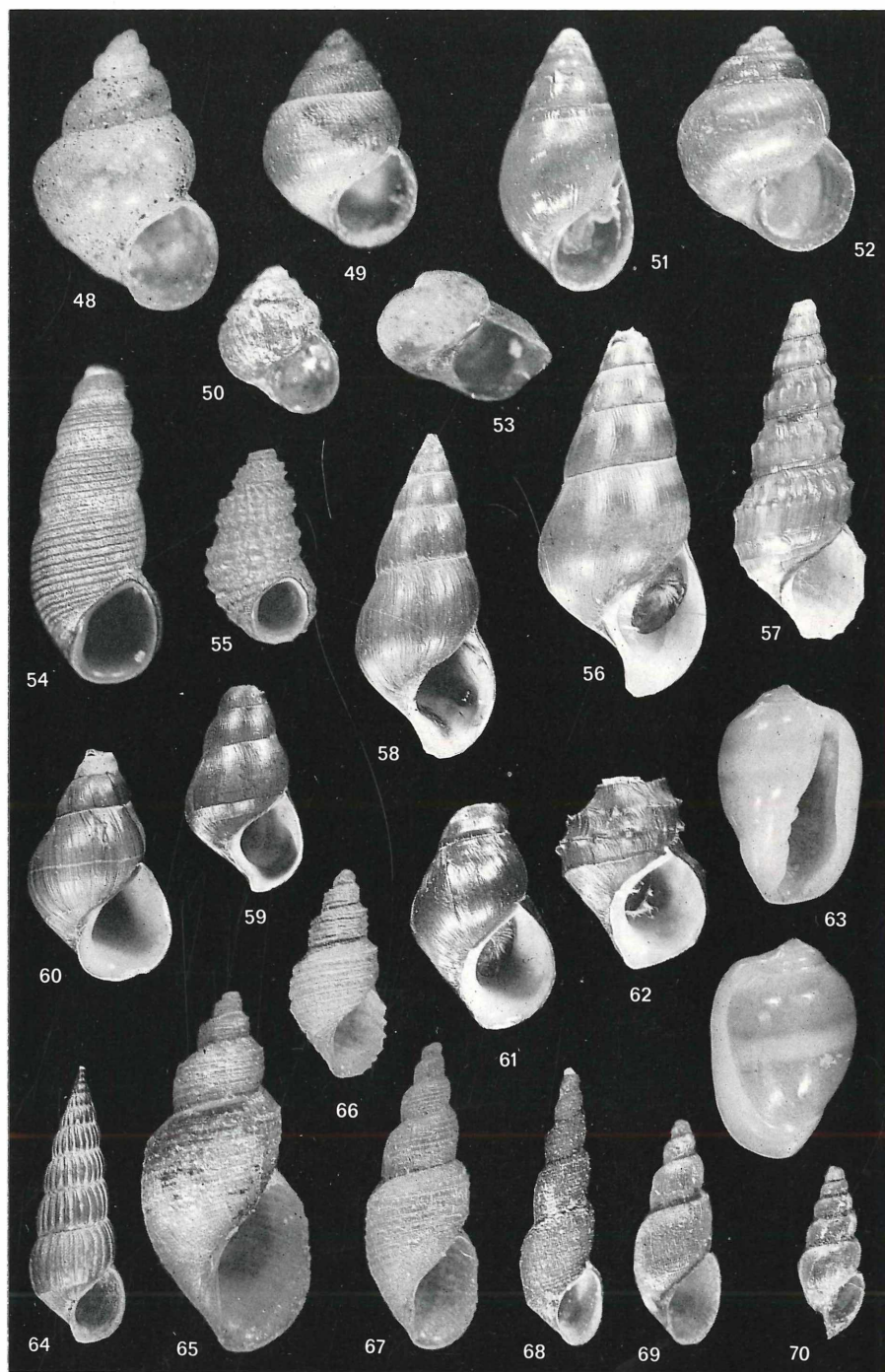


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Plate 10.

- Fig. 48. *Gangetica tigertti* n. sp.,  $^{15}/_1$  (SMRL 4031/A).
- Fig. 49. *Assimineea abbotti* n. sp.,  $^{15}/_1$  (SMRL 4917/A).
- Fig. 50. *Assimineea microscopica* n. sp.,  $^{15}/_1$  (SMRL 4109/A).
- Fig. 51. *Paludinella daengsvangi* n. sp.,  $^{10}/_1$  (SMRL 440/A).
- Fig. 52. *Paludinella thonburi* n. sp.,  $^{15}/_1$  (SMRL 4948/A).
- Fig. 53. *Chamlongia harinasutai* n. g. n. sp.,  $^8/_1$  (SMRL 5111/A).
- Fig. 54. *Fairbankia rohdei* n. sp.,  $^8/_1$  (SMRL 4011/A).
- Fig. 55. *Iravadia reticulata* n. sp.,  $^8/_1$  (SMRL 3454/A).
- Fig. 56. *Brotia (Brotia) binodosa subgloriosa* n. subsp.,  $^1/_1$  (SMRL 495/A).
- Fig. 57. *Brotia (Brotia) pseudasperata* n. sp.,  $^1/_1$  (SMRL 599/A).
- Fig. 58. *Brotia (Brotia) manningi* n. sp.,  $^1/_1$  (SMRL 3901/A).
- Fig. 59. *Brotia (Brotia) microsculpta* n. sp.,  $^1/_1$  (SMRL 3900/A).
- Fig. 60. *Brotia (Paracrostoma) solemiana* n. sp.,  $^1/_1$  (SMRL 546/A).
- Fig. 61. *Brotia (Paracrostoma) pseudosulcospira* n. sp.,  $^1/_1$  (SMRL 491/A).
- Fig. 62. *Brotoa (Paracrostoma) pseudosulcospira armata* n. subsp.,  $^1/_1$  (SMRL 492/A).
- Fig. 63. *Rivomarginella morrisoni* n. g. n. sp.,  $^3/_1$  (SMRL 961/A).
- Fig. 64. *Chrysallida (Salasiella) eppersoni* n. sp.,  $^3/_1$  (SMRL 4351/A).
- Fig. 65. *Morrisonietta krungtepensis* n. g. n. sp.,  $^8/_1$  (SMRL 444/A).
- Fig. 66. *Morrisonietta spiralis* n. sp.,  $^8/_1$  (SMRL 4077/A).
- Fig. 67. *Morrisonietta siamensis* n. sp.,  $^8/_1$  (SMRL 1007/A).
- Fig. 68. *Morrisonietta acicula* n. sp.,  $^8/_1$  (SMRL 4076/A).
- Fig. 69. *Morrisonietta gracilis* n. sp.,  $^8/_1$  (SMRL 40/A).
- Fig. 70. *Morrisonietta bandonensis* n. sp.,  $^8/_1$  (SMRL 3396/A).





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