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MONOGRAPH OF THE INDO-AUSTRALIAN *CLAUSILIIDAE*[1])

(GASTROPODA, PULMONATA, CLAUSILIIDAE, PHAEDUSINAE)

by

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I. INTRODUCTION.

The family of the *Clausiliidae* belongs to the subclass *Pulmonata* and to the order *Stylommatophora*. It is characterized among these by a turreted or fusiform shell provided with some or many folds in the aperture, and often with a very peculiar lid resting on and between these folds, called the clausilium (claudo = to close).

The radula consists of many transverse rows of teeth, each row with up to 50 separate teeth, of which the central one has one or three cusps. The laterals have two cusps, of which the outer one is the smaller.

The genital apparatus nearly always has an appendage to the duct of the receptaculum seminis and an epiphallus.

This family of landsnails has three centres of distribution, viz.

1. Europe, Northern Africa and South-Western Asia
   (subfamilies *Clausiliinae* and *Cochlodininae*)
2. Asia
   (subfamily *Phaedusinae* and a few *Neniinae)*
3. South America
   (subfamily *Neniinae)*

The subfamilies are mainly based on the geographical distribution, especially in the case of the *Phaedusinae*. The shells of this very large subfamily cannot be separated easily from the European forms, particularly from the *Cochlodininae*.

The anatomy of the Phaedusoid snails is still too little known to allow conclusions.

This paper deals with the *Clausiliidae* of the Indo-Australian area, including Indonesia (the former Dutch East Indies), Malaya, British Borneo and the southern Philippines, for the greater part island dwelling species.

In addition to the literature I studied the *Clausiliidae* of this region from the following museums:

Zoölogisch Museum, Amsterdam (Z.M.A.)
Geologisch Museum, Bandung
Naturhistorisches Museum, Basel (N.M.B.)
Museum für Naturkunde, Berlin (M.B.)
Museum Zoologicum, Bogor (M.Z.B.)
Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels (K.B.I.N.)
Museum für Natur-, Völker- und Handelskunde, Bremen
Zoologiske Museet, Copenhagen (Z.M.C.)
Senckenberg Museum, Frankfort on the Main (S.M.F.)
Rijks Museum van Natuurlijke Historie, Leyden (R.M.L.)
British Museum (Natural History), London (B.M.L.)
American Museum of Natural History, New York (A.M.N.H.)
Muséum National d'Histoire Naturelle, Paris (M.H.P.)
Natuurhistorisch Museum, Rotterdam (N.M.R.)

Raffles Museum, Singapore (R.M.S.)
Naturhistoriska Riksmuseet, Stockholm
Naturhistorisches Museum, Vienna (N.M.V.)
United States National Museum, Washington (U.S.N.M.)
Zoologisches Museum der Universität, Zurich
and from the private collections of Dr. P. BOHNY, Dr. J. TH. HENRARD, Mr. J. G. J. KUIPER, the late Dr. E. PARAVICINI, the late Dr. K. L. PFEIFFER and from my own collection.

I am greatly indebted to the authorities of these museums, especially to Dr. W. ADAM (Brussels), Dr. CH. BAYER (Leyden), Mr. A. EDLAUER (Vienna), Mrs. W. S. S. VAN DER FEEN-VAN BENTHEM JUTTING (Amsterdam), Prof. Dr. E. FISCHER PIETTE (Paris), Dr. L. FORCART (Basel), Dr. S. JAECKEL (Berlin), Dr. H. KNIPPER (Bremen), Dr. M. A. LIEFTINCK (Bogor), Dr. G. A. DE NEVE (Bandung), Prof. Dr. B. PEYER (Zurich), Mr. L. P. POUDEROYEN (Rotterdam), Dr. W. J. REES (London), Dr. H. A. REHDER (Washington), Prof. Dr. V. VAN STRAELEN (Brussels), Dr. G. THORSON (Copenhagen), Mr. M. W. F. TWEEDIE (Singapore), Mr. F. V. WEIR (New York) and Dr. A. ZILCH (Frankfort on the Main), for allowing me free access to their collections or for the loan of specimens from their departments. The same thanks are due to the owners of the private collections. I am very grateful to the Executive Committee of the „Zoölogisch Insulinde Fonds" for contributing towards the expenses of my visit to the British Museum (Nat. Hist.).

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Finally I want to express my gratitude to my wife ; it was her actual support and encouragement that made me persist in my efforts to finish this study.

This study was started with the special purpose of working out the zoogeographical data of the *Clausiliidae* from the area in question. The data turned out to be insufficient. The designations of the localities were usually defective. The study of the material available yielded mainly new morphological and systematic data on the shells. On my request living specimens were collected, thus providing data on the animals themselves and on the anatomical structure of the genital organs and of the radulae (so far the structure of the genital organs of three species only was known). As many type-specimens as possible have been studied.

In order to avoid the burdening of nomenclature with too many new names, I have maintained the old point of view, whenever I could not propose a new one with absolute certainty.

Consequently this work is mainly a systematic treatise and does not contain as many zoogeographical and ecological details as I had intended to give. May it be a starting-point for further investigations.

II. GENERAL INFORMATION ON THE PHAEDUSINAE.

Only *Phaedusinae* turned out to have been found in the area mentioned, no *Neniinae*.

The group is of Asiatic origin, some islands of the Moluccas forming the most eastern outposts. Little is known of the localities in which the animals live, with some exceptions only. The labels of the museum specimens are usually very incomplete. Usually only a town in the neighbourhood of the locality or a mountain on which the animals were found is mentioned.[1])

The Indo-Australian *Phaedusinae* are mainly mountain-dwelling forms, but there are exceptions (several *Euphaedusa cumingiana*-populations live in the lowland).

They prefer limestone. It is a pity that most often the nature of the soil is not mentioned on the labels.

Ground-dwelling specimens as well as tree-climbing ones occur in the area investigated. As a rule the habitats are in the shade, they are often moist, sometimes even very wet.

The animals are rather small snails, with slender shells, from 10 to 40 mm long and from 2 to 7 mm in diameter. The colour of the shells varies from whitish to dark chestnut brown.

A general description of the usually sinistral shell is given here, to show the most important features for identification (cf. plate I).

The shell is kept in a vertical position, the top whorls upward, the aperture facing us. The side in which the aperture lies, is the ventral side of the shell; the opposite one, the dorsal side, shows the "neck" of the shell. The neck is the dorsal side of the ultimate whorl.

A measure for the ventrosity of the shells is the proportion of length to diameter, indicated by l/d. I measured the shells by means of a sliding calliper.

The first two or three top whorls are embryonic whorls, formed in the egg-stage already; they are usually smooth. The next whorls suddenly or gradually grow wider and higher (the lateral outlines of the spire are concave, straight or convex) until they have reached their greatest diameter; the ultimate and sometimes also the penultimate whorl may be narrower again. The whorls are separated by the suture. The 8 to 16 whorls, of which a shell consists, are always provided with growth-lines; often there is a real sculpture of transverse striae or ribs; longitudinal striae are rare, only a "thread" along the suture may be present, which sometimes is broken up into small papillae. The neck may look slightly swollen or may be flat; it is flat if it bends down slowly and regularly towards the bottom part of the aperture on the ventral side. A crest on the neck is never present.

The shape of the aperture and the nature of the peristome, of which

[1]) For a map of the area, indicating most of the localities, see at the end of the paper.

the upper part may be adnate or clear of the preceding whorl, are important. The free outer wall of the aperture and the inner surface of the sides of the whorls is called the palatal wall. The folds on it, which point towards the inner space of the shell, are plicae, palatal plicae or plicae palatales. The folds on the wall that separates two whorls, called the parietal wall, are the lamellae. Opposite the palatal side of the aperture is the columellar side (the central axis of the shell is called the columella). The folds on it are also called lamellae.

Looking into the aperture one can see the upper lamella (lamella superior), which partly separates the upper left part of the aperture (the sinulus) from the rest. If the upper margin of the peristome bends upward towards the left, where it is touched by the lamella superior, the sinulus is distinctly higher. The superior lamella runs backwards and is either clear of or in communication with the lamella spiralis. The spiral lamella is a fold that usually begins about a quarter of a whorl deep in the aperture ; it ends near the ventral side in the whorl above the aperture.

Another parietal fold is the lamella inferior ; it first runs on the columella or even on the peristome and may be visible in the aperture. Inwards it leaves the columella and continues on the parietal wall, parallel to the spiral lamella ; it also ends more or less ventrally in the whorl above the aperture.

Below the lamella inferior is the lamella subcolumellaris. Its end is visible below the end of the inferior lamella on the peristome, or it is hidden behind the inferior lamella. It first runs on the palatal wall, then on the columella, rather straight upward, continues in a rather ventral position on the parietal wall and soon ends there.

On the palatal wall in the shell are the palatal plicae, they differ in position, shape and number. They are often visible through the shell, but become even clearer, if the spot on the shell is moistened, e.g. with alcohol. Only one plicae is common to all the species : the principal plica (plica palatalis principalis). It is the first distinct plica below the suture, parallel to it and the longest of all. Sometimes there is a faint sutural plica (plica suturalis) between this one and the suture. There may be one or more smaller palatal plicae below the principalis, often almost parallel to each other or graduàlly diverging towards the aperture of the shell. The upper one is called plica palatalis superior, the lower one plica palatalis inferior. Instead of one or more parallel plicae, which may be situated in a callous patch, there may be one single moon-shaped plica, the lunella. With the clausilium these plicae palatales form the closing apparatus of the shell ("lunellarium" of EHRMANN, 1927). The lamellae too play a part in the closing of the shell. When it is closed, the door (the clausilium) rests with its palatal side against the plicae, so these indicate the true place of the door. The clausilium itself is a saddle-shaped plate provided with an elastic pedicle, curving upward into the penultimate whorl and connected with the parietal wall more towards the top of the shell than the ends of the three lamellae. When the "door" is closed the columellar side of the plate lies against the subcolumellar lamella. When the snail creeps out of the shell it pushes the palatal side of the door outward just as though the columellar side of the plate were provided with hinges. While the snail is creeping the plate lies against the inner curve of the inferior lamella.

The animals themselves are small slender snails, greyish-white to almost black. They have the usual pair of upper eye-bearing tentacles (ommatophores) and a pair of small lower tentacles. The foot is small compared to the length of the shell, the visceral sac shows many whorls and does not always extend to the utmost top whorls of the shell. The respiratory opening is situated in the sinulus, which is to be regarded as the outer end of an incomplete duct, confined by: the palatal wall of the shell towards the side, the parietal wall between the whorls above, the principal plica underneath and the lamella superior and the lamella spiralis towards the columella of the shell. As the principal plica and the two lamellae do not touch, there is a longitudinal connection between this duct and the rest of the cavity of the shell. This duct continues beyond the clausilium, which prevents its being closed. Therefore, it is always possible for the snail to breathe, even when it has retired into the shell. The openings of ureter and rectum are situated by the side of the respiratory orifice.

The radula consists, as is usual with *Clausiliidae*, of numerous transverse rows of teeth. Each tooth consists of a basal plate and one or more cusps. The central tooth has a small cusp on either side. On each side there are 8—10 laterals with two cusps and a number of marginals with three or more cusps.

The genital apparatus is of the usual aspect in *Clausiliidae* (vide STEENBERG, 1914). From the bisexual gland, which consists of groups of sac-like glands, the spermoviduct leads via a vesicula seminalis into the ductus seminalis with prostate gland on the one side and into the uterus with albuminous gland on the other. The seminal duct continues into the vas deferens, which leads by way of the epiphallus to the penis. The duct from the receptaculum seminis has an appendix or diverticulum and enters the vagina, which joins the penis just before the genital opening, which lies left of and below the left upper tentacle. The retractor muscle and the nerve to this ommatophore run between penis and vagina. As the value of other anatomical characters, as far as known up to now, has proved very small for the systematics of the *Clausiliidae*, we shall not go into them much further here. A detailed anatomical description of only one species living in the area studied, has been given up to now (WIEGMANN, 1893). Of two other species only a few anatomical data are at our disposal (RENSCH, 1932; STOLICZKA, 1873).

The animals lay eggs or are ovoviviparous. The eggs are white (because of numerous calcareous particles), globular or slightly oval and have, according to the different species a diameter of 1 to 2 mm. The shells of new born animals (embryonic shells) are 2 to 3 whorls high. When species are ovoviviparous, it is possible to find embryonic shells in the parent shells long after their death, e.g. in museum specimens (LOOSJES & LOOSJES-VAN BEMMEL, 1949). The duration of life of *Clausiliidae* is rather long (LOOSJES, 1941 and 1946), up to ten years. I have been keeping living specimens of South-Eastern Asiatic species for several years. The food probably consists of algae and fungi and in some species perhaps now and then of higher plants too, living or decaying (DEGNER, 1950).

A number of the snails, received alive, were kept and bred in petri-dishes with soil, decaying leaves and limestone. Other specimens were

fixed after extending them by killing in boiled water with some menthol-crystals. I found that it is much more difficult to kill *Clausiliidae* by this method than other snail-families. Often they seem to be dead, but when transferred to alcohol (often also spontaneously) they suddenly retire into their shells. Fixation is effected in 60 per cent alcohol, in which they can also be preserved (FORCART, 1940). The dissection was carried out in a waxbasin under water with the help of the binocular-microscope. Organs and ducts are kept apart and fastened by means of very small pins. After having been hardened in 96 per cent alcohol and passed through absolute alcohol, they may be mounted on slides in canada-balsam.

III. CHRONOLOGICAL SURVEY OF THE MOST IMPORTANT LITERATURE.

1805 DRAPARNAUD: *Clausilia* nov. genus.
Animal: „Corps grêle, tortillon très allongé. Trachée saillante et tube conique court qui est reçu dans la gouttière de la columelle". Shell: „Fusiforme; sommet grêle et obtus; péristome continu, osselet élastique en gouttière, attaché par un pédicule sur la columelle et situé dans l'intérieur de la cavité du dernier tour". The species involved had been classified before with *Helix, Pupa* or *Turbo*.

1836 BENSON described the first *Clausiliidae* species of Eastern Asia (*C. loxostoma*).

1841 PFEIFFER described the shell of the first South-Eastern Asiatic species, *C. javana*; followed by *C. corticina* and *C. orientalis* in 1842.

1846 ROSSMAESSLER argued in favour of substitution of the characters of the lamellae for the external characters of the shell, as a basis for the systematics of the *Clausiliidae*. He pleaded for a more natural system.

1850 ALBERS gave a modified system, basing himself partly on this new view. In his fourth group he summarized the Asiatic species in the diagnosis: „Testa vix rimata, anfractus ultimus basi rotundatus; lunella nulla, plica palatalis suprema distincta, elongata, ceterae obsoletae; peristoma continuum, solutum, labiatum".

1852 CHARPENTIER went even further. He took the Asiatic *Clausiliidae* known up to then, together in one group, characterized by: „Lunella nulla, rarissime obsoleta, plicae palatales plures; lamella spiralis plerumque disjuncta; anfractus ultimus appressus, basi rotundatus, testa laevigata, plus minusve solida, lutescens, vel rufo-cornea; peristoma continuum, solutum".

1855 H. & A. ADAMS. *Phaedusa* nov. subgenus.
"Shell smooth, more or less solid, yellowish or rufo-corneous; lunule none or very rarely; obsolete; spiral lamella usually disjoined; last whorl appressed, rounded at the base, peristome continuous, free".

1860 ALBERS (edited by VON MARTENS) remarked:
„Die Brüder ADAMS scheinen einfach nur den Sektionen von CHARPENTIER Namen, und zwar sinnlose, gegeben zu haben". His group 4 is now called: *Phaedusa* H. & A. ADAMS, the diagnosis is: „Lunella nulla vel obsoleta; plicae palatales plures, suprema elongata; lamella spiralis plerumque disjuncta. Testa laevigata, plus minusve solida, lutescens vel rufo-cornea, anfractu ultimo basi rotundato". Type: *Clausilia corticina* BUSCH. The brothers ADAMS had not indicated a type, the first mentioned of their group *Phaedusa* was *C. cochinchinensis* PFEIFFER.

It is a fact that the natural system was not immediately followed by many students. PFEIFFER e.g. (1877) even down to the last

volume of his Monographia Heliceorum stuck to the old view, putting related species far apart. In the mean time the study of the soft parts of the animal had begun, though not of the Asiatic specimens; thus PAASCH examined the European *Clausilia ventricosa* DRAPARNAUD already in 1845 and in 1856 A. SCHMIDT published his: „Der Geschlechtsapparat der *Stylommatophoren* in taxonomischer Hinsicht gewürdigt", in which the *Clausiliidae* are included.

1867 VON VEST studied especially the closing apparatus of "open" and "closed" shells and gave a classification based on this. Most Asiatic forms he classified with this third category „clausilium ganzrandig" under: *Phaedusa* ADAMS, with the type: *C. shanghaiensis* PFR. Other Asiatic species he classed with *Alinda*.

1867 VON MARTENS classified the then known South-Eastern Asiatic species according to the colour of the shells, viz. dark-brown and yellow species. He also gave a first survey of the species occurring in the different islands of the Indo-Australian Archipelago.

1868 A. SCHMIDT laid the stress on an equal appreciation of all the characters of the internal structure of the shell. Thus he arrived at a very elaborate system for the European species, a circular classification arranged in six fields. In this classification he already took into account the anatomical data, especially those of the genital apparatus.

He also gave a nomenclature for the folds that may occur in *Clausiliidae*, which is still in use except for a few minor modifications.

1873 In the original description of *Ph. penangensis*, STOLICZKA already gave some data on the anatomical structure.

1877 O. BOETTGER gave a further classification of the *Clausiliidae*. The then known species, of the area studied by me, he brought, with all the other Asiatic species, under his section 19: *Phaedusa* H. & A. ADAMS. This he subdivided into nine groups, each composed of a number of „Formenkreise". Thus he was the first to give an elaborate classification of the Asiatic species. Later (1899) he gave some additions.

1878 KOBELT and later VON MARTENS (1891) and COOKE (1892 and 1915) gave a survey of the species found in each island of the Archipelago.

1893 WIEGMANN investigated the anatomy of a couple of forms of the area studied by me, viz. *Euphaedusa cumingiana moluccensis* (the mandibula and the radula) and *Pseudonenia gracilenta*, n.nom. for *Ps. obesa* var. *gracilior* (radula, alimentary tract, gonads, nervous system, excretive organs). This is one of the few occasions on which anatomical results on the *Clausiliidae* living in the Indo-Australian territory have become known.

1920 WAGNER drew up a system, based mainly on the anatomical characters. As the latter are still very incomplete for the Asiatic species, his system is very unsatisfactory yet. This is also due to his distributing forms from the old existing groups over new groups quite arbitrarily.

1923 KENNARD and WOODWARD, and after them LINDHOLM (1924), ap-

plied WAGNER's discoveries more cautiously and thus gave two new surveys, in which the old views were maintained, whenever there was no conclusive reason for modification. They also applied the rules of nomenclature, against which WAGNER had offended quite a few times.

1927 EHRMANN joined them with a critical examination of the system of the Asiatic *Clausiliidae*.

1933 Finally THIELE drew up a system, which is followed nowadays in its main lines. It is based on the structure of the genital organs and of the shell. When discussing my conclusions, I shall go into this system further.

DEALING MAINLY WITH THE SYSTEMATICS ARE [1]):

ADAMS, 1855; ALBERS, 1850, 1860; ALDRICH, **1889**; BOETTGER, 1877, 1878a, 1878b, 1879, **1890a**, 1890b, 1899; ASHINGTON BULLEN, 1906; CHARPENTIER, 1852; CROSSE, 1879; DEGNER, **1928**; EHRMANN, 1927; GUDE, **1914**; HAAS, **1912**; JOUSSEAUME, 1900; VAN BENTHEM JUTTING, 1941b; KENNARD & WOODWARD, 1923; KOBELT, **1896**; KÜSTER, **1847**; LAIDLAW, **1929**, **1931**; LINDHOLM, 1924, 1925; VON MARTENS, **1864a**, **1864b**, **1867**, **1892**, **1903**, 1908; VON MOELLENDORFF, **1882**, **1891a**, **1894**, **1896**, **1897**; DE MORGAN, **1885**; MOUSSON, 1848, **1849**; PEILE, 1925; PFEIFFER, **1841**, **1842**, **1845**, 1846, 1848, 1849, 1853, **1854**, 1855, 1859, 1868, 1877; PFEIFFER & ZELEBOR, **1867**; RENSCH, 1932; SARASIN, **1899**; SMITH, **1896a**, **1896b**; STOLICZKA, **1873**; SYKES, **1893**, **1894**, **1897**, 1899, **1902**; TAPPARONE CANEFRI, **1883**; THIELE, 1929—1935; TOMLIN, **1939**; VON VEST, 1867; WAGNER, 1919—1920; ZILCH, **1949**.

DATA ON THE DISTRIBUTION AND LOCALITIES ARE PROVIDED BY

ALDRICH, 1889, 1898; GODWIN AUSTEN, 1895; BOCK, 1881; BOETTGER, 1890a, 1890b; BOLLINGER, 1918; ASHINGTON BULLEN, 1906; COLLINGE, 1902, 1903; COOKE, 1892, 1915; CROSSE, 1879; FAUSTINO, 1830; FULTON, 1898; VAN HASSELT, 1824; HIDALGO, 1888; ISSEL, 1874; VAN BENTHEM JUTTING, 1925, 1929, 1941a, 1941b, 1949; KOBELT, 1878, 1896, 1897; LAIDLAW, 1932; LESCHKE, 1914; VON MARTENS, 1863, 1867, 1872, 1892; VON MOELLENDORFF, 1886, 1891a, 1891b, 1896, 1897, 1898, 1902; DE MORGAN, 1885; MOUSSON, 1848, 1849; NEVILL, 1878, 1881; PARAVICINI, 1935a, 1935b; RENSCH, 1932, 1934, 1935; ROLLE, 1908; SARASIN, 1899, 1901; SMITH, 1896a, 1896c; SYKES, 1893, 1894, 1897, 1902; TAPPARONE CANEFRI, 1883; WOODS, 1888; ZOLLINGER, 1860.

STUDIES ON THE ANATOMY, RADULA, ETC. WERE PUBLISHED BY:

RENSCH, 1932; STOLICZKA, 1873 and WIEGMANN, 1893.

[1]) Whenever new species or varieties are described, the year of publication has been printed in bold type.

IV. SYSTEMATIC ACCOUNT OF THE INDO-AUSTRALIAN PHAEDUSINAE.

List of the species and subspecies.
Type-specimens (holotypes or syntypes) studied by me, are marked with an asterisk.

Phylum *Mollusca*
Classis *Gastropoda*
Subclassis *Pulmonata*
Ordo *Stylommatophora*
Familia *Clausiliidae*
Subfamilia *Phaedusinae*

Genus *Phaedusa* H. & A. ADAMS
Sectio *Phaedusa* H. & A. ADAMS
Phaedusa corticina corticina (L. PFEIFFER)
* *Phaedusa corticina batuensis* n.subsp.
Phaedusa corticina nicobarica (GUDE)
* *Phaedusa borneensis* (L. PFEIFFER)
* *Phaedusa dorsoplicata* n.sp.
* *Phaedusa pahangensis* (LAIDLAW)
* *Phaedusa lucens* n.sp.
Phaedusa filicostata filicostata (STOLICZKA)
Phaedusa filicostata tenuicosta (NEVILL)
* *Phaedusa filicostata compressa* n.subsp.
Phaedusa filicostata kapayanensis (DE MORGAN)
* *Phaedusa filicostata musangensis* n.subsp.
* *Phaedusa filicostata filialis* (VON MARTENS)
* *Phaedusa kelantanensis* (SYKES)

Genus *Pseudonenia* O. BOETTGER
Sectio *Pseudonenia* O. BOETTGER
Pseudonenia javana (L. PFEIFFER)
Pseudonenia obesa obesa (VON MARTENS)
* *Pseudonenia obesa salacana* (O. BOETTGER)
* *Pseudonenia aenigmatica* (SYKES)
* *Pseudonenia gracilenta* n.nom.
* *Pseudonenia scalariformis* n.sp.
* *Pseudonenia suluana* (VON MOELLENDORFF)
Pseudonenia sumatrana (VON MARTENS)
Pseudonenia penangensis penangensis (STOLICZKA)
* *Pseudonenia penangensis orites* (LAIDLAW)
Pseudonenia abbreviata (VON MARTENS)
* *Pseudonenia vicaria* (O. BOETTGER)
* *Pseudonenia brachyptycta* n.sp.
Pseudonenia mentaweiensis (EHRMANN)
* *Pseudonenia jacobsoni* n.sp.

Sectio *Oospira* BLANFORD

* *Pseudonenia johorensis* (TOMLIN)

Genus *Euphaedusa* O. BOETTGER

* *Euphaedusa cumingiana cumingiana* (L. PFEIFFER)
* *Euphaedusa cumingiana moluccensis* (VON MARTENS)
* *Euphaedusa cumingiana simillima* (SMITH)
* *Euphaedusa cumingiana recondita* (SYKES)
Euphaedusa alternata (VON MOELLENDORFF)

Genus *Paraphaedusa* O. BOETTGER

* *Paraphaedusa subpolita* (SMITH)
* *Paraphaedusa celebensis* (SMITH)
* *Paraphaedusa usitata usitata* (SMITH)
* *Paraphaedusa usitata tjambensis* EHRMANN
* *Paraphaedusa bonthainensis* (P. & F. SARASIN)
* *Paraphaedusa minahassae* (P. & F. SARASIN)
* *Paraphaedusa makassarensis* (SYKES)
* *Paraphaedusa pyrrha* (SYKES)
* *Paraphaedusa schwaneri* (VON MARTENS)

Genus *Acrophaedusa* O. BOETTGER

Acrophaedusa cornea (PHILIPPI)
* *Acrophaedusa thrausta* n.sp.
Acrophaedusa orientalis (L. PFEIFFER)
Acrophaedusa junghuhni (PHILIPPI)
* *Acrophaedusa schepmani* (VON MOELLENDORFF)
Acrophaedusa alticola (VON MARTENS)
* *Acrophaedusa fruhstorferi* (VON MOELLENDORFF)
* *Acrophaedusa nubigena* (VON MOELLENDORFF)
* *Acrophaedusa wuellerstorfi* (ZELEBOR)

Genus *Hemiphaedusa* O. BOETTGER

Hemiphaedusa excurrens (VON MARTENS)

The relations of these genera and sectiones are dealt with in Chapter V.

KEY TO THE GENERA OF THE INDO-AUSTRALIAN REGION.

1. shell with a distinct lunella on the right; lamella inferior dorsally or laterodorsally not very high; clausilium with the plate regularly tapering down to the pedicle ..... **Hemiphaedusa** O. BOETTGER (p. 182)

— shell without lunella or, if a more or less distinct lunella is visible, the lamella inferior is dorsally or laterodorsally exceedingly high and the plate of the clausilium is distinctly notched at the columellar side, where it merges into the pedicle ..... 2.

2. lamella inferior dorsally or laterodorsally exceedingly high, there may be a lunella, clausilium notched at the columellar side, where the pedicle joins the plate .....
Paraphaedusa O. BOETTGER (p. 122)

— lamella inferior not exceedingly high, no lunella, clausilium not distinctly notched at the columellar side ..... 3.

3. more or less distinct papillae are present along the suture, the lamella subcolumellaris is not visible in a front view of the aperture; if papillae are not present, the shell is smaller than 12 mm .....
Euphaedusa O. BOETTGER (p. 105)

— no papillae, but if papillae are present the lamella subcolumellaris is visible in a front view of the aperture; shell longer than 12 mm ... 4.

4. shell provided with transverse wavy striae, which may present a more or less granular appearance, lamella superior usually not connected with the lamella spiralis ; below the plica principalis are an upper and a lower plica palatalis and between these one or more small parallel plicae, sometimes partly situated in a callous patch, which is most distinct in its lowest parts ; clausilium with a broad plate, broadest at $^1/_3$ from the top; ovoviviparous .....
Phaedusa H. & A. ADAMS (p. 15).

— the transverse striae are straight, lamella superior continuous with the lamella spiralis ; most often one or more (3—8) fairly long plicae lie below the upper palatal plica, the lowest is usually one of the smallest ; plate of the clausilium usually tongue-shaped, with almost parallel sides ..... 5.

5. lateral outlines of the usually horn-coloured shell concave, because of a small cylindric top ; if the shell is brown (this refers to *A. nubigena* only), the palatal plicae are distributed irregularly over the height of the whorl concerned, in such a way that no plicae occur in the centre of the whorl; aperture not trumpet-like .....
Acrophaedusa O. BOETTGER (p. 147)[1])

— lateral outlines of the usually brown shell convex or straight, top of the shell often obtuse, palatal plicae rather regularly distributed over the height of the last whorl .....
Pseudonenia O. BOETTGER (p. 56)[2])

[1]) compare also *Pseudonenia brachyptycta* n. sp., (p. 97).
[2]) compare also *Acrophaedusa wuellerstorfi* (Zel.) (p. 178).

Genus **PHAEDUSA** H. & A. ADAMS, 1855

1855 ADAMS, p. 184
1860 ALBERS, p. 274
1877 BOETTGER, p. 54
1920 WAGNER, p. 6
1927 EHRMANN, p. 32

Shell often large and fairly solid, spire with convex to straight lateral outlines. Lamella inferior not very high in its dorsal or dorso-lateral part. Below the principal plica is a distinct upper palatal plica, the lunella is replaced by a few to many small parallel plicae. In the middle of the whorl they are very small or entirely absent. Duct of the receptaculum seminis with an appendix. Probably all the species of the genus are viviparous.

Type-species: *Phaedusa corticina* (L. PFEIFFER), designated by ALBERS, 1860, p. 274.

Distribution: Eastern and South-Eastern Asia.

ONLY ONE SECTION IN THE INDO-AUSTRALIAN REGION.

Sectio **Phaedusa** H. & A. ADAMS 1855

The shell is sculptured with transverse wavy striae, which may be especially distinct on the neck. The inner end of the lamella superior is usually separated from the outer end of the lamella spiralis by a definite gap. The subcolumellar lamella is not visible in a front view of the aperture. The lower palatal plica, near the right upper angle of the aperture, is larger again than the preceding plicae; it sometimes continues outward into a callous patch, which curves upward in the direction of the row of small plicae, thus forming the lower part of a weak lunella. Clausilium with a broad plate, of which the sides, from the pedicle diverge, first quickly and later very slowly up to $^1/_3$ from the top, where the plate is broadest.

Distribution: Java and Madura, Sumatra, Borneo, Malay Peninsula.

KEY TO THE INDO-AUSTRALIAN SPECIES.

1. shell of medium size (smaller than 21.5 mm and narrower than 4.6 mm), rather delicate, greenish horn-coloured, not yellowish-brown; shining, transparent, with the exception of the neck only vaguely striated; peristomal margin white, narrow .....
   Malay Peninsula ..... **Ph. lucens** n.sp. (p. 35)

— shell not shining, at best glossy, not greenish- but yellowish-brown or violet-brown horn-coloured ..... 2.

2. shell smaller than 19 mm, rather slender (l/d more than 4.8), glossy,

peristome not very broad or expanded; shells with a connection between lamella superior and lamella spiralis may occur .....
Borneo ..... **Ph. dorsoplicata** n.sp. (p. 31)

— shell without this combination of characters ..... 3.

3. shell smaller than 20 mm, consisting of at most 10 whorls, rather ventricose (l/d less than 4.8), striation rather rough, about 10 striae to the mm on the whorl above the aperture .....
Malay Peninsula ..... **Ph. pahangensis** (LAIDLAW) (p. 33)

— shell without this combination of characters ..... 4.

4. shell of medium size, 19—24 mm long, not more than 4.5 mm wide, rather slender (l/d more than 4.8); spire turreted with straight lateral outlines; top thin and pointed; densely striated, more than 15 striae to the mm on the whorl above the aperture, the striae of the strongly bent neck are also comparatively fine; aperture fairly large in comparison to the shell and regularly rounded .....
Borneo ..... **Ph. borneensis** (PFEIFFER) (p. 28)

— shell without this combination of characters ..... 5.

5. shell more than 21.5 mm long and more than 4.3 mm wide; spire often with convex lateral outlines, top stout and rather blunt; striation rather rough .....
Java and Madura, Sumatra, Batu Islands, Nicobar Island...
.....**Ph. corticina** (PFEIFFER) (p. 16)

— shell without this combination of characters..... 6.

6. shell large, more than 29 mm long and more than 5 mm wide; spire turreted, with straight lateral outlines; top, consisting of the rather broad, blunt embryonic shell, distinctly narrower than the following whorl; colour of the shell violet-brown.....
Malay Peninsula ..... **Ph. kelantanensis** (SYKES) (p. 53)

— shell of medium size or large; spire more or less turreted with straight lateral outlines; the top, consisting of a rather small pointed embryonic shell, may be definitely narrower than the following whorl; striae definitely coarser on the back of the last whorl, peristome white, reflexed and often fairly broad; yellow to yellowish-brown horn-coloured.....
Borneo, Malay Peninsula ..... **Ph. filicostata** (STOLICZKA) (p. 38)

Phaedusa corticina (L. PFEIFFER, 1842)

KEY TO THE SUBSPECIES.

1. shell large, longer than 28 mm and wider than 5 mm; distinctly but not roughly striated.....
Batu Islands ..... **Ph. c. batuensis** n.subsp. (p. 24)

— shell smaller or narrower.....

2. shell rather short and wide, glossy, distinctly but not roughly striated.....
Nicobar Islands ..... **Ph. c. nicobarica** (GUDE) (p. 25)

— shell, if short and wide, still roughly striated, not glossy.....
Java and Madura, Sumatra .....
..... **Ph. c. corticina** (PFEIFFER) (p. 17)

Phaedusa corticina corticina (L. PFEIFFER, 1842)
(fig. 1)

1842 PFEIFFER, p. 60 (*Clausilia corticina*)
1847 KÜSTER, p. 26, pl. 2, fig. 24, 25 (*Clausilia corticina*)
1848 PFEIFFER, p. 404 (*Clausilia corticina*)
1855 ADAMS, p. 184 (*Clausilia corticina*, subgenus *Phaedusa*)
1867 VON MARTENS, p. 381 (*Clausilia corticina*, group *Phaedusa*)
1877 BOETTGER, p. 61 (*Clausilia corticina*, sectio *Phaedusa*, group *Pseudonenia*, "Formenkreis" of *javana* PFR.)
1892 COOKE, p. 468 (*Clausilia corticina*)
1906 BULLEN, p. 13 (*Clausilia* (*Phaedusa*) *corticina*)
1914 LESCHKE, p. 238 (*Phaedusa corticina*)
1915 COOKE, p. 265 (*Pseudonenia corticina*)
1929 VAN BENTHEM JUTTING, p. 81 (*Phaedusa corticina*)
1935 PARAVICINI, p. 61 (*Phaedusa corticina*)
1941 VAN BENTHEM JUTTING, p. 297 (*Phaedusa corticina*).

DESCRIPTION of the material. Shell of medium to large size, more or less fusiform, solid; purplish- to yellowish-brown, usually not glossy, not transparent. Spire thick, with convex or, rarely, straight lateral outlines. Whorls 9 to 12, nearly always 9½ to 10½, slightly convex, sculptured with numerous transverse wavy striae (about 10 to 15 to the mm on the whorl above the aperture), which are definitely coarser and stand much wider apart on the neck. A distinct, often light coloured thread runs along the shallow suture at the upper side of the lower whorls. Nuclear whorls 2 to 2½, almost smooth, they form a stout and rather blunt top. In a side view the neck slowly runs down to the base of the aperture, so the neck is not swollen dorsally, but more or less flat. Aperture broad, quadrangular egg-shaped, yellowish-brown within. The sinulus is separated only by the lamella superior. Because of the protruding lower margin of the peristome, the aperture lies as a whole in a vertical plane, parallel with the axis of the shell. The peristome is continuous, whitish, broadly reflexed, the upper margin is clear or almost clear of the preceding whorl. In the place where the lamella superior reaches the peristome, the latter is not distinctly curved. From the sinulus the outer peristomal edge bends regularly down, whereas at the parieto-columellar side of the sinulus the edge first slowly descends to the right before it runs straight down.
Lamella superior of moderate height, reaching the margin, its inner end approaches the lamella inferior and is often separated from the

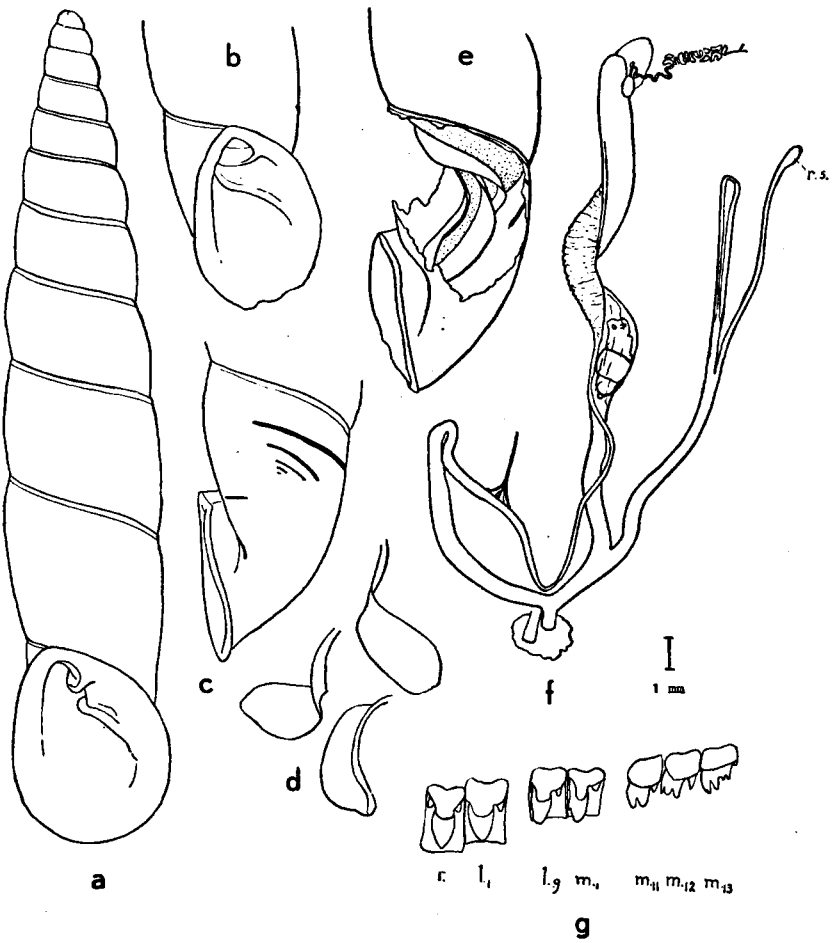

Fig. 1. **Phaedusa corticina corticina** (L. PFEIFFER)
Loc. Sumatra, Padang Highlands, Kalung, Tilatang.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell ; **d.** 3 views of the clausilium ; **e.** right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, a part of the principal plica is still visible ; **f.** reproductive organs, there is a young animal with the embryonic shell in the uterus ; **g.** some elements of the radula (× 390).

lamella spiralis by a large gap. The lamella spiralis begins somewhere between the lateral left and the dorsal side; it does not lie in a direct line with the lamella superior but more to the palatal side. It runs inward as a high lamella and ends rather abruptly in a ventro-lateral position at the left side of the shell. Lamella inferior is seen in the aperture, first as a low fold, not reaching the end of the peristome. Halfway up the visible part of the columella, in a full front view of the aperture, it increases in height so much that the margin runs horizontally; afterwards it ascends steeply inward. Looking into the aperture from below, it is possible to see the inner side of the base of this lamella; sometimes it is even

possible to see the lamella subcolumellaris in this way. The lamella inferior decreases gradually in height when it has passed the dorsal side; it ends somewhat beyond the end of the lamella spiralis or together with it. Lamella subcolumellaris is not visible in the aperture in a full front view; it begins just behind the lamella inferior, ascends rather straight as a high lamella and ends inward in about the same place as the lamella inferior.

The closing apparatus lies in a lateral position at the right side. The plica palatalis principalis runs from the dorsal to the right side or somewhat beyond it, so it is ¼ to ⅜ or almost a half whorl long. Below the principal plica there are about 3 to 6 palatal plicae, diminishing in size downward, the upper 2 to 5 above the middle of the whorl, the lower 1 or 2 below it; in the middle of the whorl they are always completely absent. The upper one is about half as long as the plica palatalis principalis. The lowest one, near the peristome, is always present and larger again than the preceding ones. This lower plica may lie in a callous patch, which curves upward in the direction of the row of upper plicae. Below the lowest plica lies the outer end of the lamella subcolumellaris. It is often impossible to see these plicae through the shell. This explains why some previous authors recorded only a few palatal folds or even none at all. The clausilium is broad and strongly curved at one third from the top of the plate, the plate too is broadest there, the sides diverge from the shaft up to that point. The top of the plate is somewhat thickened. Its dimensions are roughly: length 3.2 mm, width 1.8 mm. The clausilium has never been described before.

Length of the shells: 21.9 to 31.2 mm, diam. 4.3 to 5.6 mm; aperture: height 5.1 to 7.3 mm, width 4.0 to 5.4 mm. More than 200 specimens were measured, the averages are: shell: length 25.9 mm, diam. 5.0 mm; aperture: height 6.2 mm, width 4.6 mm.

The ventrosity of the shells, length/diam. varies from 4.4 to 6.3, the average being 5.3.

I do not know where PFEIFFER's type-specimens are preserved, they are not in the VON DEM BUSCH collection, although PFEIFFER and KÜSTER referred to him. In the first description of 1842 PFEIFFER gave the following dimensions: „long. 24, diam. 5½ mill." Later on, in 1848, he recorded: „long. 24—27, diam. 5—5½ mill. Ap. 7 mill. longa, 5 lata".

PFEIFFER (1842) described: „*Clausilia corticina* V. D. BUSCH" without any further indication. The original set came from WINTER. In 1848 PFEIFFER recorded: „*Clausilia corticina* V. D. BUSCH mss.", and not: „V. D. BUSCH in PFEIFFER". Besides he mentioned his own original publication separately. Although since then VON DEM BUSCH has always been regarded as the author, this is not correct according to my opinion, as there is nothing to prove that the description is indeed by VON DEM BUSCH, which is essential, if we want to regard him as the author (International Rules of Zoological Nomenclature, Article 21).

PFEIFFER in his original description stated that the plicae were lacking ("plicis palatalibus nullis"). KÜSTER (1847) spoke of „plica palatalis una, longa". In 1848 PFEIFFER supplemented his diagnosis by speaking of "plicae palatales sub 2 profundae". VON MARTENS (1867) did not give a clearer picture of this species by stressing, in contrast to *Pseudonenia javana* PFR. the fact that it is: „schärfer gestreift, ohne Körnelung"

(more sharply striated, without granulation). This "granulation", in my opinion better defined as "wavy striation", is especially clear on the neck, but is absent however in *Ps. javana*. Of the latter species VON MARTENS said incorrectly: „Der Rücken des letzten Umganges gerunzelt und fein körnig" (p. 380) (the back of the last whorl wrinkled and with fine granulations). Repeating PFEIFFER he continued: „nur 1—2 Gaumenfalten" (only 1—2 plicae palatales). Difficulties also arose in distinguishing between *Ph. corticina* and *Ps. javana*. BOETTGER (1877) brought them together in one group, *Pseudonenia* (type *Ps. javana*) and enumerated some characters, which fit *Ph. corticina* better than *Ps. javana*. In 1877 he had not yet seen *Ph. corticina*. Afterwards (1890) he arrived at the correct conclusions (see p. 62). I often found specimens of *Ph. corticina* and *Ps. javana* with the label *javana* PFR.

ANATOMY. Live specimens from West Java were put at my disposal by Dr. M. A. LIEFTINCK and Mr. A. C. V. VAN BEMMEL.

The snails themselves are blackish, the foot sole is grey, the upper tentacles are fawn-coloured with a black eyespot (vide photo 1). The formula of the radula is:

about $120 \times \frac{1}{3} + \frac{9}{2} + \frac{13}{3-\infty}$, i.e. about 120 rows, each row consisting of a central or rhachidian tooth with 3 cusps and to each side 9 lateral teeth with 2 cusps and 13 marginal teeth with 3 to many cusps. The teeth, cusps and basal plates are as usual in *Clausiliidae*.

Genital organs. *Ph. corticina* possesses a moderately long appendix or diverticulum to the duct of the receptaculum seminis; it has no further special appendages. The retractor and the nerve of the left upper tentacle pass between the penis and the vagina. The dimensions (rounded off to mm) of some ducts and organs, taken from a snail with a shell of 25 mm length and 5 mm width, are: penis 9 mm, epiphallus to retractor muscle 3 mm, vas deferens 10 mm, prostate and uterus 12 mm, vagina as far as the orifice of the duct of the receptaculum seminis 3 mm, from this point to the uterus 4 mm,duct of the receptaculum seminis to the attachment of the appendix 8 mm, from there to the end of the receptacle 7 mm, length of the appendix 6 mm. The duct of the receptaculum seminis and the appendix lie close against the prostate and the uterus.

In the uterus of some specimens embryos were found, provided with shells, still enveloped in membranes, with the foot or the top of the shell towards the vagina. On that spot the wall of the uterus was very thin. I found up to 6 embryos together in one specimen, the outer, proximal ones with distinct shells, the distal ones still in the egg stage. This proves that no eggs are laid, but that they continue their development in the uterus, so that young snails are born with embryonic shells of $\pm 2\frac{1}{2}$ whorls. This happened indeed in my breeding-dishes (large petri-dishes, containing earth, limestone, lichens and mosses. A total number of 7 young snails were born.

DISTRIBUTION: Java and Madura, Sumatra.

Type-locality: Java.

Clausilia corticina was described originally as occurring in Java, without exact indication of localities. BULLEN (1906) for the first time

mentioned its existence in Sumatra (Pajakombo). He remarked: „more rugose than type". PARAVICINI (1935) also mentioned specimens from Sumatra (Solok). In a survey of the distribution of Java's land-snails in 1929, Miss VAN BENTHEM JUTTING indicated East Java more specifically as the locality. Finally in 1941 she mentioned Madura (Pamekasan, leg. P. A. OUWENS) as a locality.

H a b i t a t. The only exact date comes from Dr. M. A. LIEFTINCK and Mr. A. C. V. VAN BEMMEL, who found *Ph. corticina* on a living djambu-tree (*Eugenia malaccensis* L.) (vide photo 2). The localities are all situated, as far as known, in hilly and mountainous country, viz. from 600 to 2100 m altitude. Only one find on calcareous soil is recorded (Padalarang), while for some other localities a substratum of basic rock-formations is probable.

L o c a l i t i e s. Besides many specimens that were labelled "Java" or "Sumatra" only, I studied specimens with the following more exact indications of locality.

Madura.

Pamekasan, leg. P. A. OUWENS (Z.M.A., 4)[1]. These specimens agree with Java specimens.

dimensions (in mm): shell length	shell diam.	aperture height	aperture width	number of whorls
26.8	5.4	—[2]	—	10
26.3	5.2	6.9	4.9	10
26.5	5.2	6.2	4.9	10½
27.5	5.2	6.4	—	10½

Java.

More than 120 specimens were studied. Only the specimens labelled correctly are mentioned here in order of their localities from east to west.

East Java.

Mountains near Pasuruan, 1200—1500 m, leg. H. FRUHSTORFER, 1891 (Z.M.A., 4; S.M.F. no. 61098, 5)

	25.3—28.2	4.4—4.9	5.9—6.5	4.1—4.8	10—11
averages:	26.8	4.7	6.2	4.5	

Tengger Mountains, about 1300 m, leg. H. FRUHSTORFER, 1891 (S.M.F. no. 61097, 1)

27.3	4.6	6.4	4.5	11

Southern part of Mount Smeru, coffee plantation, 1000 m, leg. J. BETREM-WESTERMAN, 1930 (R.M.L., 1). A juvenile specimen, without any doubt belonging to this species.

West Java.

Mount Pawon, near Padalarang, 700 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 1)

—	5.0	6.6	5.0	—

Limestone hills near Padalarang, leg. L. J. M. BUTOT, 1948 (M.Z.B., 1 + 4 fragments)

27.3	4.8	6.4	4.9	10½

"Tjisarua Zuid" Estate, Mount Pangrango, on the trunk of a living tree (djambu, *Eugenia malaccensis* L.) on an open spot, 1000 m, leg. M. A. LIEFTINCK and A. C. V. VAN BEMMEL, 1950 (F. E. LOOSJES collection, 5)

25.3	5.0	6.6	5.0	10
28.0	4.7	6.4	4.8	10½
26.7	4.8	6.4	—	10
25.3	4.9	—	—	10
27.4	5.1	6.7	5.0	10½

[1]) For these characters, with or without catalogue number, see p. 3. The figure after the comma indicates the number of specimens. If there are more than 5 specimens from the same locality, only the extreme and average dimensions are given.

[2]) When no figures are given the shell was damaged.

One of the specimens was suspended from a horizontal branch at a height of 2½ m by a mucous thread of ± 1 cm length; the top of the shell hung down (VAN BEMMEL).

Bogor (K. L. PFEIFFER collection no. 9255c, 3)

31.2	4.8	6.7	4.9	12
30.4	4.9	6.9	5.2	11½
29.9	5.0	6.4	5.1	12

Mount Gedeh, 1200 m (N.M.B. no. 255a, 3) and without indication of the altitude from the same locality (S.M.F. no. 30152, 2 and K. L. PFEIFFER collection no. 2010a, 2 and no. 2010b, 2)

	25.0—26.8	4.6—5.0	5.7—6.5	4.3—5.1	10—11
averages:	26.2	4.7	6.2	4.6	

Tjirunde Estate, Mount Gedeh, in old coffee-gardens, leg. DE VRIESE, 1858 (Z.M.A., 3)

24.5	5.1	6.6	4.8	9½
24.1	5.1	—	—	10
—	5.0	—	—	—

Sukabumi, leg. E. F. JOCHIM, 1914 (R.M.L. no. 104b, 1); leg. ROUYER, 1909 (K.B.I.N., 1) and without collector (N.M.R., 2 and K. L. PFEIFFER collection no. 2023e, 2)

	25.1—27.4	4.4—5.5	6.1—6.4	4.4—4.8	10—10½
averages:	25.9	4.9	6.3	4.5	

District Sukapura, Mount Djampang, south of Sukabumi, about 1200 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61103, 1)

27.1	5.1	6.8	5.2	10½

Besides these I saw two more samples from "Java" with resp. 5 and 6 specimens. The averages were:

(Z.M.A., 5):

26.5	5.1	6.2	4.5

(B.M.L. no. 1933.3-1-82-87, 6):

27.0	4.9	6.7	4.9

The averages of all the javanese shells are:

26.3	4.9	6.1	4.5

From the samples one gets the impression that two forms of *corticina* occur in Java: a short, broad one, with somewhat coarser striae and a large aperture, this is the form that is also found in Madura; and a long narrow one with less coarse striae and with a relatively small aperture. The shells of Pasuruan e.g. clearly represent the latter form, those from Tjirunde the former. The long narrow form is a little more frequent among the material investigated than the short broad one. O. BOETTGER already mentioned the narrow form separately on the labels of the material which he identified. I cannot agree with him, however, as there are clearly intermediate forms and as I found both forms together in several samples. I don't use the name, in order to avoid unnecessary increase of the number of names.

Sumatra.

Nearly always the samples from this island come from localities of which the names are known. A total number of about 100 specimens were investigated. Going from south-east to north-west I saw material from the following localities:

Palembang Highlands, Ranau District, leg. KANNEGIETER (Z.M.A., 2; S.M.F. no. 61101, 1)

23.4	5.1	5.8	4.2	9½
25.2	4.9	5.8	4.2	11
23.3	4.9	5.9	4.0	9½

Palembang Highlands, Langkapura, leg. E. PARAVICINI, 1924 (S.M.F. no. 61141, 1)

28.1	5.1	6.9	5.2	10½

Padang Highlands, Mount Kerintji, leg. E. PARAVICINI (E. PARAVICINI collection no. 685b, 2)

26.6	5.2	6.8	5.0	10
26.5	5.3	6.8	5.0	10½

Padang Highlands, Solok, leg. E. PARAVICINI (E. PARAVICINI collection no. 683c, 9)

25.0—27.9	4.9—5.4	6.2—6.9	4.7—5.0	10—10½
averages: 26.4	5.3	6.6	4.9	

Padang Highlands, Kamang Mountains near Fort de Kock, leg. J. C. VAN DER MEER MOHR (E. PARAVICINI collection no. 685c, 11)

25.6—28.2	5.0—5.5	6.1—6.9	4.6—5.3	10½—11
averages: 26.9	5.2	6.4	4.9	

Padang Highlands, cave near Fort de Kock, leg. J. C. VAN DER MEER MOHR, 1919 (Z.M.A., 15)

25.0—28.3	4.8—5.2	5.9—6.4	4.4—4.8	10—11
averages: 26.8	5.0	6.2	4.6	

Padang Highlands, Kalung, Tilatang (R.M.L., 33 + 28 juv.)

23.2—26.5	4.9—5.5	5.6—6.5	4.0—4.9	9½—11
averages: 25.1	5.1	6.0	4.6	

Padang Highlands, Pajakombo, leg. E. F. JOCHIM, 1914 (R.M.L., 4); leg. ROUYER, 1909 (K.B.I.N., 4) and without mentioning a collector (B.M.L. no. 1906.7.21.26—29, 4)

22.5—25.0	4.9—5.5	5.9—6.7	4.6—5.2	9—10
averages: 23.9	5.1	6.2	4.8	

Padang Highlands, Mount Sago (E. PARAVICINI collection no. 685d, 3)

28.1	5.2	7.3	5.9	11
21.9	5.2	6.4	4.6	9
24.2	4.9	6.3	5.0	10

Setinjak, south-east of Tapanuli, 600 m (B.M.L. unregistered, 3)

25.4	5.3	6.6	5.0	10
25.7	5.1	6.6	5.0	10
25.8	5.2	6.9	4.9	10

When studying the Sumatra material it becomes apparent that only the short broad coarsely-striated form with relatively wide aperture, was found here. BULLEN (1906) recorded for the first known specimens from Sumatra: "more rugose than type". To judge by the dimensions, the type (of Java origin) must belong to the short broad form. It is not my impression that the short Java specimens are less heavily striated than the Sumatran form.

One wonders whether two geographical species, a Javanese and a Sumatran, are involved here.

Exact comparison of the specimens and measurements, made me decide to keep the specimens of *corticina* from Madura, Java and Sumatra in one subspecies, viz. the typical one. There is no doubt that the Javanese populations differ slightly in the presence of narrow specimens. Possibly they will develop further in this direction so that in the long run two separate subspecies may be distinguished. According to my opinion there is no reason for a subdivision as yet. A more exact labelling of the material investigated might have thrown more light on this subject showing the influence of the environment on the characters discussed.

Phaedusa corticina batuensis n. subsp.
(fig. 2)

DIAGNOSIS. Differs from subspecies *corticina* by its greater length and greater width ; whorls 11 to 12 (11½ for the holotype), the striae are less distinct but clearly wavy. The upper peristomal margin is scarcely clear of the preceding whorl, the lamellae and plicae show no peculiarities.

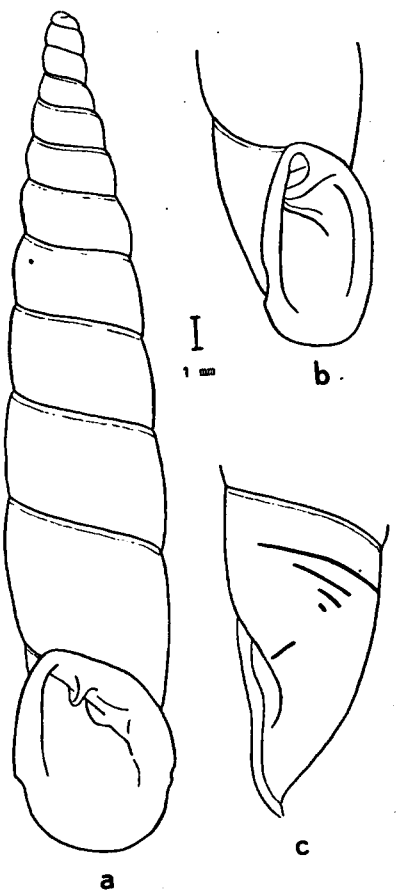

Fig. 2. **Phaedusa corticina batuensis** n.subsp.
Loc.. Batu Islands, Tanah Masa ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell.

Length of the shells: 28.1 to 31.1 mm, diam. 5.3 to 5.5 mm ; aperture : height 6.4 to 7.1 mm, width 4.7 to 5.3 mm. Only 6 specimens are available, the averages are : length of the shells 29.6 mm, diam. 5.4 mm ; aperture : height 6.9 mm, width 5.1 mm. The ventrosity of the shells, l/d = 5.2 to 5.9, the average is 5.5.

The holotype was collected at Tanah Masa Island, it is in the author's collection; its dimensions in mm are:

shell		aperture		number of whorls
length	diam.	height	width	
28.7	5.5	6.8	5.0	11½

ANATOMY unknown.

DISTRIBUTION: Batu Islands.
Type-locality: Tanah Masa Island.
Habitat, altitude and biology unknown.
Localities. Besides the holotype I studied the following sets:

Batu Islands, Tanah Masa (J. Th. HENRARD collection, 2)				
28.7	5.3	6.8	5.1	11
28.1	5.4	6.4	4.7	11
Batu Islands (S.M.F. no. 61102, 1; B.M.L. no. 1909.11.8.77—78, 2)				
31.1	5.3	7.1	5.2	12
30.2	5.5	7.1	5.2	12
30.9	5.4	7.1	5.3	12

The above data prove that 5 out of the 6 known specimens are longer than 28.5 mm. Specimens of *Ph. corticina* of such length from Sumatra are entirely unknown and among those from Java I found 12 out of a total number of 140. For the Batu Islands the width of these long specimens amounts to 5.3 to 5.5 mm, average width 5.4 mm; for Java etc. to 4.6 to 5.0 mm, average 4.8 mm. For the Batu Islands the average ventrosity of these long specimens amounts to 5.5 mm, for Java to 6.1 mm.

While, therefore, the long specimens from Java are extraordinarily slender, those from the Batu Islands on the other hand are wide. The latter might be regarded as very robust specimens of the broad form of the subspecies *corticina*, the sculpture of which is much less strongly developed.

Phaedusa corticina nicobarica (GUDE, 1914)
(fig. 3)

1882 VON MOELLENDORFF, p. 11, pl. 1, f. 12 (*Clausilia wüllerstorffi* (sic), *Phaedusa* (*Pseudonenia*), non *C. wuellerstorfi* ZELEBOR, 1867)
1895 GODWIN AUSTEN, p. 443 (*Clausilia* (*Phaedusa*) *corticina*)
1914 GUDE, p. 328, f. 114 (*Clausilia nicobarica*, subgenus *Phaedusa*, sectio *Pseudonenia*)
1925 PEILE, p. 255 (*Phaedusa nicobarica*)

DIAGNOSIS of the material. This subspecies is characterized by its less rough sculpture and strikingly glossy surface; its colour is more reddish-brown. Whorls 10 to 11. The aperture, lamellae and plicae do not show any important differences from the typical form, only the plica principalis is distinctly longer, it is quite half a whorl long. In some specimens a very weak lunella-like callous may occur.

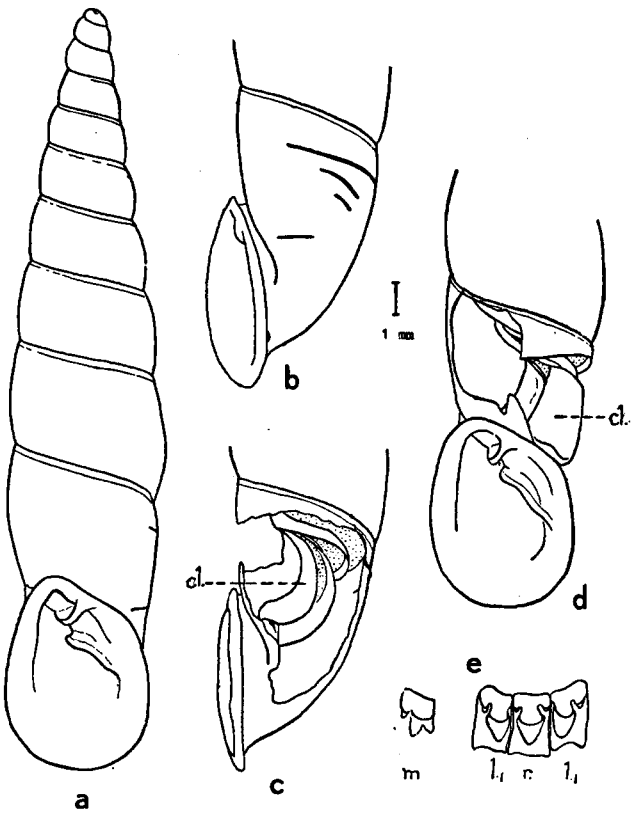

Fig. 3. **Phaedusa corticina nicobarica** (GUDE)
Loc. (**a—b**) Nicobars, Camorta
(**d—e**) Nicobars, Great Nicobar.
a. ventral side of the shell ; **b.** right side of the last whorl with the plicae seen through the shell ; **c.** right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium (cl.) is present ; **d.** ventral side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium (cl.) is present ; **e.** some elements of the radula (× 390).

I opened a specimen and found the inner structure not different from that of the subspecies *corticina*. The clausilium plate had a length of 3.0 mm and a width of 1.5 mm.

Length of the shells: 24.5 to 27.6 mm, diam. 5.0 to 5.4 mm ; aperture: height 5.9 to 6.4 mm, width 4.4 to 4.8 mm. The averages of 11 specimens are : length 25.3 mm, diam. 5.2 mm ; aperture : height 6.2 mm, width 4.6 mm. The ventrosity of the shells l/d is 4.5 to 5.3, the average is 4.9.

The holotype was described from the BEDDOME LEMAN collection. The dimensions are given by GUDE : "Long. 24.5, diam. 5.2 mm".

In his original description GUDE (1914) recorded only 2 palatal plicae, but most of the shells distinctly have more.

The history of *nicobarica* is as follows:
Von MOELLENDORFF (1882) recorded two species from the Nicobar Islands:
a. *C. wüllerstorffi* (= *Ph. nicobarica* GUDE)
b. *C. nevilliana* nov. sp. (= *Ph. wuellerstorfi* (ZELEBOR))
GODWIN AUSTEN (1895) recorded three species:
a. *C. corticina* (= *Ph. nicobarica* GUDE)
b. *C. nevilliana* (= *Ph. wuellerstorfi* (ZELEBOR))
c. *C. wüllerstorfi*
GUDE (1914) inserted the three following species from the Nicobars into his "Fauna of British India":
a. *Ph. nicobarica* n.sp.
b. *Ph. nevilliana* (= *Ph. wuellerstorfi* (ZELEBOR))
c. *Ph. wüllerstorfi*
GUDE did not identify his *Ph. nicobarica* with the *C. corticina* recorded by GODWIN AUSTEN.
PEILE (1925) pointed out that only the following two species were known from the Nicobar Islands:
a. *Ph. nicobarica* GUDE = *Ph. corticina* (GODWIN AUSTEN) = *Ph. wüllerstorffi* (sic) (VON MOELLENDORFF).
b. *Ph. wuellerstorfi* (ZELEBOR) = *Ph. nevilliana* (VON MOELLENDORFF).
It is not known whether *Ph. wuellerstorffi* (VON MOELLENDORFF) and *nicobarica* GUDE were based on the same shells.

ANATOMY. I succeeded in getting a radula of one of the animals, formula: about $170 \times \frac{1}{3} + \frac{9}{2} + \frac{20}{3-5}$.

DISTRIBUTION: Nicobar Islands: Great Nicobar and Camorta.

Type-locality: Nicobar Islands.

The type was described from "the Nicobar Islands". GODWIN AUSTEN mentioned *Ph. corticina* as occurring in Great Nicobar. PEILE also mentioned Great Nicobar.

Habitat and biology unknown.

Localities. I saw the following specimens from Great Nicobar and Camorta:

Great Nicobar (S.M.F. no. 61105, 1; B.M.L. no. 3767.03.7.1, 2 and B.M.L. no. 91.3.17.159—160, 2)

dimensions (in mm)				number of whorls
shell		aperture		
length	diam.	height	width	
25.1	5.2	6.2	4.7	10
27.6	5.2	6.4	4.5	11
24.7	5.3	6.3	4.8	10
24.8	5.3	6.3	4.6	10
25.2	5.2	6.3	4.7	11

Camorta (B.M.L. no. 4096.03.7.1, 3)

25.8	5.2	6.4	4.8	10½
25.3	5.0	6.2	4.4	10½
24.9	5.2	—	4.5	10

The kindness of Dr. A. ZILCH at Frankfort on the Main enabled me to see the late Dr. P. EHRMANN's notes on this subspecies. EHRMANN studied and measured three specimens (now destroyed) of the Hamburg Museum; he recorded:

24.5	5.4	5.9	4.4	9¾
25.2	5.0	6.0	4.6	9¾
25.2	5.2	6.1	4.4	9¾

As far as the dimensions go, the subspecies *nicobarica* agrees well with those of the subspecies *corticina* from Sumatra. It even is a little shorter and broader on an average.

Phaedusa borneensis (L. PFEIFFER, 1854)
(fig. 4)

1854 PFEIFFER, p. 296 (*Clausilia Borneensis*)
1859 PFEIFFER, p. 736 (*Clausilia Borneensis*)
1867 VON MARTENS, p. 382 (*Clausilia Borneensis*, group *Phaedusa*)
1877 BOETTGER, p. 63 (*Clausilia borneensis*, sectio *Phaedusa*, group *Formosana*, "Formenkreis" of *cochinchinensis* PFR.)
1892 COOKE, p. 468 (*Clausilia bornensis* (sic))
1915 COOKE, p. 265 (*Formosana borneensis*)

DESCRIPTION of the material (the holotype included). Shell of medium size, more or less turreted-fusiform, not very solid, purplish- to yellowish-brown, dull or moderately glossy, a little transparent. Spire slender with straight lateral outlines. Whorls 10 to 12, slightly convex, sculptured with numerous transverse, almost parallel, fine wavy striae (about 15 to 20 to the mm on the whorl above the aperture) which are usually only slightly coarser and stand only a little wider apart on the neck. A faint light-coloured thread sometimes runs along the suture at the upper side of the lower whorls (e.g. in the type). Nuclear whorls 2½ to 3, almost smooth, they form a thin and pointed apex. In a side view the neck is distinctly bent to the base of the aperture, which gives it a more or less swollen appearance (conf. *corticina*, fig. 5).

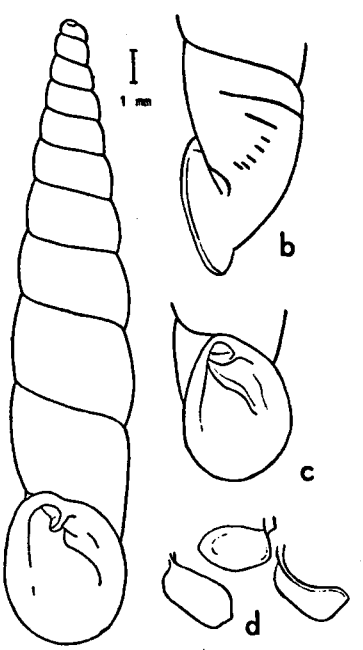

Fig. 4. **Phaedusa borneensis** (L. PFEIFFER)
Loc. Borneo, Sarawak, Mount Kawa.
a. ventral side of the shell; **b.** dorsolateral-right side of the last whorl with the plicae seen through the shell; **c.** ventrolateral-left side of the last whorl; **d.** 3 views of the clausilium.

Aperture broad, quadrangularly rounded, egg-shaped, yellowish-brown within, the sinulus is only separated by the lamella superior. The aperture lies on the whole in a vertical plane, almost parallel with the axis of the shell. The peristome is continuous, thin, white, broadly reflexed; the upper margin is clear of the preceding whorl; it is not bent in the place where it is touched by the superior lamella. From the sinulus the outer peristomal edge rapidly descends, curved slightly outwards. At the columellar side, the edge descends rather slowly and regularly rounded.

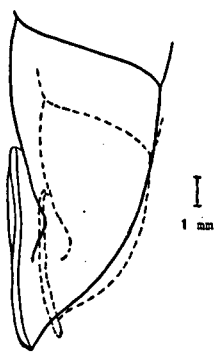

Fig. 5. Comparison of the swollen "neck" of the shell of *Ph. borneensis* (dotted line) with the flat one of *Ph. c. corticina*.

Lamella superior of moderate height, not always reaching the margin; its inner end is clear of the lamella spiralis and approaches the lamella inferior. The outer end of the lamella spiralis at best reaches the left side of the last whorl, lying distinctly nearer to the suture than the lamella superior. The spiral lamella runs inward as a high fold and ends between the ventral and the left side of the previous whorl, almost over the sinulus. Lamella inferior is seen in the aperture as a low ridge; it hardly reaches the peristome halfway up the columellar side. When disappearing into the aperture it increases in height so much that its edge runs almost horizontal. In a dorsal position this edge ascends rather steeply, it ends almost together with lamella spiralis and lamella subcolumellaris ventrolaterally at the left side. Looking into the aperture it is not or hardly possible to see the inner side of the base of the inferior lamella. Lamella subcolumellaris is scarcely visible when we look from below and from the left into the aperture. It ascends rather straight.
The closing apparatus lies at the right side, sometimes a little to the dorsal side. The plica palatalis principalis runs from beyond the dorsal side to the right side. It is about ⅜ to ½ whorl long. Below it we count 5 tot 9 almost parallel palatal plicae, of which the upper one or two (just below the principalis) and the lower one (somewhat above the end of the lamella subcolumellaris) are longest. A lunella-like callous may be present in which the small plicae are included. In the middle of the whorl the plicae are extremely short or entirely absent. Below the lowest at the right side of the umbilicus the outer end of the lamella subcolumellaris may be seen through the shell. The plate of the clausilium, which has never been described before, is strongly curved at one

third from the top; the sides of the plate diverge from the pedicle up to about the same place, so the plate is broadest there. The top of the plate is slightly thickened. The dimensions of the plate are: length 2.5, width 1.4 mm.

Length of the shells: 19.6 to 23.1 mm, diam. 3.7 to 4.4 mm; aperture: height 4.4 to 5.4 mm, width 3.5 to 4.2 mm. I studied 25 specimens, the averages are: shell: length 21.2, diam. 4.0 mm; aperture: height 4.9, width 3.9 mm. The ventrosity of the shells, l/d is 4.9 to 5.6, the average is 5.2.

The holotype measures (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21.5	4.2	4.7	3.9	11

PFEIFFER described the species after a shell in the CUMING collection. This holotype is now in the British Museum (Nat. Hist.). In his first description PFEIFFER (1854) recorded: "long. 22, diam. 4½ mill.". Later on (1859) he mentioned: "long. 22, diam. 4½ mill. Ap. 5 mill. longa, 4 lata".

PFEIFFER's descriptions of 1854 and 1859 give the same figures. VON MARTENS (1867) gave some supplementary data. BOETTGER (1877) put the species in his group *Formosana,* in the "Formenkreis" of *C. cochinchinensis.* The similarity with *Ph. corticina* PFR. is so evident, however, that I don't hesitate to consider these two species very closely related. This is not the only case in which there has been or still is uncertainty whether a form should be classed with *Phaedusa* or with *Formosana* (subgenus of *Hemiphaedusa*). The similarity between these two groups is very great, at least in some characters (vide e.g. EHRMANN 1927 and LOOSJES 1948).

The differences between *Ph. corticina* and *Ph. borneensis* are: *borneensis* is smaller, more turreted, more delicately striated, the thread along the suture is often absent, basally the neck is distinctly more curved, the closing apparatus is sometimes situated a little more dorsally than in corticina.

ANATOMY unknown.

DISTRIBUTION: Sarawak and North Borneo.

Type-locality: Sarawak.

Phaedusa borneensis has been described from Sarawak without any further indication of locality.

Habitat. The species has been found on limestone several times.

Biology unknown.

Localities: Besides the type I saw sets from the following localities:

Sarawak, Niah, leg. A. EVERETT (B.M.L. no. 4075.03.7.1, 6)[1])

	20.4—22.2	3.8—4.3	4.4—5.3	3.5—4.1	10—11
averages:	21.2	4.1	4.9	3.8	

Sarawak, Niah, on limestone (B.M.L. from the COOKE collection, 1)

23.1	4.4	5.4	4.2	11

[1]) vide note on p. 21.

Sarawak Mount Kawa, limestone hills in the Bau district near Kuching, leg. M. W. F. TWEEDIE. 1949 (R.M.S., 11 + 4 fragments)

	19.6—22.0	3.7—4.1	4.4—5.1	3.7—4.1	11—11½
averages:	20.8	4.0	4.8	3.8	

North Borneo, Barit Mountains (U.S.N.M. no. 428698, 1)

21.4	4.2	4.8	3.9	12

A sample labelled "Borneo caves" contained only three fragments, leg. A. EVERETT (B.M.L. from the GODWIN AUSTEN collection).

Phaedusa dorsoplicata n.sp.
(fig. 6)

DIAGNOSIS. Shell rather small and slender, glossy, the neck looks swollen, faintly striated, except on the neck, margin of the peristome narrow, shells with lamella superior and lamella spiralis connected occur, closing apparatus dorso-lateral to about dorsal.

DESCRIPTION. Shell rather small, more or less turreted-fusiform, not very solid, purplish- to yellowish-brown, moderately glossy, slightly transparent. Spire slender, with straight lateral outlines, the first 2 to 3 whorls may form a separate little top. Whorls 11½, convex, sculptured with faint, transverse, slightly wavy striae, which become blurred in the middle of the lower whorls (about 12 to the mm) and are distinctly coarser on the neck. There is no thread running along the suture. The lowest of the nuclear whorls has a slightly "drawn out" appearance. There are nearly 3 smooth nuclear whorls. The neck is swollen as in *Ph. borneensis* PFR.

Aperture small, quadrangular egg-shaped, light-brown within, it protrudes a little. The sinulus is formed by the lamella superior and by the slightly curved upper peristomal margin, which bends upward to the left, after contact with the lamella superior. The basal peristomal margin lies a little backward, so the plane in which the margin of the aperture lies is not completely vertical. The peristome is continuous, white, rather thick and narrowly reflexed; the upper margin is clear of the preceding whorl, it is slightly bent on the spot where the lamella superior touches it. From the sinulus the outer margin curves down regularly; the parieto-columellar margin has a slight angle at the right side, before it descends. Lamella superior of moderate height, reaching the margin; it is often connected with the lamella spiralis (3, among which the holotype, out of 4 specimens). Lamella spiralis rather high, ending ventrally, together with the lamella inferior and lamella subcolumellaris. Lamella inferior, which does not touch the margin on the outside, is first seen as a low fold, later on increasing in height. Its edge turns spirally inward into the shell and ascends regularly. When looking into the aperture, it is hardly possible to see the inner side of the base of the inferior lamella. Lamella subcolumellaris may be seen behind the inferior lamella a little better than is usual in this group.

The position of the closing apparatus is dorso-lateral or almost on the dorsal side (the holotype). The plica palatalis principalis runs from the left to the right side, it is a ½ whorl long. Below it we

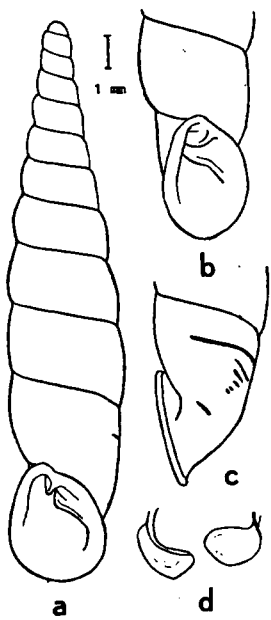

Fig. 6. **Phaedusa dorsoplicata** n.sp.
Loc. Borneo, Mount Parung ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** dorsolateral-right side of the last whorl with the plicae seen through the shell ; **d.** 2 views of the clausilium.

count up to 7 plicae palatales, situated in a white callous patch ; the upper ones and the lowest, which is near the end of the lamella subcolumellaris, are longest, but still quite small. The end of lamella subcolumellaris can be seen through the shell at the right side of the umbilicus. The clausilium is strongly curved, broadest at one third from the slightly blunt, thickened apex. Measurements : length 2.2, width 1.1 mm. Only four specimens are known.
The dimensions (in mm) of the holotype are :

shell		aperture		number of whorls
length	diam.	height	width	
18.3	3.7	3.9	2.9	11½
and those of the paratypes :				
17.3	3.4	3.4	2.4	11½
18.8	3.6	3.6	2.6	11½
18.3	3.5	3.5	2.7	11½

The ventrosity of the shells, l/d = 4.9 to 5.2, the average is 5.1.
Holotype and paratypes are preserved in the Zoological Museum, Amsterdam.

ANATOMY unknown.

DISTRIBUTION : Borneo, eastern part.
Type-locality: Mount Parung.

The locality is Mount Parung, between Tenggarong and Balik Papan, the shells were collected by Mr. VAN HOUTEN.

This species is undoubtedly closely related to *Ph. corticina*, but shows some deviations from the general type, 1. the striation hardly deserves the epithet "wavy" and 2. in three of the shells, as has been mentioned, the lamella superior and the lamella spiralis are connected. The aperture is rather small too and the peristomal margin is narrow, but this occurs more often. The external form of the shell recalls that of *cumingiana* PFR.

The occurrence of specimens with connected lamella superior and lamella spiralis together with specimens with the lamella superior and the lamella spiralis clear of each other, in one species, is not rare among the *Phaedusinae* (LOOSJES, 1950). It is not a constant character either in the European *Clausiliidae*, e.g. *Clausilia pumila* ZIEGLER and *C. plicatula* DRAPARNAUD.

Phaedusa pahangensis (LAIDLAW, 1929)
(fig. 7)

1929 LAIDLAW, p. 262 (*Clausilia pahangensis*)
1949 VAN BENTHEM JUTTING, p. 62, f. 2 (*Phaedusa pahangensis*)

DESCRIPTION of the material (the holotype included). Shell small, but comparatively wide, fusiform, rather solid, purplish- to grey-brown, dull, not transparent. Spire quickly broadening with straight or convex lateral outlines. Whorls 8½—9½, rather convex, sculptured with numerous transverse, strong, wavy striae (about 10 to the mm on the whorl above the aperture), they are but slightly coarser on the neck and are somewhat wider apart there. A distinct thread of the same colour as the shell runs below the shallow suture in most of the specimens. Nuclear whorls 2½, smooth. In a side view the neck curves regularly and slowly down to the base of the aperture. The penultimate whorl is broadest.

Aperture quadrangular, egg-shaped, light-brown within. The sinulus is separated from the rest of the aperture only by the superior lamella. The plane in which the peristome lies is curved backward basally, only the upper part runs parallel with the axis of the shell. The peristome is continuous, white, projecting and broadly reflexed; the upper margin is clear of the preceding whorl; it is not bent where it is touched by the lamella superior. The descent of the outer peristomal edge from the sinulus is almost straight; the parieto-columellar margin curves down regularly, forming ¼ of the circumference of a circle. The base of the peristome is regularly curved.

Lamella superior is of moderate height, reaching the margin; its inner end is clear of the lamella spiralis and approaches the lamella inferior. The outer end of the spiral lamella lies at the left side, to the left of the superior lamella. The lamella spiralis ascends as a high fold. Lamella inferior ends low, half way up the columellar side of the aperture; it does not reach the margin. It increases in height when curving upward into the aperture; in a full front view its edge is not completely horizontal when disappearing from sight. The inner ends of the lamellae

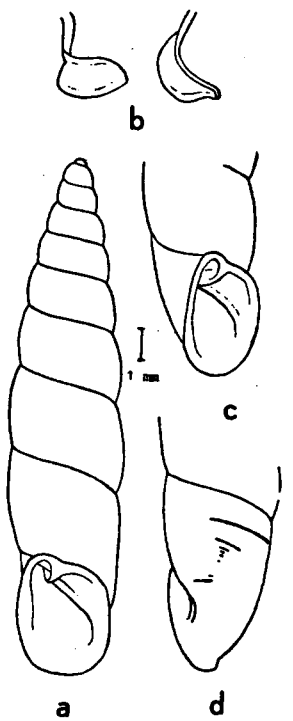

Fig. 7. **Phaedusa pahangensis** (LAIDLAW)
Loc. (**a**—**c**) Malay Peninsula, Cameron Highlands, Mount Tahan; holotype.
(**d**) Malay Peninsula, Cameron Highlands, Telom Valley near Mount Siku.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** dorsolateral-right side of the last whorl with the plicae seen through the shell; **d.** 2 views of the clausilium.

have not been studied. When looking into the aperture it is hardly possible to see the inner side of the base of the inferior lamella. Lamella subcolumellaris is not or scarcely visible when seen from below and from the left side into the aperture.

The closing apparatus lies between the dorsal and the right side. The plica palatalis principalis runs from the dorsal side to the right side; it is about ¼ whorl long. Below it we count 5 to 10 almost parallel plicae palatales. The longest are found at the top, near the plica palatalis principalis and at the bottom near the umbilicus. Between these two longer folds we find a series of small plicae, not interrupted in the middle of the whorl. Exceptionally some very small plicae occur between the principal plica and the upper palatal plica. These plicae and the end of the lamella subcolumellaris (between the lowest plica and the umbilicus) are not easily discernible through the shell. The plate of the clausilium is broadest at $^1/_3$ from the slightly thickened top. Its dimensions are: long 2.1, width 1.4 mm.

Length of the shells: 16.8 to 19.4 mm, diam. 3.7 to 4.5 mm; aperture: height 3.8 to 4.9 mm, width 3.0 to 3.8 mm. Ten specimens were measured, the averages are: shell: length 18.3, diam. 4.3 mm; aperture: height 4.6, width 3.5 mm. The ventrosity of the shells, l/d = 4.0 to 4.6, the average is 4.3.

LAIDLAW's holotype is in the British Museum (Nat. Hist.) (no. 1930. 8.29.1, 1).
dimensions (in mm)

shell		aperture		number of whorls
length	diam.	height	width	
17.0	3.7	3.8	3.0	8½
LAIDLAW recorded:				
16.5	3.75	3.75	3.25	8½

In his description LAIDLAW did not mention more than 3 plicae palatales below the principalis. He compared his shell to *Acrophaedusa cornea* PHIL. from Java, which is certainly not correct. Relationship with *Ph. filicostata* STOL. on the other hand is clear (vide p. 38).

ANATOMY unknown.

DISTRIBUTION: Malay Peninsula, Western Pahang, Cameron Highlands.
Type-locality: Mount Tahan.
The type-locality is Mount Tahan, near the frontier of Pahang-Kelantan, 1300 m, Padang Sebrang, jungle. In 1949 Miss VAN BENTHEM JUTTING mentioned three other localities: Telom Valley, near Mount Siku, 1500 m; Mount Brinchang, 1500—1800 m and Kuala Terla, Telom Valley, 1300—1700 m. She gave a figure of the clausilium of a specimen from Mount Siku.
Habitat and biology unknown.
Localities: Besides the holotype I saw specimens from the following localities, all in the Cameron Highlands.

Telom Valley, near Mount Siku, 1500 m, 1935 (Z.M.A., 3 and R.M.S., 5)[1])

	18.2—19.4	4.2—4.5	4.7—4.9	3.4—3.8	9
averages:	18.6	4.4	4.8	3.5	

Mount Brinchang, 1500—1800 m, 1935 (R.M.S., 1)

16.8	4.2	4.5	3.5	9

Kuala Terla, Telom Valley, 1300—1700 m, 1935 (R.M.S., 1)

18.4	4.2	4.5	3.5	9½

Phaedusa lucens n.sp.
(fig. 8)

DIAGNOSIS. Shell of medium size, rather delicate, greenish-horn-coloured, shining, transparent, with the exception of the neck only vaguely striated; margin of the peristome narrow; closing apparatus dorso-lateral.

DESCRIPTION. Shell of medium size, more or less turreted-fusiform, delicate, greenish, horn-coloured, shining, transparent. Spire slender with straight lateral outlines. Whorls 9½ to 11, mostly 10 (10½ for the

[1]) vide note on p. 21.

holotype), slightly convex, to the naked eye almost smooth, only provided with faint transverse striae, representing the growth-lines; they are definitely coarser and slightly wavy on the neck. There is a faint thread running along the suture. Nuclear whorls 2½, almost smooth. The neck bends regularly and slowly towards the base of the aperture. The penultimate whorl is widest.

Aperture quadrangular egg-shaped; horn-coloured within; the sinulus is separated from the rest of the aperture only by the lamella superior. As the basal edge of the peristome lies slightly backward, the plane in which the peristome lies runs parallel to the axis only in the upper half. The peristome is continuous, white, somewhat widened and reflexed; the margin is narrow, the upper margin is clear of the preceding whorl; where it touches the lamella superior, there is no angle. The base of the peristome is regularly rounded, the sides of the margin run almost parallel; from the top of the sinulus the parieto-columellar side gradually descends to the right to a point ventral of the closed umbilicus, from there it goes down fairly straight.

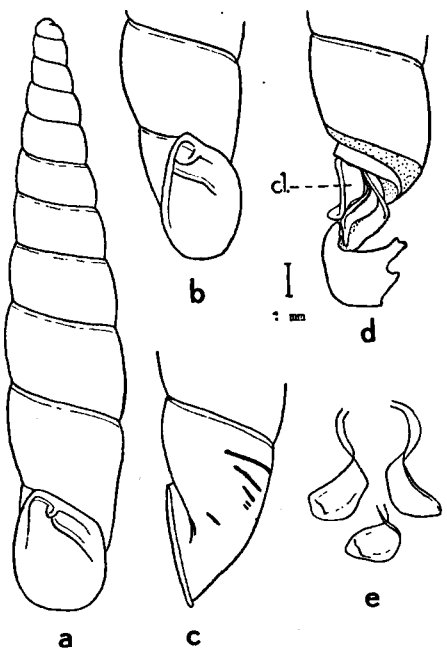

Fig. 8. **Phaedusa lucens** n.sp.
Loc. (**a**—**c**) Malay Peninsula, Mount Charas; holotype.
(**d**—**e**) Malay Peninsula, Mount Charas.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** dorsolateral-right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium (cl.) is present; **e.** 3 views of the clausilium.

Lamella superior is of moderate height, reaching the margin; its inner end is clear of the lamella spiralis and approaches the lamella inferior. The lamella spiralis ends in the aperture at the left side and

runs inward, increasing in height towards the right side; it ends rather abruptly in a ventral position. Lamella inferior is seen in the aperture at the right side as a low fold, not reaching the margin, running inward and upward; it soon becomes high, in such a way that the thickened edge disappears almost horizontally. It ends beyond or together with the other lamellae in a ventral position. When one looks into the aperture the inner side of the base of the inferior lamella is hardly visible. Lamella subcolumellaris is not or scarcely discernible in the aperture; it ascends straight upwards.

The closing apparatus lies just between the dorsal and the right side. The plica palatalis principalis runs from dorso-lateral at the left side to the right side; it is about 3/8 whorl long. Below and near the principalis we find 1 or 2 plicae palatales in a dorso-lateral position. There are no plicae in the middle of the whorl, but just above the closed umbilical slit is a third short fold, more os less parallel with the upper ones. The lamella subcolumellaris may be seen from outside through the shell, just above and at the right side of the umbilicus. The plate of the clausilium is strongly curved at one third from the top; the sides diverge from the pedicle up to about the same place, the top is slightly thickened. The dimensions of the plate are: length 2.6 mm, width 1.5 mm.

Length of the shells: 16.0 to 21.0 mm, diam. 3.5 to 4.5 mm; aperture: height 3.6 to 4.9 mm, width 2.8 to 3.7 mm. I studied 55 specimens, the averages are: shell: length 18.0, diam. 4.0 mm; aperture: height 4.1, width 3.1 mm. The ventrosity of the shells l/d = 4.2 to 5.1, the average is 4.8.

The holotype is in the British Museum (Nat. Hist.); its dimensions (in mm) are:

shell		aperture		number of whorls
length	diam.	height	width	
19.1	3.9	4.0	2.9	11

This species has not yet been mentioned in literature. Superficially, relationship with *Ph. corticina* seems out of the question. On investigating the course of lamellae and plicae, however, the relationship becomes apparent.

ANATOMY unknown. Like *Ph. corticina* the species is ovoviviparous, as I found an embryonic shell in one of the shells (vide LOOSJES & LOOSJES-VAN BEMMEL, 1949).

DISTRIBUTION: Malay Peninsula; Eastern Pahang, Mount Charas.

Type-locality: Mount Charas.

The species is only known from the type-locality, Mount Charas, an isolated limestone hill, where it was found by Mr. M. W. F. TWEEDIE in 1946 and 1947. Paratypes are in the Zoological Museum, Amsterdam, the Raffles Museum, Singapore and in the author's collection.

Habitat and biology unknown.

Phaedusa filicostata (STOLICZKA, 1873)

KEY TO THE SUBSPECIES

1. shell of medium size, less than 24 mm long, fusiform, with a rather short spire, quickly tapering into the top ; relatively wide and ventricose (width more than 4.2 mm, l/d less than 5) .....
Malay Peninsula ..... **Ph. f. compressa** n. subsp. (p. 44)

— shell turreted-fusiform, with a relatively slender spire 2

2. shell of medium to large size (longer than 20.5 mm), with a very long spire, tapering very regularly and gradually into the top, very slender (diameter less than 5 mm, l/d is more than 5); there are more than 12 whorls ; the lower whorls are relatively short (when measured along the ventral side of the shell, the lowest half of the total length encloses the aperture and almost 3 whorls above it) .....
Malay Peninsula .....
Ph. f. kapayanensis (DE MORGAN) (p. 46)

— the lower whorls of the shell are relatively long (when measured along the ventral side of the shell, the lowest half of the total length encloses the aperture and 2 whorls above it) ..... 3.

3. shell smaller than 21 mm, aperture with a comparatively broadly reflexed white peristome .....
Malay Peninsula ..... **Ph. f. musangensis** n. subsp. (p. 49)

— shell larger than 20 mm, aperture not with such a striking broadly reflexed white peristome ..... 4.

4. shell of medium to large size, the 3 lowest whorls usually increase regularly in height .....
Malay Peninsula (Penang Island included) .....
Ph. f. tenuicosta (NEVILL) (p. 40)

— shell the same, but with very flat bottom whorls- or more distinctly striated ..... 5.

5. shell large, the 3 lowest whorls are about equally high and very flat, they form a real cylinder .....
Borneo ..... **Ph. f. filialis** (VON MARTENS) (p. 50)

— as *tenuicosta* but more distinctly striated .....
Penang Island ..... **Ph. f. filicostata** (STOLICZKA) (p. 38)

Phaedusa filicostata filicostata (STOLICZKA, 1873)

1873 STOLICZKA, p. 28, pl. 3, f. 7—8 (*Clausilia* (*Phaedusa*) *filicostata*)
1877 PFEIFFER, p. 471 (*Clausilia filicostata, Phaedusa*)
1878 NEVILL, p. 183 (*Clausilia* (*Phaedusa*) *filicostata*)

DESCRIPTION (according to STOLICZKA). Shell turreted-fusiform, whorls regularly and slowly tapering into the apex, delicate, pale horn-coloured; whorls 10—11, each whorl with a distinct thread near the shallow suture, sculptured with oblique and close-set ribs, antepenultimate whorl almost as wide as the penultimate one, the last whorl somewhat contracted near the aperture.
Aperture ovate, subtriangular, peristome expanded, clear of the preceding whorl.
Lamella superior small, scarcely extending as far as the peristomal margin, its inner end quickly disappearing. Lamella inferior strong, rather oblique; about ten plicae palatales, the top one, at some distance from the suture, is longest; the second and the third are much shorter, the others are very short and irregularly placed.
Length 21.2, diam. 4.4 mm; aperture: height 4.8 (peristome damaged), width 3.6 mm. A specimen with an undamaged peristome: height 5.3, width 4.0 mm.

ANATOMY unknown.

DISTRIBUTION: Penang Island.
Type-locality: Penang Hill.
According to NEVILL (1878) the holotype was in the Indian Museum at Calcutta, but it turned out to be no longer there, as Dr. HORA kindly informed me. Besides the holotype and paratypes from Penang, NEVILL mentioned a *filicostata* form from Perak (found at Mount Pondong = Mount Pondok), which he called var. *tenuicosta*. According to CROSSE (1879) and to VON MOELLENDORFF (1886) the Penang specimens have stronger ribs than the shells from the mainland.

I saw only 2 *filicostata* specimens from Penang Island (from the BEDDOME collection, now in the British Museum (Nat. Hist.).
The dimensions (in mm) are:

shell		aperture		number of whorls
length	diam.	height	width	
22.7	4.6	4.8	3.7	12
22.3	4.2	4.5	3.5	12

They were completely identical with specimens from Perak (Mount Pondok) and Kedah (Mount Baling), even in the costulation. So either the Penang shells are identical with the mainland form and STOLICZKA only had some extremely costulated specimens in hand, when he described the species, or there are two subspecies of *Ph. filicostata* at Penang Island, one *Ph. f. filicostata*, limited to the island and one *Ph. f. tenuicosta*, occurring on the island as well as on the mainland.
I think the first supposition may be the most probable, but as STOLICZKA's types have been lost, it will not be easy to solve the problem.
Apart from the costulation, the other differences between *filicostata* STOL. and the mainland form of *filicostata* (subsp. *tenuicosta* NEVILL) mentioned by VON MOELLENDORFF (length, width and their relation and the number of whorls) are not valid, for the dimensions given by STOLICZKA also agree with those of *tenuicosta* specimens. VON MOELENDORFF stated that he had not seen STOLICZKA's type-specimens.

Phaedusa filicostata tenuicosta (NEVILL, 1878)
(fig. 9)

1878 NEVILL, p. 183 (*Clausilia* (*Phaedusa*) *filicostata* var. *tenuicosta*)
1879 CROSSE, p. 337 (*Clausilia* (*Phaedusa*) *filicostata* var. *β tenuicosta*)
1885 DE MORGAN, p. 363, 366 (*Phaedusa filicostata* var. *β tenuicosta*)
1886 VON MOELLENDORFF, p. 306 (*Clausilia* (*Pseudonenia*) *filicostata* var. *tenuicosta*)

DESCRIPTION of the material. Shell of medium to large size, turreted-fusiform, not very solid, brown to yellowish-brown, rather dull, scarcely transparent. Spire gradually broadening with rather straight lateral outlines. Whorls 10½ to 14½, rather convex to almost flat, sculpture with numerous transverse, fine, wavy striae (about 8—15 to the mm; only the large specimens have more than 10 striae to the mm), which are distinctly coarser and stand wider apart on the neck. A distinct thread, mostly in the colour of the shell but sometimes whitish, especially in larger specimens, runs below the shallow suture. Nuclear whorls 2½ to

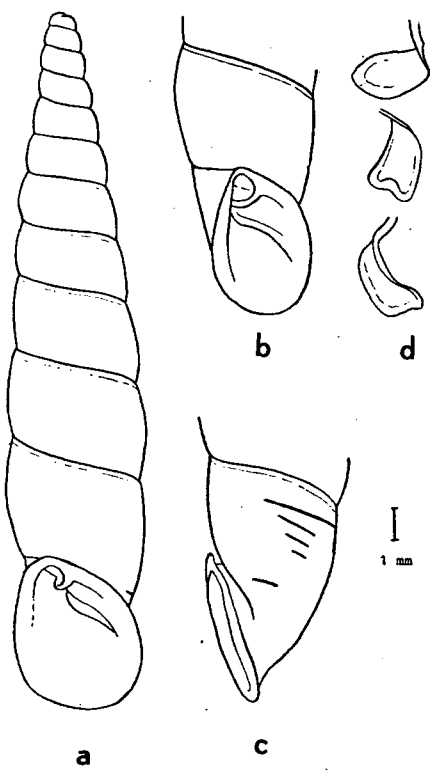

Fig. 9. **Phaedusa filicostata tenuicosta** (NEVILL)
Loc. (**a**—**c**) Malay Peninsula, Mount Pondok.
(**d**) Malay Peninsula, Mount Baling.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** 3 views of the clausilium.

3, smooth and narrow ; they form a rather sharp pointed apex. A distinct widening of the whorls is often present where the nuclear whorls merge into the following one, in such a way that it looks as if a delicate top has been placed on the lower whorls. In a side view the neck is not or rather strongly curved down towards the base of the aperture. The penultimate whorl is broadest. The lower whorls increase regularly in height, only the last two or three are comparatively higher so that, measured along the ventral side, the lower half of the total length encloses the aperture and only two whorls above it.

Aperture broad, quadrangular, yellowish within. The sinulus is for the greatest part separated from the aperture by the lamella superior. The plane in which the peristome lies is almost vertical and runs parallel with the axis of the shell. The aperture is not strikingly small compared to the whole shell. The peristome is continuous, whitish and reflexed, the upper margin is clear of the preceding whorl. In large specimens there is a comparatively large space between the edge and the penultimate whorl. In the specimens from the type-locality and the localities north of it, the edge is scarcely clear of it. The peristome is often slightly bent upwards in the place, where it touches the superior lamella, to assist the latter in forming the sinulus. From the sinulus downwards the outer margin is straight or somewhat curved. The parieto-columellar margin descends slowly as an almost straight edge from the sinulus to the right side near the closed umbilical slit ; at the right side it descends abruptly. The base of the peristome is regularly rounded.

Lamella superior is of moderate height, reaching the margin ; its inner end approaches the lamella inferior and is clear of the lamella spiralis. The outer end of the lamella spiralis lies at the left side, a little nearer to the suture than the end of the lamella superior. Lamella spiralis increases in height and ends rather abruptly in a ventral position. The outer end of the lamella inferior lies on the peristome near and halfway up the right margin. At first it is a low, thick fold. Before ascending it disappears into the aperture with its swollen edge in an almost horizontal position. In a dorsal position this lamella is high, it ends inward together with the lamella spiralis and the lamella subcolumellaris or together with the lamella subcolumellaris beyond the lamella spiralis. When looking into the aperture, it is possible to see the inner side of the base of the inferior lamella. The lamella subcolumellaris is not or scarcely visible behind the outer end of the lamella inferior, if one looks from the left side and from below into the aperture.

The closing apparatus lies at the right side or a little dorsally. The principal plica runs from the dorso-lateral left side to latero-ventral at the right side, it is not quite a half whorl long. Below it is a series of up to 9 parallel plicae palatales, of which the upper ones and the lowest are longest ; the others are usually very faint and small although exceptions occur. Sometimes these plicae lie in a white callous patch. Below the lowest plicae we can see the end of the lamella subcolumellaris through the shell. The plate of the clausilium is broad and short and regularly bent, the sides diverge from the pedicle to a point at one third from the top of the plate ; the top is slightly thickened. The dimensions of the plate are : long 2.7, width 1.6 mm in a specimen of medium size and about 3.0 and 1.7 mm in a large specimen.

Length of the shells: 20.2 to 32.3 mm, diam. 3.9 to 6.3 mm; aperture: height 4.3 to 6.4 mm, width 3.2 to 5.3 mm. About 150 specimens were measured. As the dimensions of the populations of the different localities differ greatly, it is of no interest to give the averages here. The ventrosity of the shells is l/d = 4.6 to 6.0, the average is 5.2.

In 1878 NEVILL published the name *tenuicosta* for the *filicostata* specimens of Perak (Mount Pondok); the only description he gave was contained in the name *tenuicosta* (delicately ribbed). In fact this name indicates the most important character of the subspecies and may be taken for the description. Since none of the later descriptions give other valid characters I regard NEVILL as the author. CROSSE (1879) only recorded var. *β tenuicosta*: "qui se distingue par un peu plus de finesse dans ses costulations" (which distinguishes itself by its more delicate costulations). VON MOELLENDORFF (1885) gave a description, which after all turned out to be not quite correct. He stated that the variety is longer, and at the same time slenderer, the striation is much finer, that there are fine spiral lines besides and that there are 12 whorls instead of 10 to 11. He had not the opportunity, however, to make reliable comparisons, because he had not seen the type-specimens and had only studied STOLICZKA's original but incomplete description (conf. p. 39).

ANATOMY unknown.

DISTRIBUTION: Malay Peninsula.

Type-locality: Mount Pondong (= Mount Pondok).

The subspecies is only recorded from the type-locality (Mount Pondong). SYKES (1902) reported the occurrence of *filicostata* in Kelantan, but afterwards (1903) COLLINGE stated that SYKES had told him that these shells were varieties of *Ph. kelantanensis* SYKES. COLLINGE (1903) himself referred to similar specimens as *Ph. kelantanense* (sic!), collected in Siam at Nawng Chik, Mount Besar (2,500 feet). I am not sure whether these specimens were indeed *Ph. kelantanensis* or *Ph. filicostata tenuicosta*.

Habitat. The biology of this mountain-dwelling subspecies is unknown. It is recorded from altitudes between 100 to 400 m (DE MORGAN, 1885).

Localities. I studied specimens from the following localities:

Perak; Mount Pondok, near Padang Rengas, leg. M. W. F. TWEEDIE, 1938. According to Mr. TWEEDIE this is the Mount Punong or Pondong of GODWIN AUSTEN and NEVILL, the type-locality (R.M.S., 15) and leg. HUNGERFORD (S.M.F. no. 62655, 4)[1])

dimensions (in mm):	shell		aperture		number of whorls
	length	diam.	height	width	
	20.5—24.3	4.1—4.9	4.5—5.4	3.2—4.1	11—12½
averages:	22.7	4.6	5.0	3.6	

Perlis; Mount Kaki, leg. M. W. F. TWEEDIE, 1938 (R.M.S., 12). The specimens do not show any important differences with those from the type-locality.

	22.6—25.9	4.3—4.7	4.8—5.4	3.6—4.1	11—13
averages:	24.0	4.5	5.1	3.8	

[1]) vide note on p. 21.

Kedah ; Mount Baling, leg. M. W. F. TWEEDIE, 1938 (R.M.S., 79). This form agrees, also in its dimensions, completely with specimens from the type-locality.

	20.7—25.6	4.1—4.8	4.6—5.4	3.5—4.3	10½—12½
averages :	22.8	4.4	5.0	3.9	

Perak ; Lenggong (R.M.S., 2)

—	5.1	5.6	4.1	—
—	5.1	6.0	4.3	—

Perak ; Kuala Kangsar (S.M.F. no. 30149, 2); very large specimens with a comparatively solid shell and peristome.

32.3	5.9	7.0	5.1	12½
29.1	5.7	6.9	5.2	12

Kelantan ; Batu Tongkat near Gua Musang (R.M.S., 2). Only slightly larger than the specimens from the type-locality.

25.1	4.3	5.4	3.9	12
24.0	4.5	5.3	4.1	11½

Kelantan ; Gua Madu near Gua Musang, leg. M. W. F. TWEEDIE, 1939 (R.M.S., 6). A form of medium height, a little slenderer than typical *tenuicosta*, aperture somewhat smaller.

	20.3—21.1	3.9—4.1	4.3—4.7	3.2—3.5	12—12½
averages :	20.8	4.0	4.4	3.4	

Pahang ; Kota Tongkat, leg. M. W. F. TWEEDIE, 1947 (R.M.S., 16). Very large shells with extremely flat whorls, the neck usually regularly bent towards the base of the aperture, not swollen.

	27.6—31.7	4.8—5.7	5.5—6.4	3.8—5.1	13—14½
averages :	29.0	5.3	6.0	4.6	

Pahang ; Kota Gelanggi, leg. M. W. F. TWEEDIE, 1947 (R.M.S., 7). The same form as the previous one.

	25.4—32.2	4.9—5.6	5.1—6.1	4.1—4.9	12½—14½
averages :	29.1	5.3	5.7	4.6	

Pahang ; Mount Charas, leg. M. W. F. TWEEDIE, 1946 (R.M.S., 8). Shells intermediate in length between specimens from the type-locality and the large ones from Kota Tongkat and Kota Gelanggi.

	26.9—27.4	4.6—5.0	5.1—5.9	3.8—4.5	12
averages :	27.2	4.8	5.6	4.2	

Pahang ; Mount Panching, leg. M. W. F. TWEEDIE, 1947 (R.M.S., 2)

29.7	5.0	6.4	4.6	12½
24.4	4.8	5.5	4.3	11

In addition I studied specimens only labelled Perak (some large shells among others) or Kelantan. Especially among the shells with the latter indication were specimens of intermediate size and structure, just like the shells from Batu Tongkat, recorded above. At first I was much impressed by the striking differences in dimensions between the specimens from Perlis, Kedah and the North of Perak on the one side and the extremely large ones from some southern and eastern localities on the other, but close comparison shows that there are many transitional forms ; the subspecies is very variable. Besides the dimensions and the convexity of the whorls, the colour of the shells may vary considerably, often even among the same population. There may also be wide divergences in the degree of curvature of the neck. Without exact knowledge of the biotopes, it cannot be decided to what extent these variations, as far as they do not occur among one and the same population, are hereditary and due to prolonged isolation or have originated as a non-hereditary direct answer to environment factors.

The Malay Peninsula, besides the central north-south mountain-range, consists of lowland plains, out of which isolated hills and mountains, often of calcareous formation, rise. Due to their isolation the faunae of these heights, rising like islands out of a sea of non-calcareous lowland, may gradually assume a peculiar character by the formation of new subspecies and later even of new species (cf. TWEEDIE, 1947 ; VAN BENTHEM JUTTING, 1950, 1952).

I can only regard the above-mentioned variations within the subspecies *filicostata tenuicosta* as the first steps on the way to the formation of new species by isolation. Populations from different localities often show important differences, but nevertheless transitional forms may be found elsewhere. The number of specimens known from each locality is usually very small and therefore the range of variation within the population is often badly or not at all known. It is quite possible that one would be able to describe several more subspecies, if one could dispose of extensive material. I have an impression of the variation among the populations of Kaki Mountain, Mount Baling and Mount Pondok on the one hand and those of Kota Tongkat and Kota Gelanggi on the other.Only the first group presents a relatively homogeneous picture. Unfortunately I hardly ever found considerable numbers of specimens from those localities that yielded transitional forms or from which specimens are known that show relatively wide divergences. Neither does the geographical position of the localities give sufficient evidence. As far as I can see now, there is no regular development of form in a special geographical direction. If we consider, moreover, that adaptation to the circumstances in the different localities will have some influence, it may be clear that any extensive subdivision of *filicostata tenuicosta* would be premature.

As has been mentioned before, the variations among the specimens from one and the same locality may be fairly great ; we find an analogy with the Tonkinese *Phaedusa paviei* MORLET (vide LOOSJES, 1949). This too is a fact that urges to caution in the classification and the description of separate forms of *filicostata*.

Phaedusa filicostata compressa n.subsp.
(fig. 10)

DIAGNOSIS. S h e l l of medium size, usually smaller than subsp. *tenuicosta*, but comparatively broader, it has a plump appearance, very fragile, yellowish-brown, the lateral outlines are straight or slightly convex (the holotype). The rather short spire is rapidly but regularly tapering to the embryonic whorls, they form no separate top, as is often the case in the subsp. *tenuicosta*. Whorls 9 to 11, usually 10, rather convex. There may be a thread along the suture (the holotype e.g.). About 15 transverse, wavy striae are counted to the mm on the whorl above the aperture, they are but slightly coarser on the neck. The last whorl is short, the neck is strongly curved towards the base of the peristome.

The a p e r t u r e is very broad at its base, especially the right angle

bulges out. The plane in which the peristome lies is not parallel with the axis of the shell, because the basal part of the peristome is receding. The closing apparatus lies between the dorsal and the right side. The plica palatalis principalis ends at the right side. For the rest the lamellae and plicae show no important differences with those of *tenuicosta*. The dimensions of the plate of the clausilium are 1.7 by 2.7 mm.

Length of the shells: 19.1 to 23.6 mm, diam. 4.3 to 4.8 mm; aperture: height 4.8 to 5.4 mm, width 3.5 to 4.2 mm. I studied 15 specimens. The averages are: length of the shells: 20.7, diam. 4.6 mm; aperture: height 5.0, width 3.9 mm. The ventrosity of the shells, l/d = 4.1 to 4.9, the average is 4.4.

The holotype is preserved in the British Museum (Nat. Hist.), paratypes are in the Raffles Museum, Singapore, the Zoological Museum,

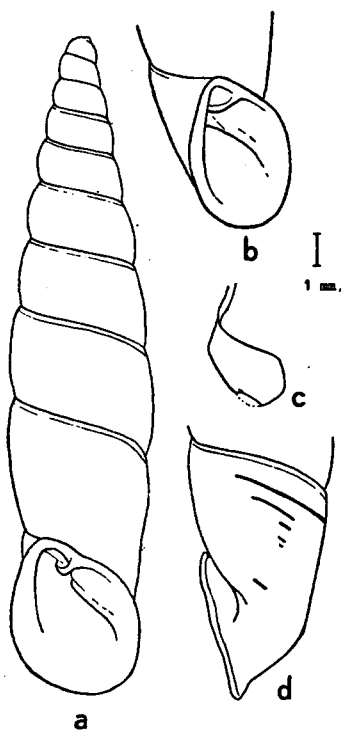

Fig. 10. **Phaedusa filicostata compressa** n.subsp.
Loc. (a–c) Malay Peninsula, Mount Chintamani; holotype.
(d) Malay Peninsula, Mount Chintamani.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** the clausilium; **d.** right side of the last whorl with the plicae seen through the shell.

Amsterdam and in the author's collection. The dimensions of the holotype are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
20.9	4.6	4.9	3.9	10

ANATOMY unknown.

DISTRIBUTION : Malay Peninsula ; Western Pahang : Mount Chintamani near Bentong.

Type-locality: Mount Chintamani.

The type-locality is the only locality known. The shells were collected by Mr. M. W. F. TWEEDIE in 1935.

This subspecies seems most closely related to some *tenuicosta* specimens from Perlis, Kedah and Perak (Mount Pondok). This subspecies I see as a product of continued development during isolation, in the same way as in the following subspecies.

Phaedusa filicostata kapayanensis (DE MORGAN, 1885)
(fig. 11)

1885 DE MORGAN, p. 39, pl. 6, f. 8 (*Pseudonenia Kapayanensis*)
1891 VON MOELLENDORFF, p. 338 (*Clausilia* (*Pseudonenia*) *Kapayanensis*)
1902 COLLINGE, p. 72 (*Clausilia kapayanensis*)

DIAGNOSIS of the material. Shell of medium size to large, slender distinctly turreted, not very solid, brown to yellowish-brown, dull, scarcely transparent. Spire gradually and slowly broadening, with straight lateral outlines. Whorls 12½ to 14½, slightly convex. In a side view the neck is strongly curved down to the base of the aperture. The height of the whorls is steadily increasing from the first top whorl down to the last, in such a way that, measured along the ventral side of the shell, the lower half of the total length encloses the aperture and almost 3 whorls above it.

Aperture more or less triangular. The sinulus is only separated from the aperture by the lamella superior. The plane in which the peristome lies is curved slightly backward basally. The aperture is relatively small. From the sinulus the outer peristomal edge descends straight, the parietocolumellar edge is regularly but steeply curved downward.

The lamellae show no differences compared with subsp. *tenuicosta*.

The closing apparatus lies usually at the right side. We may note up to ten plicae between the principal plica and the lamella subcolumellaris. The plate of the clausilium has never been described before ; it is broad and short, the main curve at $^1/_3$ from the top, there it is broadest too, the sides diverge up to that point in such a way that the plate is almost triangular. The top is slightly thickened. The dimensions of the plate are : length 2.3, width 1.5 mm.

Length of the shells: 20.8 to 27.8 mm, diam. 3.5 to 4.7 mm ; aperture : height 4.1 to 5.6 mm, width 2.8 to 4.1 mm. I studied 40 specimens. The ventrosity of the shells, l/d = 5.2 to 6.4, the average is 5.8.

It is unknown to me where the original set is preserved. The dimensions of the holotype, as communicated by DE MORGAN, are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
22.0	3.5	4	—	13—14

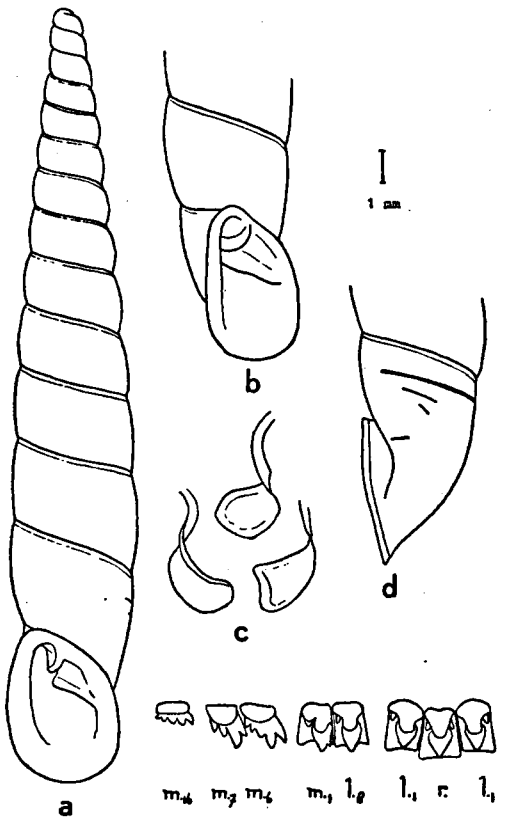

Fig. 11. **Phaedusa filicostata kapayanensis** (DE MORGAN)
Loc. Malay Peninsula, Batu Caves.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** 3 views of the clausilium ; **d.** right side of the last whorl with the plicae seen through the shell ; **e.** some elements of the radula (× 390).

In his description DE MORGAN recorded : "petite dent très peu marquée au-dessus de ces deux plis" (small tooth very indistinct above these two folds). It is not easy to understand what he meant with this "small tooth", for in his figures it is not reproduced. The opinion of VON MOELLENDORFF (1891) was that *kapayanensis* is "very closely allied to *filicostata*, especially to its Perak variety, and I would not hesitate to identify it with the latter, if the author did not speak of a third "tooth" on the columellar margin, meaning an emerged columellar lamella, which is not visible in *C. filicostata*".

I have to admit that I did not see the type-specimen, but I saw several specimens from the type-locality, which did not have the said tooth, but which otherwise completely answered the description. On the other hand, I saw *tenuicosta* specimens with the outer end of the lamella subcolumellaris just appearing from behind the inferior lamella, forming a faint tooth below the end of the latter.

ANATOMY. From a specimen from Batu Caves a radula could be studied. The formula is about 143 $\times \frac{1}{3} + \frac{9}{2} + \frac{17}{3-\omega}$.

DISTRIBUTION : Malay Peninsula.

Type-locality: Mount Lano.

In literature the following localities are recorded : the type-locality is Perak, Mount Lano near Kampong Kapayan, abundant ; on tree-trunks and between vegetable detritus with *Alycaeus* and *Aulopoma*. COLLINGE (1902) recorded the subspecies from the State of Ligeh, Belimbing (in the district of Patani, Siam).

Habitat. The habitat of this subspecies is on tree-trunks and on the soil between decaying matter of vegetable origin, at 100 to 600 m altitude.

Localities. I saw shells from the following localities :

Mount Besar, west of Patani (Siam) (B.M.L. no. 1904.5.26.53—55, 3)

21.8	4.1	4.6	3.5	13½
—	4.0	4.6	3.4	—
—	4.0	4.5	3.4	—

This locality agrees with the one mentioned by COLLINGE (1902).

Perak ; Mount Lano, near Ipoh (K.B.I.N., 5)

22.9	3.9	4.1	2.8	14
23.6	4.0	4.5	3.4	14
24.1	4.1	4.5	3.5	14
24.3	3.9	4.6	3.4	14
21.7	4.0	4.4	3.3	13

Perak ; Mount Rapat, south of Ipoh, 1933 (R.M.S., 1). This locality is very near Mount Lano.

21.4	4.0	4.3	3.3	13

Selangor ; Batu Caves, leg. M. W. F. TWEEDIE, 1932 (R.M.S., 7); 1928 (R.M.S., 10) and from the GODWIN AUSTEN collection, now in the British Museum (Nat. Hist.) (B.M.L. no. 4028.03.7.1, 4)

	23.4—27.8	4.1—4.6	4.6—5.6	3.4—4.0	13—14½
averages :	25.5	4.4	5.0	3.7	

The specimens from the last mentioned locality are generally larger than those from Perak, still there is in my opinion no reason to distinguish between the two forms. To what extent there is question of an independent development in the same direction in two isolated areas or only of two different localities of the same subspecies, we cannot yet decide. There are too few data to form an opinion.

As VON MOELLENDORFF stated, the close relationship between *Ph. f. kapayanensis* and the *filicostata tenuicosta* form from Perlis, Kedah and Perak (Mount Pondok) is evident.

As to the distribution, the area, where subsp. *kapayanensis* is found, lies north and south of that of *Ph. filicostata tenuicosta*. This is not very likely for two related subspecies. As they are very closely related they might perhaps better be united. But since it is desirable to obtain more data on eventual differences of the subspecies, it seems best to maintain the names.

Subspecies *compressa* is a broad short form of *Ph. filicostata* ; subsp. *kapayanensis* is a very long slender form with a small aperture, instead of a strikingly large one.

Phaedusa filicostata musangensis n.subsp.
(fig. 12)

DIAGNOSIS. Shell of small to medium size, turreted-fusiform, spire with straight lateral outlines. Whorls 10½ to 12½ (the holotype 11½). Nuclear whorls regularly attached to the lower whorls; the neck is strongly curved down and looks a bit swollen.
The aperture protrudes strikingly; the upper part of the peristome is widely separated from the preceding whorl; peristome white and usually very broadly reflexed. The sinulus is rather high, yet there is no angle or only a faint one in the upper peristomal margin. At the parieto-columellar side of the sinulus the margin descends to the right corner of the aperture, generally more vertically than in subsp. *tenuicosta*; from there it runs straight down.

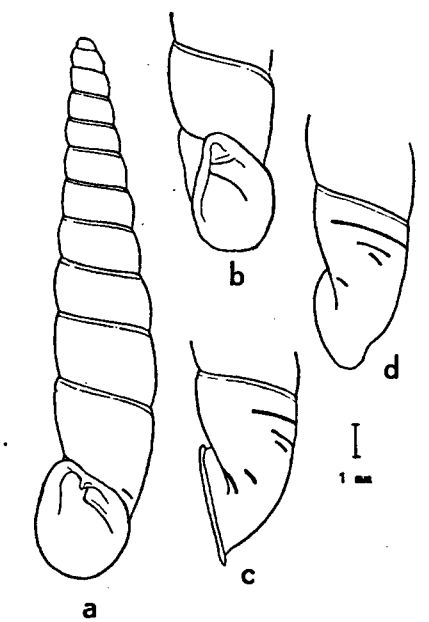

Fig. 12. **Phaedusa filicostata musangensis** n.subsp.
Loc. Malay Peninsula, Gua Musang; holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** dorsolateral-right side of the last whorl with the plicae seen through the shell.

The lamellae are not different from those of the subspecies *tenuicosta*.
The closing apparatus lies between the dorsal and the right side. The plica palatalis principalis runs from the right side to somewhat beyond the dorsal side. There is no white callous spot in which the plicae lie. The clausilium shows no peculiarities, the measurements of the plate are 2.2 and 1.3 mm.

Length of the shells: 16.1 to 20.2 mm, diam. 3.4 to 4.2 mm; aperture: height 3.6 to 4.7 mm, width 2.8 to 3.4 mm. I studied 17 specimens. The ventrosity of the shells, l/d = 4.3 to 5.2, the average is 4.8.

The type is in the British Museum (Nat. Hist.), paratypes are in the Raffles Museum, Singapore, the Zoological Museum, Amsterdam and in the author's collection. The dimensions of the holotype are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
17.6	3.4	3.8	2.8	11½

and of the paratypes:

19.8	4.0	4.6	3.4	12½
19.9	3.9	4.7	3.4	12½
17.6	3.8	4.0	2.9	11½
19.7	3.8	4.2	3.0	12
18.8	3.6	4.1	2.8	11½
17.0	3.6	3.8	2.8	11
17.5	3.8	3.6	2.9	11½

ANATOMY unknown.

DISTRIBUTION: Malay Peninsula; Kelantan.
Type-locality: Gua Musang.
The type-locality is Kelantan, Gua Musang, the shells were collected by Mr. M. W. F. TWEEDIE in 1939.
Another locality is:

Kelantan; Gua Nenek (7 miles south of Gua Musang), leg. M. W. F. TWEEDIE, 1939 (R.M.S., 4)

19.7	3.8	4.3	3.4	12
20.2	4.2	4.4	3.3	11½
17.0	4.0	4.2	3.3	10½
16.1	3.6	3.8	2.8	10½

This subspecies reminds one of the previous one, but the protruding aperture with the often broad and white peristome, the higher sinulus and the more dorsal position of the palatal plicae are real differences.

Phaedusa filicostata filialis (VON MARTENS, 1903)
(fig. 13)

1903 VON MARTENS, p. 425 *Clunsilia* (err. typ.) *filialis*)
1908 VON MARTENS, p. 287, pl. 6, f. 21 (*Clausilia filialis*)

DIAGNOSIS. It is very difficult to describe the real difference between this shell and the large shells of the subsp. *tenuicosta*, as the variability of subsp. *filialis* is not known. Fragile shells like the *filialis* specimen are an exception in the *filicostata* group; the last three whorls are clearly cylindrical, only the upper ones form the conical spire in *filialis*. In other *filicostata* subspecies the conical spire is comparatively much longer and

includes also the antepenultimate and often the penultimate whorl. The lowest three whorls are very flat in subsp. *filialis* and nearly equal in height. The lamellae and plicae are not different at all, only the position of the row of plicae is much more horizontal, running from the dorsal to the ventral side.

REDESCRIPTION of the holotype (the only specimen known). Shell large, turreted-fusiform, fragile, yellowish-horn-coloured, slightly glossy, transparent. Spire conical, slender, gradually broadening; with slightly convex lateral outlines. Whorls 13, the lowest flat, sculptured with numerous transverse, fine, wavy striae (about 12 to the mm on the whorl above the aperture), which are distinctly coarser and stand wider apart on the neck. There is a distinct thread in the colour

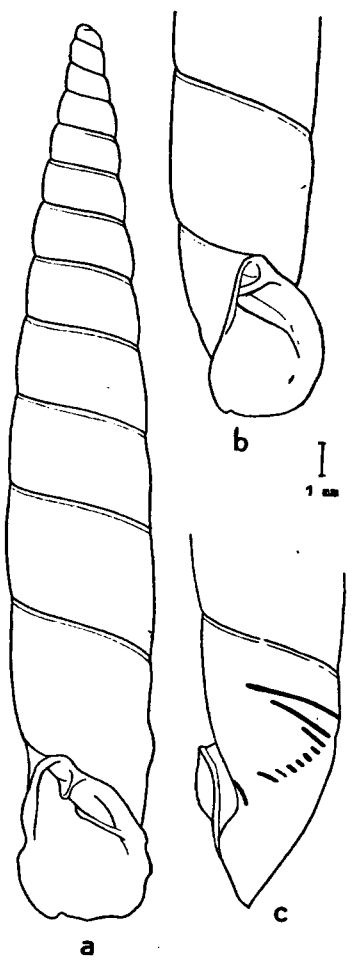

Fig. 13. **Phaedusa filicostata filialis** (VON MARTENS)
Loc. Borneo, Mount Sekerat; holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell.

of the shell below the shallow suture. Nuclear whorls about 3, faintly striated, indistinctly separated from the lower whorls, as these are but little wider at the transition. The last 3 whorls together form a cylinder, they form the lowest half of the shell. In a side view the neck regularly and slowly curves towards the base of the aperture.

Aperture pear-shaped triangular; the sinulus is almost entirely formed by the lamella superior, for there is only a faint angle in the peristome. The peristome is continuous, whitish; as it is much damaged it is impossible to record whether it was broadly reflexed or not; the upper margin is clear of the preceding whorl. From the sinulus the outer margin runs down in a slow curve, the parieto-columellar margin runs down slowly to the right side. There it has a faint angle and then runs down almost straight, but a little to the right. The base of the aperture is rather wide and rounded.

Lamella superior of moderate height, reaching the margin; there is a wide gap between its inner end and the outer end of lamella spiralis. Lamella inferior is seen as a low fold, ending in the middle of the columellar side of the aperture, not reaching the margin. Halfway the visible part of the columella it becomes higher, its thickened edge turning almost horizontally inward. This edge forms with the clearly visible columella a fork-like structure. The base of lamella inferior is visible, if one looks from below and from the right side into the aperture. Behind the inferior lamella the lamella subcolumellaris is visible in an oblique view of the aperture. The position of the inner ends of the lamellae is unknown to me, as the only available shell could not be opened.

The closing apparatus lies at the right side, the upper plicae lie in a rather dorsal position. The plica palatalis principalis runs from dorsolateral-left to ventrolateral-right. Below it and parallel with it runs a distinct groove, which is certainly an individual deviation, the shell had been damaged here. There are 8 plicae palatales, arranged in a faint, almost horizontal curve. This curve runs down from dorso-lateral to ventro-lateral, close to the right (parieto-columellar) upper angle of the peristome. The top and second plicae are longest. Below this row of plicae, which are for the greater part rather short, the lamella subcolumellaris is visible through the shell. Clausilium unknown.

There is only one specimen, the holotype, which is in the Berlin Museum. Owing to the kindness of Dr. S. JAECKEL of that Museum and the intercession of Dr. A. ZILCH of the Senckenberg Museum I was able to study it. Its dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
29.9	4.9 more than	5.6 more than	4.2	13

VON MARTENS stated in his original description:

31	5	6½	4²/₃	13

Besides these figures he gave some other data, which are not quite correct, e.g. the number of palatal plicae (including the principalis) 3, the occurrence of a lunella, etc.

ANATOMY unknown.

DISTRIBUTION : Borneo.
Type-locality: Mount Sekerat.
The type has been collected by M. SCHMIDT on Mount Sekerat, near Selankau, on limestone.
Habitat and biology unknown.

Phaedusa kelantanensis (SYKES, 1902)
(fig. 14)

1902 SYKES, p. 22 and p. 61, pl. 3, f. 1 (*Clausilia* (*Pseudonenia*) *kelantanense* (sic))
1902 VON MOELLENDORFF, p. 135 (*Phaedusa* (*Pseudonenia*) *kelantanensis*)
1903 COLLINGE, p. 212 (*Clausilia kelantanense* (sic))
1949 VAN BENTHEM JUTTING, p. 62 (*Phaedusa kelantanensis*)

DESCRIPTION of the material (the holotype included). Shell large, turreted-fusiform, not very solid, dark chestnut-brown, sometimes yellowish-brown; glossy, scarcely transparent. Spire abruptly widening below the 2½—3 top whorls; giving the impression that a blunt top has been superimposed on the broader lower whorls. The spire has rather straight lateral outlines. Whorls 11—12, rather convex, sculptured with numerous transverse, fine, wavy striae (about 16—18 to the mm on the whorl above the aperture), coarser and wider apart on the neck. Sometimes very faint spiral lines are visible between the striae. A faint thread in the colour of the shell runs below the shallow suture. Nuclear whorls (3) broad, almost smooth; they form a distinct, delicate, and blunt top. The penultimate whorl is broadest. The lower whorls are comparatively higher than the others. In a side view the neck is not very strongly curved. Aperture ovate-pyriform, trumpet-like, reddish-brown within. The sinulus is broad, it is separated from the aperture by the lamella superior. This feature is also accentuated by the edge of the peristome, which is distinctly bent upwards in the place where it is touched by the superior lamella. The plane of the peristome bends backward below, hence it does not run parallel with the axis of the shell. The aperture is rather large. The peristome is continuous, whitish, and reflexed, the upper margin is free, it even protrudes distinctly from the preceding whorl. From the sinulus the outer margin runs straight or slightly curved down. The parieto-columellar margin runs regularly curved down and towards the right side. The base of the peristome is rounded.
Lamella superior is of moderate height, reaching the margin; its inner end approaches the lamella inferior, it is clear of the lamella spiralis. The outer end of the lamella spiralis lies at the left side, a little more towards the suture than the lamella superior. Lamella spiralis runs upward as a high crest. Lamella inferior is visible in the aperture as a high thin fold of which the margin runs almost horizontally inward (in the *filicostata* subspecies this lamella is heavier and lower). When looking into the aperture it is possible to see the inner side of the base of the inferior lamella. Lamella subcolumellaris is only visible behind the outer end of lamella inferior, looking from the left side and from below into the aperture.

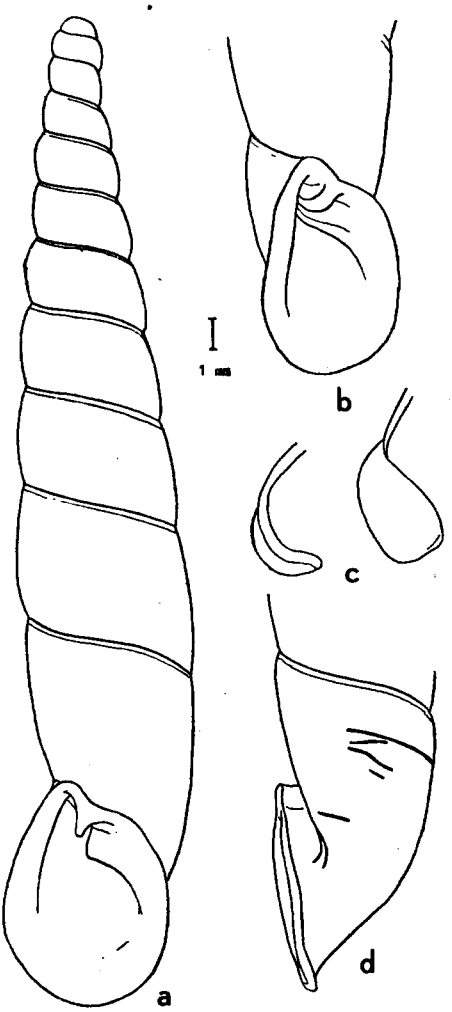

Fig. 14. **Phaedusa kelantanensis** (SYKES)
Loc. Malay Peninsula, Kelantan ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** 2 views of the clausilium ; **d.** right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies at the right side. The principal plica runs from dorso-lateral on the left side to ventro-lateral on the right side. It is about half a whorl long. Below the plica principalis are some 3 to 6 plicae of which the upper one is the longest, the second or third is separated from the last, the lowest, by a large gap. The lowest lies at the right side a little above the umbilical slit. At the right side of the umbilicus, between this and the lowest plica palatalis, is the end of the lamella

subcolumellaris, hardly visible through the shell. The plate of the clausilium is broadest at 1/3 from the relatively blunt apex, the sides diverge from the pedicle up to that point, its length is about 3.2 mm, its width 1.8 mm.

Length of the shells 29.1 to 33.3 mm, diam. 5.1 to 5.7 mm; aperture: height 5.9 to 6.9 mm, width 4.5 to 5.3 mm. I studied 20 specimens. The ventrosity of the shells is 5.4 to 6.2; the average is 5.8.

SYKES recorded for the type (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
31.8	5	6.5	4.8	11½

I studied the type-specimens in the British Museum (Nat. Hist.) (holotype and paratype: no. 1930. 1.21.12—13, 2) and measured:

31.8	5.4	6.8	4.9	12

The paratype measured:

29.3	5.2	6.6	5.1	11

SYKES (1902) described traces of spiral sculpture, crossing the transverse striae. Some specimens have the spiral sculpture indeed, but because SYKES did not mention the wavy character of the striae, he may have mistaken it for the spiral striation. According to him the specimens were collected together with specimens of *Ph. filicostata* and both species are related. "Besides differences of the plicae and lamellae the much larger protoconch will readily separate them" (SYKES, 1902). I cannot confirm that there are many reliable differences between the large specimens of *Ph. filicostata tenuicosta* and *Ph. kelantanensis* in relation to the lamellae or plicae, only in the latter the lamella inferior is higher and thinner. The embryonic whorls of *kelantanensis* and the shape of the aperture and of the sinulus, however, are different. Also the upper peristomal margin is even clearer of the preceding whorl, than in *Ph. filicostata*. If we realize that we often find some specimens of *Ph. kelantanensis* with its blunt and broad apex, among a large number of sharp pointed specimens of equally large *filicostata tenuicosta* or mixed up with other *filicostata* subspecies, I wonder whether these thick-topped shells may be only modifications of *Ph. filicostata tenuicosta*. As the occurrence of two subspecies of the same species in one and the same locality is not very well possible, *Ph. kelantanensis* could be at best a modification. This I think is not quite acceptable in view of the differences. In analogy with the related *Phaedusa paviei* MORLET and *Ph. phongthoensis* LOOSJES & LOOSJES-VAN BEMMEL (1949), where the presence of embryonic shells in the parent shells, each with their own constant character, settled the matter, I am inclined to consider them as different species. It is probable that *Ph. filicostata tenuicosta* and *Ph. kelantanensis* are also viviparous, but I have never found embryonic shells in the full-grown shells among the material I examined.

VON MOELLENDORFF (1902) measured specimens of 12 to 12½ whorls, length 33 and 31.9 mm and diam. 5.5 and 5 mm. He quoted the following differences with *Ph. filicostata*: slenderer stature, the wavy striae denser and more distinct, also almost microscopic spiral striae. According to him, *Ph. kelantanensis* is only a local race of *Ph. filicostata*. It is noteworthy, that the wide top whorls are not mentioned by him. COLLINGE (1903)

wrote that SYKES had informed him that the shells which SYKES recorded from Kelantan as *C. filicostata* STOL. 1902, were a variety of *Ph. kelantanensis* and not *Ph. filicostata* at all. Perhaps COLLINGE and SYKES had before them large specimens of *Ph. filicostata tenuicosta*, a form unknown to VON MOELLENDORFF.

ANATOMY. I studied the radula of this species. The formula is about $112 \times \frac{1}{3} + \frac{9}{2} + \frac{19}{3-\omega}$. The teeth have rather blunt cusps in the specimen investigated.

DISTRIBUTION : Malay Peninsula.
Type-locality: Kelantan.
The species is known from Kelantan and Pahang.
VAN BENTHEM JUTTING (1949) recorded a specimen from Selangor, four miles from Genting Sempak Hill Station, leg. C. DOVER, 1926, collected on bark in damp forest. I saw this specimen also, it measured :

29.7	5.2	6.3	4.5	11½

Habitat. Mr. DOVER's information gives us some data on the habitat. It may be a tree-climbing form, its long and slender appearance might also point in that direction.
Localities. Besides this specimen and the original set I saw shells from the following localities :

Kelantan ; Gua Nenek, 7 miles south of Gua Musang, leg. M. W. F. TWEEDIE, 1939 (R.M.S., 1)[1])

29.1	5.2	5.9	4.7	12

Kelantan ; Batu Tongkat near Gua Musang, leg. M. W. F. TWEEDIE, 1939 (R.M.S., 2)

29.4	5.3	6.5	4.9	11
—	5.4	6.4	4.9	—

Pahang ; Kota Tongkat, leg. M. W. F. TWEEDIE, 1947 (R.M.S., 1)

29.7	5.3	6.5	4.8	11½

Pahang ; Mount Chintamani, near Bentong, leg. M. W. F. TWEEDIE, 1935 (R.M.S., 1)

31.9	5.1	6.5	4.9	12

Further I saw specimens only labelled Kelantan or Kilantan, like the original set. Thus the species is so far almost only known from the eastern part of the Peninsula. As mentioned before, it was often collected together with *Ph. filicostata* subspecies.

Genus PSEUDONENIA O. BOETTGER, 1877

1877 BOETTGER, p. 59
1927 EHRMANN, p. 32

Shell more or less solid, spire with convex to straight lateral outlines ; the transverse striae are rectilinear, not wavy ; lamella superior continuous with the spiral lamella ; below the principal plica are some long (2 or

[1]) vide note on p. 21.

more, exceptionally only one), and usually some short (1 or more) plicae regularly distributed over the height of the whorl, no lunella.
Duct of the receptaculum seminis with an appendix.
Presumably all species lay eggs.
Type-species: *Pseudonenia javana* (L. PFEIFFER), indicated by BOETTGER 1877, p. 59.

Distribution: Eastern and South-Eastern Asia.

THE TWO SECTIONES OCCURRING IN THE AREA ARE DISTINGUISHED AS FOLLOWS:

1. shell fusiform with a pointed or moderately blunt apex .....
Eastern and South-Eastern Asia.....
sectio **Pseudonenia** BOETTGER (p. 57)

— shell more or less oval and with a very blunt apex .....
Eastern and South-Eastern Asia.....
sectio **Oospira** BLANFORD (p. 103)

Sectio **Pseudonenia** O. BOETTGER, 1877

Shell fusiform or turreted, with a pointed or rather blunt apex.

Distribution: Eastern and South-Eastern Asia.

KEY TO THE INDO-AUSTRALIAN SPECIES.

1. lamella subcolumellaris is visible in a full front view of the aperture ..... 2. [1])

— lamella subcolumellaris is not visible in a full front view of the aperture ..... 7.

2. shell clearly turreted with pointed top and small aperture .....
Borneo ..... **Ps. scalariformis** n.sp. (p. 78)

— shell fusiform with more or less blunt top ..... 3.

3. shell ventricose, width more than 5 mm ..... 4.

— shell not conspicuously ventricose, width at most 5 mm ..... 5.

4. shell moderately ventricose (l/d is at least 4.3), the spire is not a conspicuously squat cone, aperture very wide, auriform, with a wide high sinulus, the peristomal edge is broadly reflexed .....
Sumatra ..... **Ps. aenigmatica** (SYKES) (p. 73)

[1]) In *Ps. javana* populations occur in which part of the specimens have a lamella subcolumellaris which is not or scarcely visible in the aperture. These specimens are distinguishable from other species with the same type of subcolumellar lamella by their slender shape and by the presence of usually 3 plicae palatales below the long principal plica.

— shell moderately to extremely ventricose, in the Sumatran specimens very ventricose (l/d at most 4.1), the spire is often a strikingly short squat cone, the aperture not so broadly reflexed, auriform .....
Sumatra, Java ..... **Ps. obesa** (VON MARTENS) (p. 66)

5. below the plica principalis at least another 3 or more moderately long (more than 1 mm) plicae palatales ..... 6.

— below the plica principalis 2 more moderately long (more than 1 mm) and 1, exceptionally 2, short plicae palatales .....
Java, Madura and some neighbouring small islands .....
Ps. javana (PFEIFFER) (p. 59)

6. below the plica principalis more than 6 moderately long distinct plicae palatales, only slightly differing in length .....
Sulu Islands ... **Ps. suluana** (VON MOELLENDORFF) (p. 80)

— below the plica principalis at most 5 moderately long plicae palatales .....
Sumatra ..... **Ps. gracilenta** n. nom. (p. 75)

7. shell with only a rather long plica palatalis superior and no other plicae below the plica principalis .....
Simalur Island ..... **Ps. jacobsoni** n. sp. (p. 100)

— shell has more than one plica palatalis below the principalis ..... 8.

8. shell shorter than 22 mm and not wider than 5 mm, rather fragile, yellow horn-coloured, glossy, with strikingly short plica palatalis principalis (at most the length of ¼ whorl) .....
Sumatra ..... **Ps. brachyptycta** n.sp. (p. 97)

— the shell has not got this combination of characters ..... 9.

9. shell shorter than 21 mm ..... 10.

— shell longer than 21 mm ..... 11.

10. shell slender (diam. less than 5 mm), orange-brown, shining, aperture narrow, not wider than 4 mm .....
Sumatra ..... **Ps. vicaria** (SYKES) (p. 94)

— shell at least 5 mm wide, aperture wide, wider than 4 mm .....
Mentawei Islands ... **Ps. mentaweiensis** (EHRMANN) (p. 99)

11. shell practically smooth, peristomal edge sharp or narrowly reflexed, lamella inferior ascends quickly, almost vertically .....
Malay Peninsula ..... **Ps. penangensis** (STOLICZKA) (p. 85)

— shell clearly and densely striated, peristomal edge broadly reflexed,

lamella inferior with thickened edge, which does not ascend quite so steeply ..... 12.

12. shell has a maximum of 10 ventricose whorls (l/d reaches a maximum of 4), the conical spire is short and wide, in such a way, that the length of the shell is less than 2.2 times the length of the aperture and the preceding whorl together, measured along the ventral side ... Sumatra ..... **Ps. abbreviata** (VON MARTENS) (p. 91)

— shell has at least 9 whorls, rather slender (l/d is at least 4), the conical spire is long and rather slender, in such a way that the length of the shell is more than 2.3 times the length of the aperture and the preceding whorl together, measured along the ventral side ... Sumatra ..... **Ps. sumatrana** (VON MARTENS) (p. 81)

Pseudonenia javana (L. PFEIFFER, 1841)
(fig. 15)

1841 PFEIFFER, p. 49 (*Clausilia javana*)
1846 PFEIFFER, p. 63 (*Clausilia Heldii*, nom. nud.)
1847 KÜSTER, p. 26, pl. 2, f. 26—28 (*Clausilia javana*), p. 27, pl. 2, f. 29—31 (*Clausilia Heldii*)
1848 PFEIFFER, p. 404 (*Clausilia javana* = *Clausilia Heldii*)
1849 MOUSSON, p. 39 (*Clausilia Heldii* var. *baronensis*)
1855 ADAMS, p. 184 (*Clausilia javana*, subgenus *Phaedusa*)
1867 VON MARTENS, p. 380, f. 2 on p. 378 (*Clausilia javana* and *Clausilia Heldii*, group *Phaedusa*), p. 381 (*Clausilia Heldii* var. *Baronensis*)
1877 BOETTGER, p. 60 (*Clausilia Heldi*, sectio *Phaedusa*, group *Pseudonenia*, "Formenkreis" of *Heldi*), p. 61 (*Clausilia javana*, sectio *Phaedusa*, group *Pseudonenia*, "Formenkreis" of *javana*)
1878 NEVILL, p. 183 (*Clausilia* (*Phaedusa*) *javana*)
1890 BOETTGER, p. 148 (*Clausilia* (*Pseudonenia*) *javana* = *Clausilia* (*Pseudonenia*) *heldi*)
1892 COOKE, p. 468 (*Clausilia javana* and *Clausilia heldii*)
1914 LESCHKE, p. 238 (*Phaedusa heldii* and *Phaedusa javana*)
1915 COOKE, p. 265 (*Pseudonenia javana* and *Pseudonenia heldii*)
1920 WAGNER, p. 10 (*Aprosphyma* (*Macrenoica*) *javana*)
1935 PARAVICINI, p. 174 (*Phaedusa javana*)
1941 VAN BENTHEM JUTTING, p. 297 (*Phaedusa* (*Pseudonenia*) *heldi*, *Phaedusa* (*Pseudonenia*) *heldi* var. *baronensis*), p. 298 (*Phaedusa* (*Pseudonenia*) *javana*).

DESCRIPTION of the material. Shell of medium height to large; fusiform, rather solid; usually reddish- to violet-brown, sometimes however, a yellowish specimen or even an albinotic one may occur; slightly glossy, not or scarcely transparent. Spire thick, with convex or at best straight lateral outlines. Whorls 8½ to 11, nearly always 9 to 10, slightly convex, sculptured with numerous oblique, fine, straight, transverse striae (about 10 to 15 to the mm on the whorl above the aperture), which are often coarser and stand wider apart on the neck. A faint or distinct thread, in the colour of the shell, sometimes runs below the shallow suture. A part of the whorl below the suture may be distinctly lighter in colour (e.g. cream-coloured) than the rest of the shell. The nuclear whorls,

about 2½, are smooth and rather convex, they form a blunt apex. In a side view the neck runs very slowly and regularly down to the base of the aperture; hence the neck is not at all swollen.

A p e r t u r e oblique, triangular, pear-shaped, trumpet-like, often violet-coloured within; the sinulus is high, as the upper peristomal margin is bent sharply upward to the left of the place where it is touched by the superior lamella, hence the sinulus is not only separated from the aperture by the lamella superior. The base of the peristome lies at the back of the plane in which the rest of it lies, sometimes the top of the sinulus also recedes. The peristome is continuous, whitish, sometimes

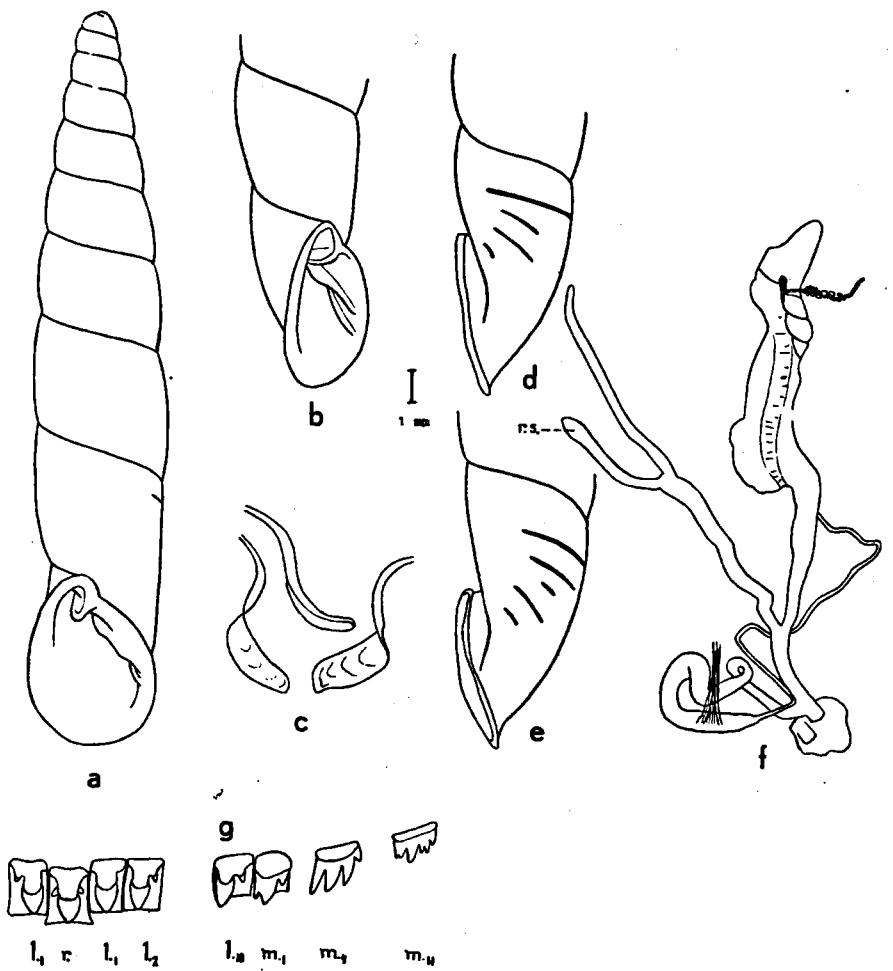

Fig. 15. **Pseudonenia javana** (L. PFEIFFER)
Loc. Java, Mount Gedeh.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** 3 views of the clausilium; **d.** right side of the last whorl with the plicae seen through the shell (principalis + 3 plicae); **e.** the same of another shell (principalis + 4 plicae); **f.** reproductive organs (r.s. = receptaculum seminis); **g.** some elements of the radula (× 390).

broadly reflexed, the upper margin is clear of the preceding whorl. The peristome is nearly always distinctly curved, where it is touched by the lamella superior. From the sinulus the outer margin regularly curves down, whereas the parieto-columellar margin may show a slight angle or be fairly straight. The basal part of the aperture is broad and bulges slightly towards the right.

Lamella superior oblique and rather high, reaching the margin, always connected with a low lamella spiralis, which ends internally in a ventrolateral-left position, together with the two other lamellae. Lamella inferior does not always reach the margin, it is low and ascends straight into the shell. Often the columella is distinctly visible as a real edge, joining the thickened edge of the inferior lamella in the aperture, it looks as if the lamella is forked. When looking obliquely from below into the aperture one can hardly see the base of the inferior lamella.

Lamella subcolumellaris is usually visible in a full front view of the aperture, often it even reaches the margin. Sometimes, however, it can only be seen in an oblique view of the aperture.

The closing apparatus lies at the right side. The plica palatalis principalis runs from ventro-lateral on the right side to a little beyond the dorsal side, it is almost half a whorl long. Below this plica we always find two fairly large plicae, and a small or very small third, slightly diverging towards the outside of the shell. They are quite regularly distributed from the principal plica to the umbilical slit. The subcolumellar lamella may sometimes be seen through the shell, but only its lowest parts run on the palatal wall. In addition to the plicae mentioned some more small ones may occur exceptionally between the principal plica and the first lower one, between the first and the second ordinary plica, or between the second and the small third. I never saw a specimen showing all these accessory plicae together. The clausilium has a long, regularly curved, narrow plate, with a distinct top, the sides of the plate run almost parallel, its length is 2.5 to 3.0 mm, its width 1.0 to 1.2 mm.

Length of the shells: 18.0 to 27.5 mm, diam. 3.7 to 5.0 mm; aperture: height 4.1 to 6.5 mm, width 3.1 to 4.9 mm. More than 350 specimens were measured. The ventrosity of the shells l/d = 4.5 up to 6.0, the average is 5.2. In one specimen, however, l/d = 4.0, in one 6.5 and in another 6.6. These 3 specimens were more or less montrosities.

According to PFEIFFER (1841) the number of whorls and the dimensions are: „8—9 whorls, long. 11, diam. 2 lin.". I do not know where the original set is preserved. According to an information of Dr. A. ZILCH it formerly was in PFEIFFER's collection in the Stettin Museum.

PFEIFFER's original description is very incomplete. He mentioned among others, only one plica palatalis, but there was no misunderstanding about the lamella subcolumellaris, which he called „emersa". It is incomprehensible therefore, why KÜSTER (1847) recorded: „Spindelfalte kaum sichtbar" (lamella subcolumellaris hardly visible). KÜSTER also mentioned two palatal plicae. As it is often very difficult to get the right impression of the number of plicae in an undamaged shell, it is clear that one is liable to make mistakes when but a few specimens are available.

After *Clausilia javana*, KÜSTER described his new species „*Clausilia*

Heldii" of which he stated: „closely related to last-mentioned species, distinguishes itself constantly from the latter by slighter size; wider rounder aperture, more palatal plicae, less strongly bent lamella inferior, clearly visible lamella subcolumellaris, wider area round umbilicus and glossier". He further mentioned 10 whorls and 4 plicae palatales. One by one these differences do not hold. Smaller and larger specimens are found together and numerous intermediate forms are known.

A fairly regular series can be formed out of all the specimens, if they are arranged according to length, width or ventrosity. There are important individual differences in the shape of the aperture. The number of plicae palatales mentioned by PFEIFFER is too small. The more or less distinct bifurcation of the inferior lamella, caused by a more or less clearly visible columella, is, according to my experience, an individual feature and has nothing to do with the absence or presence of other characters. The other differences mentioned are also individual. It remains a strange fact, however, that KÜSTER includes in his new species *Heldii* just those specimens that possess an emerging lamella subcolumellaris.

Soon after, PFEIFFER (1848) published a revised edition of his original description, giving the following number of whorls and dimensions: "9—10 whorls" and "long 23, diam. $4^2/_3$ mill. Ap. fere 6 mill. longa, $4^1/_3$ lata." Moreover he mentioned 3—4 plicae palatales, including the plica principalis, and he repeated his "subcolumellaris emersa". Quite correctly he included *Heldii* KÜST, as a synonym of *javana* PFR.

MOUSSON (1849) followed KÜSTER and moreover described *Heldii* var. *baronensis* which in many of its characters merges gradually into *javana*. It is clear that this form lies entirely within the range of variation of *javana*.

VON MARTENS (1867) also followed KÜSTER, but stated that *heldi* can hardly be kept separate from *javana*. It is confusing that he interchanged the sculpture of *Ps. javana* with that of *Ph. corticina* and vice versa.

O. BOETTGER (1877) established *javana* PFR. as the type of his group *Pseudonenia*, in which he included, besides a "Formenkreis" of *Heldi* KÜST., a.o. a "Formenkreis" of *javana* PFR. Within the latter he included *Ps. javana* PFR. and *Ph. corticina* PFR. As the most important characters of this "Formenkreis" he mentioned: "plica palatalis supera plerumque unica, lamella spiralis deficiens, subcolumellaris immersa". The two first-mentioned characters fit neither *javana*, nor *corticina*, the last only *corticina*. For the rest *Ph. corticina* PFR. is the type of *Phaedusa* and therefore *Pseudonenia* is, if *corticina* and *javana* are placed in the group, as BOETTGER does, synonymous with *Phaedusa*. In 1890 BOETTGER agreed with PFEIFFER and stated that *heldi* KÜST. is synonymous with *javana* PFR. In spite of all this, *heldi* keeps cropping up as an independent species.

WAGNER (1920) mentioned *javana* in his new system (which he pretended to be based primarily on the anatomical data) as belonging to the genus *Aprosphyma* and subgenus *Macrenoica*. Against his classification, at least as far the asiatic forms go, a great many objections must be raised (EHRMANN, 1927). WAGNER included in *Macrenoica* a very heterogeneous assemblage of species, without satisfactory reasons. Of

the 12 species mentioned the anatomy of only one (*mairei* BAVAY & DAUTZENBERG) is known. The characters of the shell which WAGNER mentioned are so vague that they don't give much to go by either. There is no sense in mentioning the anatomical data of his group here, as they do not hold in all respects for *javana*.

Finally O. BOETTGER mentioned several varieties of this species in manuscript. According to my opinion they refer to modifications, hence there is no reason for their publication.

ANATOMY. Up to now nothing was known about the radula and the genital organs of *Ps. javana*. Mr. A. M. R. WEGNER collected a number of specimens in Java (Megamendung, under the loose bark of a dadap-tree (*Erythrina* sp.), which as usually were forwarded immediately by Mr. L. J. M. BUTOT. They were still alive, when I got them.

The animal is black with a grey sole, the upper tentacles are yellowish-brown with a black eye-spot (vide photo 3).

The formula of the radula is: about $120 \times \frac{1}{3} + \frac{10}{2} + \frac{16}{3-\omega}$, i.e. about 120 rows, each row consisting of a rhachidian tooth with 3 cusps and to either side of it 10 lateral teeth with 2 cusps each and 16 marginal teeth with 3 to many cusps. The teeth, cusps and basal plates are as usual in *Clausiliidae*.

Genital organs. The appendix or diverticulum to the duct of the receptaculum seminis is twice as long as the last, distal part of this duct from the attachment. There are no other conspicuous appendices. The retractor muscle and the nerve of the left upper tentacle pass between the penis and the vagina. The dimensions (rounded off to mm) of some ducts and organs, measured in a snail with a shell of 20 mm length and 4 mm width, are: penis 7 mm, epiphallus as far as the retractor muscle 3 mm, vas deferens 17 mm, prostate and uterus 7 mm, vagina as far as the orifice of the duct of the receptaculum seminis 3 mm, from there to the uterus 5 mm, duct of the receptaculum seminis as far as the attachment of the appendix 7 mm, from there to the end of the receptaculum 4 mm, length of the appendix 7 mm. The duct of the receptaculum seminis and the appendix are strikingly wide in this species, both are situated against the uterus and the prostate gland. The receptaculum itself lies aside, among connective tissue. In one of the two specimens the penis formed a loop, through which the retractor muscle passed; one would have regarded this as a character of the species, but eventually it was not present in another specimen.

In the thin-walled uterus of one specimen six eggs were found. The species is not viviparous, but lays eggs. In my cultivating dishes eggs were laid by some specimens from Megamendung. The eggs are globular or oval, they have a diameter of about 2 mm (I noted 2.0 by 2.4 mm and 1.7 by 2.3 mm). The egg-shell is provided with scattered calcareous particles.

DISTRIBUTION: Java, Madura, Nusa Barung, Nusa Kambangan.

Type-locality: Java.

In the first description only Java is mentioned as the type-locality. Further localities given in literature are: Nusa Baron, an island south

of East Java (MOUSSON, 1849) [1]); on lime-rocks in Java (ZOLLINGER, 1860); near Buitenzorg, Java, 3000 feet (NEVILL, 1878); Mount Salak and Mount Gedeh, Java (BOETTGER, 1890); Sukabumi, W. Java (PARAVICINI, 1935) and Madura Island, Pamekasan, leg. P. A. OUWENS and Nusa Kembangan, a small island south of Central Java (VAN BENTHEM JUTTING, 1941).

H a b i t a t. Some cases are known in which *Ps. javana* PFR. was found on limestone, e.g. the find near Sukanegara. ZOLLINGER stated, as has been mentioned above, that the species had been found on "lime-rocks in Java".

The altitudes above sea-level, on which specimens of this species have been found, vary from 600 to 3200 m, so these are again hill- and mountain-dwellers. Few data are available on the biotope, a few times localities in woods have been reported. Whether they are ground- or tree-dwellers I do not know. Mr. A. M. R. WEGNER found the snails on a dead fallen dadap-tree. *Erythrina* sp., underneath the trunk, under the loose bark. Internally the tree was still normal, not excessively decayed and wet, and it was grown over with mosses and lichens. The shells were hanging down almost vertically.

L o c a l i t i e s. I here only give the sets with more accurate data ranging from east to west); besides those I studied many sets labelled „Java" only.

Madura.
Pamekasan, leg. P. A. OUWENS (Z.M.A., 5)[2])
dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
22.6	4.2	5.0	3.7	10
20.4	4.3	4.9	3.4	9
23.7	4.1	5.3	4.1	10
21.0	4.1	5.1	3.9	9
22.5	4.1	—	—	10

Nusa Barung, a small island south of East Java.
Hanging on lime-rocks, leg. H. ZOLLINGER (Zoologisches Museum der Universität, Zürich, 6). This is the original set of MOUSSON's *Heldii* var. *baronensis*!

	21.4—24.8	4.3—4.7	5.3—5.6	3.8—4.4	9½—10½
averages:	23.4	4.5	5.5	4.1	

These six shells form a fairly heterogeneous company ; there are for instance specimens among them with the subcolumellar lamella reaching the peristome, but there are also some, whose lamellae are only clearly visible in an oblique view of the aperture. The colour of the shells too, which was described minutely by MOUSSON (1849) is not at all the same in all the specimens. According to my opinion there is therefore no reason to give a separate name to these specimens (vide p. 62).

Nusa Kambangan, a small island, south of Central Java, leg. Mrs. A. C. VAN HEURN, 1931 (Z.MA., 2)

20.8	4.7	4.9	3.5	9½
ca 20	5.0	—	—	9½

Java.
West Java.
Garut, leg. A. STRUBELL (S.M.F. no. 61083, 1 ; no. 61085, 4 and Z.M.A., 1); ca 700

[1]) This form, previously described by MOUSSON (1849) as *Heldii baronensis*, is not different from *Ps. javana*.
[2]) vide note on p. 21.

m altitude, leg. W. C. VAN HEURN, 1929 (R.M.L., 1) and 1200—1700 m altitude, leg. W. C. VAN HEURN (J. TH. HENRARD collection, 1)

	21.0—25.8	3.9—4.6	4.8—5.7	3.4—4.2	9½—10½
averages:	23.8	4.3	5.4	4.0	

Mount Tjikorai, ca 1700 m, leg. H. FRUHSTORFER, 1891 (N.M.R., 1; S.M.F. no. 61093, 3; Z.M.A., 2 and F. E. LOOSJES collection, 1)

	22.1—27.0	4.4—4.7	5.3—5.9	3.8—4.1	10—11
averages:	24.2	4.5	5.6	4.0	

Mount Papandajan, ca 3200 m, leg. H. FRUHSTORFER, 1891 (S.M.F. no. 61092, 2)

26.6	4.9	6.0	4.2	11
23.4	4.8	5.7	4.4	10

Mount Papandajan, Tjibulu near Tjikadjang, leg. W. C. VAN HEURN, 1929 and 1930 (R.M.L. 103a, 2 and 103b, 19)

	22.0—25.9	4.4—4.7	5.6—5.9	3.9—4.4	9—10½
averages:	24.4	4.6	5.7	4.2	

Pengalengan near Bandung, 1500 m, leg. H. FRUHSTORFER, 1895 (S.M.F. no. 61082, 1)

22.8	4.5	5.2	4.1	9½

Sukabumi (K.B.I.N., 8 and E. PARAVICINI collection, no. 684a, 1)

	19.5—21.9	4.0—4.5	4.7—5.4	3.4—4.1	9—10
averages:	21.1	4.3	5.0	3.8	

District Sukapura, Mount Djampang, south of Sukabumi, ca 1200 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61081, 6; no. 61094, 3 and no. 61136, 1)

	18.0—26.6	3.7—4.3	4.1—6.1	3.1—4.2	8½—10½
averages:	21.1	4.1	5.2	3.9	

Limestone hill near Sukanegara, ca 1000 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 1)

24.6	4.4	5.1	3.9	10

Situ Gunung (a lake) on Mount Gedeh, 1200 m, leg. M. A. LIEFTINCK, 1937 (Z.M.A., 2)

23.0	4.5	5.6	4.1	9
24.7	4.2	5.4	4.1	10

Mount Gedeh, 1200 m (N.M.B. no. 253a, 4); ca 1300 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 30151, 2; no. 30147, 2 and Z.M.A., 3); leg. LEDRU, 1898 (K.B.I.N., 1) and ca 1300 m, leg. VON MALTZAN, 1881 (S.M.F. no. 61086, 10)

	20.4—27.1	4.1—4.9	5.0—6.3	3.5—4.8	9—10½
averages:	22.8	4.4	5.5	4.1	

"Tjisarua Zuid" Estate, Mount Pangrango, wood at ca 1100 m, leg. M. A. LIEFTINCK, 1932 (Z.M.A., 1)

19.2	4.3	4.6	3.3	10

Mount Pantjar near Bogor, ca 800 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 11)

	20.5—23.2	4.1—4.5	4.8—5.3	3.6—4.0	8½—10
averages:	21.4	4.3	5.0	3.8	

Mount Paniisan near Bogor, ca 600 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 1)

22.8	4.4	5.2	3.7	10

Megamendung, near Bogor, wood, ca 900 m, leg. M. A. LIEFTINCK, 1932 (Z.M.A., 3); on very wet soil at the underside of a fallen tree (dadap, *Erythrina* sp.), which was overgrown with mosses and lichens, under the already loose bark, shells hanging at

an angle of almost 90°, 700 m, leg. A. M. R. WEGNER, 1951 (M.Z.B., 7 and F. E. LOOSJES collection, 6)

	19.1—25.4	4.0—4.8	4.5—5.6	3.3—4.3	9—10
averages:	22.2	4.3	5.1	3.9	

Tjiliwung Estate, Puntjak-pass, near Bogor, 1000 m, leg. W. C. VAN HEURN, 1932 (J. TH. HENRARD collection, 1)

25.7	4.4	5.5	3.9	11

Mount Bunder (on the label err. as M. Bundler), Mount Salak, leg. BRYANT and PALMER, 1909—10 (U.S.N.M. no. 261687, 4)

19.8	4.2	5.0	3.5	9
20.8	4.4	5.0	3.7	9½
20.9	4.0	5.0	3.6	10
21.1	4.2	4.9	3.7	10

Mount Salak, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61080, 5)

26.3	4.8	5.9	4.4	11
26.2	4.7	5.7	4.5	11
25.9	4.6	5.9	4.7	10½
21.0	4.3	5.3	4.1	9
18.8	4.7	5.3	4.3	8½

Palabuan, near Wijnkoopsbay, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61087, 4 and no. 61088, 7 ; Z.M.A., 5);without indication of collector (R.M.L., 1 and S.M.F. no. 61089, 2)

	20.1—23.6	4.0—4.5	4.7—5.6	3.5—4.1	9—10½
averages:	21.9	4.2	5.1	3.8	

Tjisolok, west of Palabuan, leg. O. STAUDINGER, 1893 (S.M.F. no. 61091, 1)

25.5	3.9	5.2	3.8	11½

Mount Karang, wood near the craters, 1000 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 2)

25.6	4.6	6.0	4.4	10
24.8	4.6	5.7	4.0	10

Mount Karang, wood near Kampong Tjinjurup, 700 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 1 fragm.)

This survey clearly shows that all the localities that are situated in Java itself are in West Java ; there are, however, too many sets without exact locality to justify the conclusion that the species has never been found in Central and East Java.

In none of the localities mentioned a (clearly definable) aberrant form of *javana* occurs.

Pseudonenia obesa (VON MARTENS, 1867)

KEY TO THE SUBSPECIES.

1. the spire of the shell is usually an elongated cone ; subcolumellar lamella is rather delicate and usually just visible in a full front view of the aperture .....
   Java ..... **Ps. o. salacana** (O. BOETTGER) (p. 70)

— the spire of the shell is a short cone of no more than 7 whorls; the subcolumellar lamella is high and protrudes .....
Sumatra ..... **Ps. o. obesa** (VON MARTENS) (p. 67)

Pseudonenia obesa obesa (VON MARTENS, 1867)
(fig. 16)

1867 VON MARTENS, p. 380 (*Clausilia obesa*, group *Phaedusa*)
1868 PFEIFFER, p. 410 (*Clausilia obesa*)
1893 SYKES, p. 29 (*Clausilia Melvilli*).
1915 COOKE, p. 265 (*Euphaedusa obesa*)
1925 VAN BENTHEM JUTTING, p. 143 (*Phaedusa sumatrana*)
1935 PARAVICINI, p. 59 (*Phaedusa deliniana*, nom. nud.)
1941 VAN BENTHEM JUTTING, p. 298 (*Phaedusa sumatrana, Pseudonenia*)

DESCRIPTION of the material. Shell of medium height to large; ventricose fusiform, solid, reddish- to yellowish-brown, rather dull, not transparent. Spire conical, thick-set, with straight lateral outlines. Whorls 8½—10, slightly convex, sculptured with numerous very fine transverse striae (about 15 to the mm on the whorl above the aperture), which are somewhat coarser and stand a little wider apart on the neck. Usually there is no thread along the suture. The part of the whorls below the shallow suture, especially on the upper whorls, is often less intensely coloured. The nuclear whorls are almost smooth and rapidly broadening. The neck is rather distinctly bent towards the base of the aperture.
Aperture oblique, broad, pear-shaped, yellowish-brown within; the sinulus is broad but not exceedingly high, although the upper margin forms a slight angle, where it is touched by the lamella superior. The base of the aperture does not protrude so far as the upper parts. Hence the peristome as a whole lies in a plane that does not run parallel with the axis of the shell. The peristome is continuous, white and often shining, broadly reflexed; the upper margin is clear of the preceding whorl. From the sinulus the outer margin regularly curves down, whereas the parieto-columellar margin sometimes has a slight angle at the right side instead of a regular curvature, before it runs fairly straight downwards and at the same time slightly outwards.
Lamella superior oblique and high, reaching the margin, always connected with the low lamella spiralis. The latter ends inward in a ventral position before the ends of the two other lamellae. Lamella inferior is a low fold, of which only the lowest part is visible in a full front view of the aperture, as it turns inward and upward very soon; externally it almost reaches the margin; at the dorsal side it is relatively high, the inner end gradually diminishes in height, almost as far as the left side. It is nearly always difficult or even impossible to see the base of the lamella inferior by looking into the aperture. The columellar edge is not very distinct. The subcolumellar lamella is always clearly visible below the lamella inferior; it is a strong fold, which ends outside near the margin and inside in a lateral position beyond the two other lamellae.
The closing apparatus lies at the right side. The plica pala-

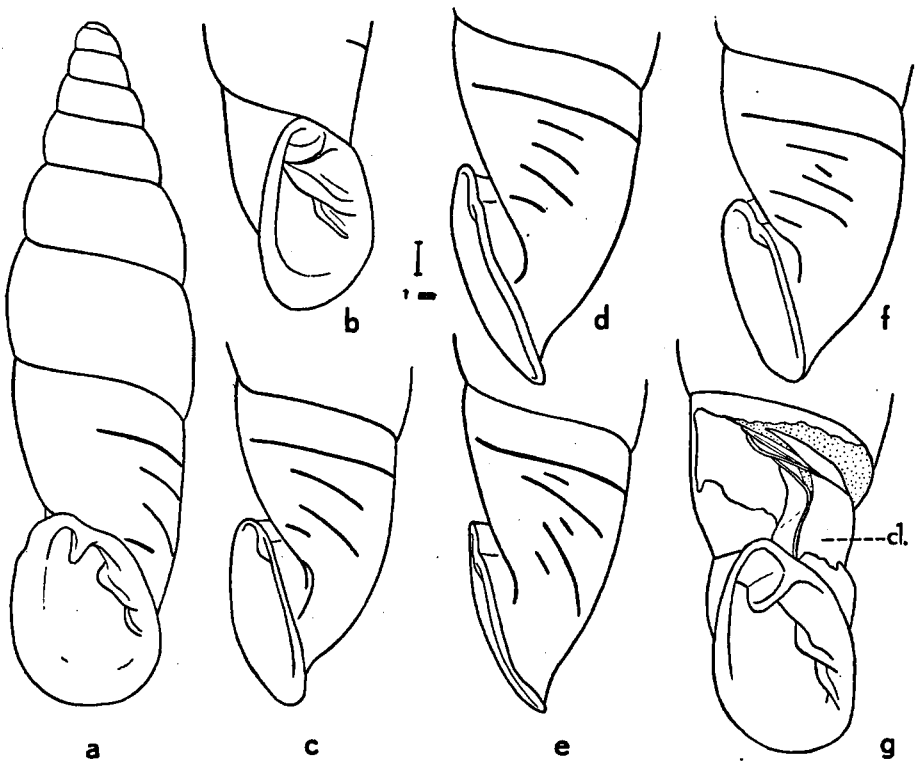

Fig. 16. **Pseudonenia obesa obesa** (VON MARTENS)
Loc. (**a**—**c**) Sumatra, north of Point Lampong (holotype of *melvilli* SYKES)
(**d**—**f**) Sumatra, Langkapura
(**g**) Sumatra, Mount Tanggamus.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell (principalis + 3 plicae); **d.**, **e.** and **f.** the same of other shells with 4, 5 and 5 plicae below the principalis; **g.** ventrolateral-left side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium (cl.) is present.

talis principalis is half a whorl long; it runs from the dorsal side to the ventral side. Below it are 3 to 5 plicae palatales, rather regularly distributed. When there are 3, we observe from above to below: long, long, short. Between the two long plicae a fourth may occur, which often appears in other Phaedusoid groups also. This fourth plica may become as long as the other long ones (long, long, long, short). Very rarely an accessory fifth plica occurs between the principal plica and the first normal plica, which is always short. Exceptionally there may be some more short plicae. Because of the irregular distribution of these plicae, however, it is obvious that the individual is abnormal. Below the short lowest plica the lamella subcolumellaris is scarcely visible from outside; it runs just behind the umbilical slit. The plate of the clausilium is regularly and slowly bent, the sides run almost parallel. I cannot give the exact dimensions of the plate.

Length of the shells: 21.6 to 28.0 mm, diam. 5.9 to 7.1 mm; aperture: height 5.8 to 7.8 mm, width 4.3 to 5.9 mm. I studied 18 specimens. The ventrosity of the shells l/d is 3.5 to 4.1, the average is 3.9.

VON MARTENS (1867) recorded for the type: "Anfr. 9, long. 24½, diam. anfr. antepenult. 7, penult. 6½, apert. alt. 7, lat. 6 mm". According to him it is in the "Rijks Museum" at Leyden, but it proved not to be there.

The original description leaves very little doubt as to what species is meant. Including the plica palatalis principalis VON MARTENS mentioned 4 plicae. PFEIFFER (1868) repeated VON MARTENS's data. SYKES (1893) described *Ps. melvilli* although he knew *Ps. obesa*; he considered the two species as closely related and mentioned the differences afforded to him in litteris by BOETTGER (at that time only one specimen of either species was known, as far as I know). "Differt a *Cl. obesa* v. MTS. anfr. solum 8½, penultimo ventrosiore quam antepenultimo, apert. ovata, lamellis extrorsum convergentibus, plicis principali et palatalibus, 3 longis, nec. 4". The difference in the number of whorls 8½ or 9 is unimportant. I studied the type of SYKES's *melvilli* in the collections of the British Museum (Nat. Hist.). In addition to the plica palatalis principalis it has 3 (not 2) ordinary palatal plicae (long, long, short). The detail on the ventrosity of the whorls is not correct either, the antepenultimate whorl is widest in both species. The figure accompanying SYKES's description does not leave any doubt about this fact either, nor about: "Lamellis extrorsum convergentibus". Consequently *melvilli* is synonymous with *obesa*. SYKES's hypothesis that *Ps. melvilli* is the shell referred to by VON MARTENS (1867, p. 384), when the latter wrote the postscript about *Hemiphaedusa excurrens*, is incorrect, as VON MARTENS positively mentioned specimens with a clearly visible lunella.

PARAVICINI (1935) referred to a species *Phaedusa deliniana* MLLDFF, but to my knowledge VON MOELLENDORFF never described a species of that name. In the collections of the Senckenberg Museum and of PARAVICINI are shells labelled *deliana*. The first shell thus named is probably a shell from the Deli district in East Sumatra. I suppose that VON MOELLENDORFF called it *deliana* in manuscript only (now in the Senckenberg collection). HAAS, who according to an indication on PARAVICINI's labels, identified specimens from Langkapura, Southern Sumatra, for him, established the similarity with *Ps. deliana* MLLDFF ms., not knowing that this name had never been published. Why PARAVICINI did not write *deliana* but *deliniana* is not clear. This complicated state of affairs was not necessary at all, as the specimens without doubt belong to *Ps. obesa* MARTS.

ANATOMY unknown.

DISTRIBUTION: Sumatra, Sebesi Island.

Type-locality: unknown.

Clausilia obesa was described after a specimen of unknown origin. Because of the structure of the shell VON MARTENS supposed the locality to be somewhere in the Indian Archipelago or in Further India. SYKES (1893) mentioned a place a few miles north of Point Lampong, S. Sumatra, and PARAVICINI (1935) Langkapura, Sumatra.

Habitat. Exact data on the localities are only known from Southern Sumatra. As to the biotope, we only know that specimens were found in newly cleared, burnt-down jungle. Once 600 m above sea-level is recorded. Nothing is known on the nature of the soil.
Localities. The following specimens were studied by me:

Sebesi Island.
leg. K. W. DAMMERMAN, 1921 (M.Z.B., 1)[1])

dimensions (in mm): shell length	shell diam.	aperture height	aperture width	number of whorls
24.7	6.8	6.8	5.7	9

This specimen was erroneously published under the name of *Ph. sumatrana* MARTS. by VAN BENTHEM JUTTING (1925 and 1941).

Sumatra.
Lampong districts, a few miles north of Point Lampong, leg. E. C. BUXTON, 1873—1874 (B.M.L. no. 1930.1.21.14, 1)

22.4	5.9	6.3	4.8	8½

This is the holotype of *Ps. melvilli* SYKES.

Lampong districts, southern slope of Mount Tanggamus, 600 m, in newly cleared jungle, leg. R. W. VAN BEMMELEN, 1930 (R.M.L., 2 and Geologisch Museum, Bandung, 1).

27.0	7.1	7.8	5.9	9
28.0	7.0	7.6	5.6	9
24.6	6.8	6.6	4.6	9

Lampong districts, along the motor-road between Rantautidjang and Padjaresuk, west of the line Telokbetong-Sukadana, leg. SZEMIAN, 1930 (R.M.L., 2 and Geologisch Museum, Bandung, 2)

24.0	6.2	6.4	5.2	9
24.0	6.4	6.5	—	9
21.6	6.2	6.3	4.7	9
23.5	6.0	5.8	4.3	9½

Palembang Highlands, Mount Raja near Lake Ranau, in burnt-down jungle, leg. R. W. VAN BEMMELEN, 1929 (R.M.L., 2 and Geologisch Museum, Bandung, 2)

26.6	6.9	7.7	5.4	9
26.1	6.5	7.0	5.7	9
25.4	6.6	6.3	4.9	9
24.1	6.7	6.6	4.8	9

Palembang Highlands, Langkapura, leg. E. PARAVICINI, 1924 (S.M.F. no. 61141, 1 and E. PARAVICINI collection, no. 689a, 3)

24.8	6.0	6.4	5.0	9½
25.3	6.4	6.6	5.1	10
24.6	6.0	6.5	4.8	10
24.4	6.2	6.7	5.0	10

Among these four there are specimens with 3, 4 and 5 palatal plicae.

District of Deli, East Sumatra (S.M.F. no. 61140, 1)

—	6.6	6.8	5.5

Pseudonenia obesa salacana (O. BOETTGER, 1890) (fig. 17)

1890 BOETTGER, p. 149 (*Clausilia salacana, Pseudonenia*)
1914 LESCHKE, p. 239 (*Phaedusa salacana*)
1915 COOKE, p. 265 (*Pseudonenia salacana*)

[1]) vide note on p. 21.

DIAGNOSIS of the material. Shell of medium height to large; ventricose fusiform; not very solid, reddish-brown to yellowish-horn-coloured, sometimes slightly glossy, not or scarcely transparent. Spire conical, not always as squat as in *Ps. obesa obesa*; the lateral outlines are straight or sometimes slightly concave, in which case the embryonic whorls are not so regularly attached to the lower ones as is normally the case. Whorls 9½ to 11½, rather convex, sculptured with numerous fine transverse striae (about 15 to 20 to the mm on the whorl above the aperture); they are not or hardly any coarser on the back of the last whorl. The nuclear whorls, ca 2½, are almost smooth and usually rather rapidly broadening.

Aperture as in the subspecies *obesa*. The peristome is continuous, whitish, sometimes a little shining, broadly reflexed.

Lamella superior of medium height, oblique, reaching the margin, always connected with the low lamella spiralis, which ends inward between the ventral and the left side. Lamella inferior as in *obesa* proper. The lamella subcolumellaris is delicate and usually just visible in a full front view of the aperture; exceptionally, however, it may run almost as far as the margin, or stay behind the inferior lamella. Internally it

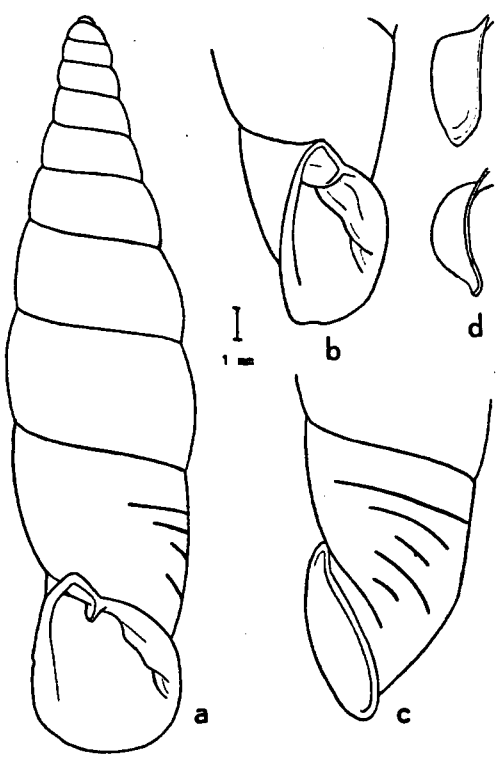

Fig. 17. **Pseudonenia obesa salacana** (O. BOETTGER)
Loc. (a—c) Java, Mount Salak; lectotype.
(d) Java, Mount Salak.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell; **d.** 2 views of the clausilium.

ends beyond the two other lamellae in a lateral position at the left side. The closing apparatus lies at the right side. Below the plica principalis are four palatal plicae, rather regularly distributed. From above to below: long, short, long, short. Below the short last one the lamella subcolumellaris is only vaguely visible through the shell behind the umbilical slit. The plate of the clausilium is rather narrow, regularly and slowly bent, the sides run almost parallel, the top is slightly thickened, the dimensions are: length 3.0 mm, width 1.5 mm.
Length of the shells: 21.4 to 29.4, diam. 5.4 to 6.5 mm; aperture: height 5.4 to 6.7 mm, width 4.0 to 5.4 mm. I studied 26 specimens. The ventrosity of the shells l/d is 3.8 to 4.6, the average is 4.2.

According to BOETTGER (1890) the dimensions are: number of whorls 10 to 10½, length 25 to 26 mm, diam. 6 to 6.5 mm, aperture: height 6.5 to 6.6 mm, width 4.75 to 5 mm.

The holotype was in the STRUBELL collection. It was destroyed during the second World War, as Dr. ZILCH informed me. I have chosen a lectotype out of the paratypes present in the collections of the Senckenberg Museum (S.M.F. no. 61060). Its dimensions are:

dimensions (in mm):				number of whorls
shell		aperture		
length	diam.	height	width	
24.2	6.1	5.9	4.8	10

BOETTGER (1890) remarked that this species occupies an intermediate position between *Acrophaedusa junghuhni* PHIL. and *Ps. javana* PFR., but that it ought to be included in the dark-coloured group of *Ps. javana*. On superficial observation the light-coloured specimens remind one indeed of *junghuhni*; the dark specimens are often not easily distinguishable from *obesa*. In view of this similarity I regard *salacana* as a subspecies of *Ps. obesa*.

ANATOMY unknown.

DISTRIBUTION: Java.
Type-locality: Mount Salak.
The type-locality is: "spurs of Mount Salak", where it was found by A. STRUBELL.
Habitat and biology unknown.
Localities. I only saw specimens from two localities in West Java.

Mount Salak, leg. A. STRUBELL, 1889 (S.M.F. no. 61060,5; no. 61059, 2; no. 61061, 3; no. 61058, 2 and Z.M.A., 2).[1]) These are all paratypes.

	21.4—25.2	5.4—6.4	5.4—6.4	4.0—5.1	9½—11
averages:	23.8	5.9	6.0	4.7	

Mount Salak, leg. H. FRUHSTORFER, 1893 (S.M.F. no. 61063, 1); Id. recorded without collector (K.B.I.N., 1)

29.4	6.5	6.7	4.9	11
25.3	6.0	6.6	5.4	11

[1]) vide note on p. 21.

Palabuan, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61062, 2 and Z.M.A, 1)

23.9	5.7	5.4	4.5	10
23.5	5.6	5.5	4.4	10
23.9	5.5	5.5	4.1	10½

Some specimens only labelled „Java" are not mentioned here.

Pseudonenia aenigmatica (SYKES, 1893)
(fig. 18)

1893 SYKES, p. 28 (*Clausilia aenigmatica*)
1898 ALDRICH, p. 1 (*Clausilia aenigmatica*)
1915 COOKE, p. 265 (*Euphaedusa aenigmatica*)

DESCRIPTION of the material (the type included). Shell of medium height to large; fusiform, solid, reddish- to yellowish-brown, rather dull, not transparent. The spire forms an elongated cone with straight lateral outlines. Whorls 9 to 10 rather convex, sculptured with numerous fine transverse striae (about 15 to the mm on the whorl above the aperture). They are only slightly coarser and wider apart on the neck. There is no thread along the suture. Sometimes a pale band may be seen below the suture. The ca 2½ nuclear whorls are smooth. The neck is regularly and slowly bent towards the base of the aperture.

Aperture broad, ear-shaped, brown-horn-coloured within; the sinulus is broad and rather high, the upper peristomal margin has a distinct angle in the place where it is touched by the superior lamella. The base of the peristome is slightly receding. The peristome is continuous, whitish, broadly reflexed, the upper margin is clear of the preceding whorl. From the sinulus the outer peristomal margin descends as a regular strong curve, the parieto-columellar margin is faintly curved towards the right side of the base of the peristome.

Lamella superior oblique and high, reaching the margin, always connected with lamella spiralis. Lamella inferior is low, it does not reach the margin and ascends quite soon, turning inward. It is not or hardly possible to see the base of the lamella inferior by looking into the aperture from below and at the same time from the right side. There is no distinct columellar edge. The lamella subcolumellaris is just visible in the aperture in a full front view, but it does not reach the margin. The inner ends of the lamellae could not be studied.

The closing apparatus lies at the right side. The plica palatalis principalis is about a half whorl long, extending from the dorsal to the ventral side. Below it we count 4 palatal plicae, regularly distributed over the whole height of the whorl. From above to below they are: long, long, long, short or: long, short, long, short. Just under the umbilical slit the lamella subcolumellaris may be seen through the shell. The clausilium has a narrow, regularly curved plate, the top is a little flattened, length of the plate 3.3 mm, width 1.2 mm.

Length of the shells: 23.7 to 28.5 mm, diam. 5.4 to 6.6 mm; aperture: height 6.4 to 7.6 mm, width 4.6 to 5.9 mm. I studied 13 specimens. The ventrosity of the shells l/d is 4.3 to 4.9, the average is 4.5.

The holotype is in the British Museum (Nat. Hist.) (no. 82.10.16. 105,1), where I studied it. Its dimensions are (in mm):

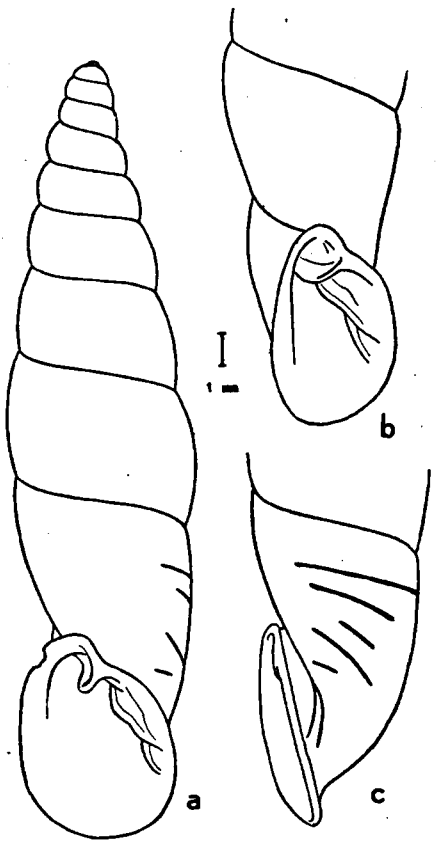

Fig. 18. **Pseudonenia aenigmatica** (SYKES)
Loc. Sumatra, Sawahs Hudjung ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell.

shell		aperture		number of whorls
length	diam.	height	width	
25,9	6.0	6.8	5.0	10

It is yellowish, the peristome is not very broad.

In his original description SYKES mentioned 4 plicae palatales, visible through the shell, the principalis included. When he gave the differences with *Ps. obesa obesa* (which he had never examined) he most unexpectedly wrote that the penultimate whorl of *obesa* is the widest, whereas in *aenigmatica* it is the antepenultimate whorl. The antepenultimate one, however, is broadest in both species. Still, the differences are mainly restricted to the shape of the shells (*aenigmatica* being slenderer, the ventrosity 4.3 to 4.9 instead of 3.5 to 4.1), the shape of the aperture and the weaker and less protruding subcolumellar lamella. When large series of shells of both species become available, intermediate specimens may be found. Therefore I am not convinced that *Ps. aenigmatica* can be maintained as an independent species.

ANATOMY unknown.

DISTRIBUTION : Sumatra.
Type-locality: Sawahs Hudjung.
According to SYKES's publication the type-locality is: "Sawahs and Hoedjoeng, Sumatra", whereas the label accompanying the holotype recorded: "Sawahs Hoedjoeng". ALDRICH (1898) indicated Marang, Southern Sumatra, as locality.
Habitat. Up to now this species has only been known from Southern Sumatra. Biotope and biology are unknown.
Localities: In addition to the holotype I saw material from the following localities:

Pager Alam near Lahat, leg. J. SEMMELINK, 1898 (R.M.L., 3 and Z.M.A., 7), leg. VAN DER SLEEN (Z.M.A., 1)[1])

	23.7—27.7	5.4—5.8	6.4—7.2	4.6—5.6	9—10
averages:	25.7	5.6	6.8	5.2	

Palembang Highlands, Ranau District, leg. KANNEGIETER (Z.M.A., 1)

28.5	6.6	7.6	5.9	9½

Pseudonenia gracilenta n nom.
(fig. 19)

1891 VON MARTENS, p. 244, pl. 14, f. 15—18 (*Clausilia obesa* var. *gracilior*, *Phaedusa*)
1893 WIEGMANN, p. 224, pl. 16, f. 11—17 (*Clausilia obesa* var. *gracilior*)

DESCRIPTION of the material (the holotype included). Shell of medium height, fusiform, rather solid, reddish-brown, glossy, slightly transparent. Spire an elongated cone, with straight lateral outlines. Whorls 9½—10½, rather convex, especially the upper ones, sculptured with fine, transverse striae (about 6 to the mm on the whorl above the aperture); they are distinctly coarser and stand wider apart on the neck. Usually there is no thread along the suture. Below the suture each whorl shows a narrow cream-coloured band. The nuclear whorls are smooth and cream-coloured; they form a rather blunt apex. The neck runs regularly down towards the base of the aperture.
Aperture oblique, rather narrow, triangular-pear-shaped, light-brown within, the sinulus is high, because of the rather vertical position of the right side of the peristome, the angle in the margin at the outer end of the superior lamella is only faint. The base of the peristome is receding. The peristome is continuous, white, glossy, broadly reflexed, somewhat thickened; the upper margin is clear of the preceding whorl; where it is touched by the lamella superior, it is only slightly curved. From the sinulus the outer peristomal margin is regularly curved down, whereas the parieto-columellar margin descends rather obliquely but straight. There is no angle at the right side near the umbilical slit.
Lamella superior is of medium height, reaching the margin, connected with the very low spiral lamella, which becomes high in a lateral

[1]) vide note on p. 21.

position and ends ventrally. Lamella inferior is strong but low, clearly visible in the aperture, it ascends rather straight into the shell, outside it scarcely reaches the margin. The columella is often visible as a low edge. When looking obliquely from below into the aperture, one cannot or hardly see the base of the inferior lamella. Lamella subcolumellaris is visible in a full front view of the aperture ; it reaches the margin of the peristome. The inner ends of the two last mentioned lamellae lie beyond the spiral lamella.

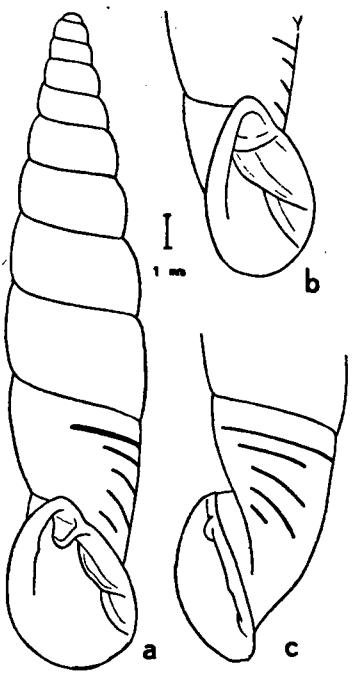

Fig. 19. **Pseudonenia gracilenta** n.nom.
Loc. Sumatra, Manindjau ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies between the ventral and the right side, ventrolateral). The plica palatalis principalis runs from the dorsal to the ventral side, so it is a half whorl long. Below the principal plica we notice 4 plicae palatales, rather regularly distributed over the whorl, of which the upper three are almost equally long, the fourth is shortest. The lamella subcolumellaris is scarcely visible through the shell. I do not know the clausilium.

Length of the shells: 16.7 to 23 mm, diam. 3.7 to 5 mm ; aperture : height 3.9 to 6 mm, width 2.7 to 4½ mm. Only 4 specimens were measured by myself. Two others can be found in VON MARTENS's original publication and in WIEGMANN (1893). The ventrosity of the shells l/d is 4.4 to 5.1, the average is 4.7.

The dimensions (in mm) given in VON MARTENS's original description are :

shell		aperture		number of whorls
length	diam.	height	width	
22	4½	6	4½	9½

The holotype is in the Berlin Museum. I had the opportunity to study it.
Dimensions (in mm) :

21.4	4.6	5.7	4.1	10½

The original description is clear enough. VON MARTENS mentioned 4 plicae palatales, visible through the shell. There are 5, however, the principalis included.

Here we have to do with a really independent species and not with a subspecies. Not only the exterior (ventrosity, form of the neck and the aperture and the sculpture), but the lamellae and plicae also show considerable differences from *P. obesa*, e.g. the position of the closing apparatus. As HANLEY and THEOBALD (1870), described *Phaedusa insignis* var. *gracilior*, Burma, which was published as an independent species by GUDE in 1914, the name *"gracilior"* is preoccupied. Hence I propose *gracilenta*.

ANATOMY. In 1893 WIEGMANN described the anatomy of a specimen from Manindjau. It was grey with a dirty-white sole. According to him the radula has the formula $92 \times \frac{1}{3} + \frac{9}{2} + \frac{17}{3-\omega}$. The dimensions (rounded off) of some ducts of the genital organs, measured in a snail with a shell of 23 mm length and 5 mm diam. are : penis 4.5 mm, epiphallus as far as the retractor-muscle 2 mm, vas deferens (from retractor) 12 mm, prostate and uterus 10 mm, vagina as far as the orifice of the duct of the receptaculum seminis 1.5 mm, from there to the uterus 2.5 mm, duct of the receptaculum seminis as far as the attachment of the appendix 3.4 mm, from there to the end of the receptacle 7 mm, the club-shaped vesicula itself is 2 mm, appendix 13 mm. For further details I refer to the original publication. So, just as in *Ps. javana* PFR., the duct of the receptaculum seminis from the attachment of the appendix upward (the distal part) is almost half as long as the appendix ; as far as that attachment the duct is strikingly broad here too.

DISTRIBUTION : Sumatra.
Type-locality: Manindjau.

The type-locality is Manindjau, situated in the mountains near Padang on the Western coast of Sumatra. WIEGMANN's specimen of which he investigated the anatomy, was collected in the same locality. According to him the dimensions were :

23	5	5.2	3.6

Habitat. This *Pseudonenia* too is a mountain-dwelling form (1800 m above sea level). Biotope and biology unknown.

Localities. Besides the type I saw the following specimens :

Padang Highlands, Manindjau (Z.M.A., 1)[1])

21.8	4.7	5.5	3.7	10

Padang Highlands, Mount Singgalang, 1800 m, leg. E. JACOBSON, 1925 (Z.M.A., 2).

18.7	3.7	3.9	2.7	10
16.7	3.7	4.1	2.9	10

These specimens are slightly smaller than those from Manindjau, there are no further differences.

Pseudonenia scalariformis n.sp.
(fig. 20)

DIAGNOSIS: Shell slender, turreted, with convex whorls. Spire with straight lateral outlines. Aperture triangular-ovate. Lamella subcolumellaris runs to the edge of the peristome. The closing apparatus lies a little ventrally at the right side. Below the principalis are three plicae, the upper two are rather long, the lowest is short.

DESCRIPTION. Shell of medium height, turreted, rather delicate, yellowish-brown, sligthly glossy, transparent. Spire slender, scalariform, with straight lateral outlines. Whorls 12½, convex, sculptured with very faint growth-lines, almost smooth; only the neck shows transverse striae (it is not possible to give the exact number to the mm); a thread in the colour of the shell runs below the rather deep suture. The nuclear whorls are smooth, cream-coloured, and form a rather sharp apex. A band on the whorls below the suture is cream-coloured. In a side view the neck is very slowly bent towards the base of the aperture.

Aperture oblique, small and triangular ovate, horn-coloured within, the sinulus is broad but not high, the parietal margin is distinctly bent where it is touched by the superior lamella. The base of the peristome is receding, the top of the sinulus also recedes. The peristome is continuous and has the colour of the shell, not reflexed but a bit widened like a trumpet, the margin is slightly thickened. The upper margin is clear of the preceding whorl, it is curved where it is touched by the lamella superior. From the sinulus the outer and the parieto-columellar margin are both curved down regularly.

Lamella superior is of intermediate height, reaching the margin, connected with the lamella spiralis. Lamella inferior is visible in the aperture as a rather low fold, which quite soon turns inward and upward into the shell. At the dorsal side, the inferior lamella is not very high, its outer end does not reach the margin. When looking obliquely from below into the aperture, one cannot see the base of the inferior lamella. The columellar edge is not very distinct. The lamella subcolumellaris is strong. It runs towards the margin of the peristome. I did not study the inner ends of the lamellae, because I did not want to open the only available specimen.

The closing apparatus lies a little ventrally at the right side. The plica palatalis principalis lies rather far away from the suture, it is

[1]) vide note on p. 21.

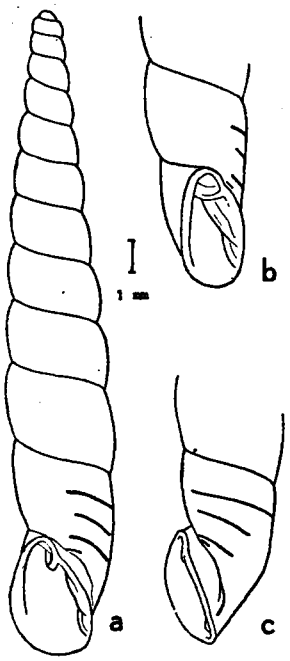

Fig. 20. **Pseudonenia scalariformis** n.sp.
Loc. Borneo, Sarawak, Mount Poe ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

a half whorl long and runs from the ventral to the dorsal side. Below it we find 3 palatal plicae of which the upper two are longest, parallel and running from the ventral to the right side ; the lowest is short, it lies at the ventral side near the curvature of the upper peristomal margin. The lamella subcolumellaris is not easily seen through the shell. The clausilium is not known, as I could not sacrify the type-specimen.

The unique shell, now in the author's collection, is the holotype. Its dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21.1	3.5	3.8	2.4	12½

The ventrosity l/d is 6.0.

ANATOMY unknown.

DISTRIBUTION : Borneo, Sarawak.

Type-locality: Mount Poe.

The type-locality is Sarawak, Mount Poe, altitude 1000 m. It was presented to me by Mr. F. F. LAIDLAW.

Habitat and biology unknown.

Pseudonenia suluana (VON MOELLENDORFF, 1894)
(fig. 21)

1894 VON MOELLENDORFF, p. 211 (*Clausilia* (*Pseudonenia*) *suluana*)
1915 COOKE, p. 265 (*Pseudonenia suluana*)

REDESCRIPTION of the holotype (the only specimen known). Shell of medium height, fusiform, solid, brown, a bit glossy, scarcely transparent. Spire rather slender, with slightly convex lateral outlines. Whorls 10, rather flat, almost smooth, apparently caused partly by corrosion ; the neck too is rather smooth. There is no thread along the shallow suture. The nuclear whorls are convex, they form a rather blunt apex. The whorls gradually increase in height. In a side view of the shell the neck slowly bends down towards the base of the aperture.
Aperture a little oblique, pear-shaped, trumpet-like. The sinulus is rather broad and high, because the margin of the peristome is bent up towards the left side where it is joined by the lamella superior. The basal part of the peristome is receding. The peristome is continuous, whitish, widened, not reflexed, scarcely thickened, the upper margin is clear of the preceding whorl. The peristome has a distinct angle where it is touched by the superior lamella. From the sinulus the outer peristomal margin is slowly curved down, the parieto-columellar margin is also regularly but more distinctly curved. Lamella superior rather high, reaches the margin, connected with the spiral lamella. Lamella inferior is low,

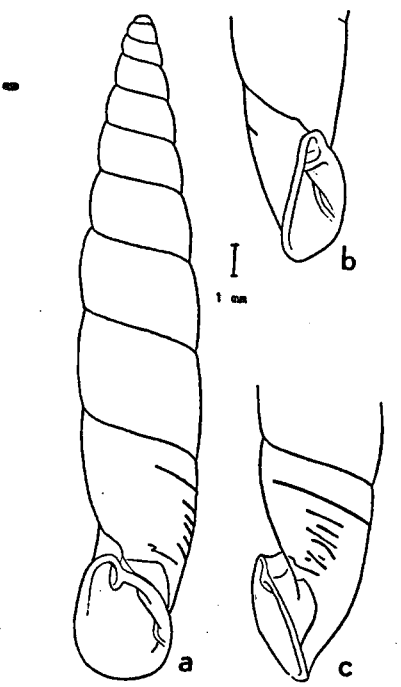

Fig. 21. **Pseudonenia suluana** (VON MOELLENDORFF)
Loc. Sulu Island ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell.

only the lowest parts are visible in the aperture, as it soon runs inward and straight upward into the shell; dorsally it is not particularly high; it does not reach the margin. When looking obliquely from below into the aperture, the base of the inferior lamella is invisible. Lamella subcolumellaris is clearly visible in the aperture and reaches the margin. It was not possible to study the inner ends of the lamellae, because I could not open the type-specimen.

The closing apparatus lies between the ventral and the right side. Plica palatalis principalis is more than a half whorl long, it runs from the ventral side to beyond the dorsal side, a little behind the peristome. Below it are about 7 palatal plicae, regularly distributed over the height of the whorl, they are of medium length to short. The subcolumellar lamella is visible through the shell behind the umbilical slit and below the plicae. The clausilium could not be studied.

The only specimen known of this species, the holotype, is in the Senckenberg Museum at Frankfort on the Main (no. 62668, 1). I had an opportunity to study it. Its dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21.8	4.0	4.3	3.1	10
VON MOELLENDORFF recorded:				
22	4	4.25	3.12	

The ventrosity l/d is 5.5.

VON MOELLENDORFF supposed relationship with *Ph. borneensis*, which is certainly wrong, the latter belonging to quite another genus. See p. .

ANATOMY unknown.

DISTRIBUTION: Sulu Island.

Type-locality: Sulu Island.

The type-locality is Sulu Island, where it was collected by I. ROESELER in 1890.

Habitat and biology unknown.

Pseudonenia sumatrana (VON MARTENS, 1864)
(fig. 22)

1864 VON MARTENS, p. 270 (*Clausilia sumatrana* part.)
1867 VON MARTENS, p. 379, f. 1 on p. 378 (*Clausilia sumatrana* var. a, group *Phaedusa*)
1868 PFEIFFER, p. 410 (*Clausilia sumatrana* var. *attenuata*)
1877 BOETTGER, p. 60 (*Clausilia sumatrana* part., sectio *Phaedusa*, group *Pseudonenia*, "Formenkreis" of *sumatrana*)
1881 BOCK, p. 631 (*Clausilia sumatrana* part.)
1891 VON MARTENS, p. 253 (*Clausilia sumatrensis* (sic) part.)
1892 COOKE, p. 468 (*Clausilia sumatrana* part.)
1893 SYKES, p. 28 (*Clausilia sumatrana* var. *attenuata*)
1906 ASHINGTON BULLEN, p. 127, textf. (*Clausilia sumatrana*)

1908 ROLLE, p. 68 (*Clausilia sumatrana*)
1915 COOKE, p. 265 (*Pseudonenia sumatrana*)
1935 PARAVICINI, p. 61 (*Phaedusa sumatrana*)

DESCRIPTION of the material. Shell large, fusiform, rather solid, usually reddish- to violet-brown, sometimes slightly glossy, not or scarcely transparent. Spire thick, conical, with slightly convex or straight lateral outlines. Whorls 9 to 11½, nearly always 10 to 11, slightly convex or almost flat, sculptured with numerous fine transverse oblique striae (about 10 to the mm on the whorl above the aperture), which stand wider apart on the neck. There is often a cream-coloured spiral band on the whorls below the suture. Exceptionally there may also be a thread in the colour of the shell below the suture. The nuclear whorls 2½—3) are smooth, forming a rather blunt apex. The lower whorls grow regularly higher and broader and become at the same time more flattened. The neck is distinctly bent towards the base of the peristome.
Aperture broad, pear-shaped, brownish within ; the sinulus is broad but not very high. There is no, or only a faint angle in the upper peristomal margin, where it is touched by the superior lamella. The basal

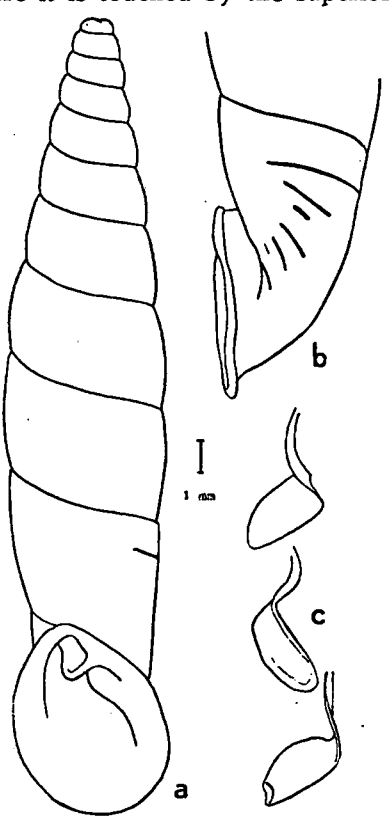

Fig. 22. **Pseudonenia sumatrana** (VON MARTENS)
Loc. Sumatra.
a. ventral side of the shell ; **b.** right side of the last whorl with the plicae seen through the shell ; **c.** 3 views of the clausilium.

part of the peristome lies only little behind the plane in which the upper parts of the peristome lie, while the top of the sinulus also recedes a little sometimes. The peristome is continuous white and often shining, broadly reflexed; the upper margin is clear of the preceding whorl and not or scarcely curved at the columellar side of the sinulus. From the sinulus the outer margin is regularly and distinctly curved downward, as is the parieto-columellar side. The latter, however, may be rather straight in some specimens.

Lamella superior oblique and high, reaching the margin, always connected with lamella spiralis, which ends inward between the ventral and the left side, in about the same place as the inferior lamella. Lamella inferior is not very low and does not reach the margin externally; its edge is like a thick cord, clearly visible in a full front view, but soon turning inward and upward rather spirally. Its inner base cannot or hardly be seen, if one looks from below and from the right side into the aperture. The columella is sometimes visible as a well-marked edge, in such a way that it looks as if the inferior lamella is forked inward. Lamella subcolumellaris is not visible in a full front view of the aperture, it ends inward in a lateral position, beyond the two other lamellae.

The closing apparatus lies at the right side, sometimes slightly ventrally. The plica palatalis principalis extends from between the ventral and the right side to beyond the dorsal side; it is almost half a whorl long. Below it are 4 to 6 distinct, almost parallel plicae, rather regularly distributed over the height of the whorl, 4 of which are always rather long, the other ones lie between or below these rather long ones and may be short or long. The 4 longer ones, however, may also be of different size, the first (upper one) and the third are usually longest, but exceptions to this rule are possible. Consequently there is quite a lot of variation in the number and position of the palatal plicae in this species. Lamella subcolumellaris is hardly visible through the shell. The plate of the clausilium has a thickened top; its sides run more or less parallel. Dimensions of the plate: length 3.1 mm, width 1.4 mm.

Length of the shells: 23.6 to 31.5 mm, diam. 4.8 to 6.5 mm; aperture: height 5.8 to 8.0 mm, width 4.3 to 6.0 mm. I studied 30 specimens. The ventrosity of the shells l/d is 4.0 to 5.8, the average being 4.8.

According to VON MARTENS (1864) the dimensions are: „long. 25, diam. 6, apert. long. 7, lat. 6 mm." The original specimens are in the Berlin „Museum für Naturkunde". In 1867 VON MARTENS mentioned for his var. *a*: „long. 31½, diam. 6; apert. long. 8, lat.inclus.perist. 6, exclus. 4½ mm".

In his original description VON MARTENS (1864) gave a sufficiently clear characterization of the species. In 1867 he recorded the existence of two forms, a long var. *a.* and a short, relatively ventricose, var. *b.* or var. *abbreviata.* They occur side by side in the type-locality. Although VON MARTENS could not establish the existence of any intermediate forms, he regarded both as modifications of the same species.

PFEIFFER (1868) adopted VON MARTENS's description, but he named the two varieties, according to the first word used by VON MARTENS in his description, viz. var. *a.* = *attenuata* and var. *b.* = *brevior.* In a list of *Clausiliidae* found in Sumatra, VON MARTENS (1891) mentioned

by mistake *„sumatrensis"*. BULLEN (1906) proposed to use the name *sumatrana* for the long form; the short broad form he regarded as a separate species, which he called *„robustior"* (vide p. 93). I agree with him, but I prefer to use *abbreviata* instead of *robustior* (see p. 93).

ANATOMY unknown.

DISTRIBUTION : Sumatra.

Type-locality: near Kepahiang.

The type-locality is : on stony soil along the new road from Tibingtingi to Benkulen, a short distance before Kepahiang, Southern Sumatra. Other localities recorded since then are : BOCK (1881), „common in coffee plantations at Paio", Sumatra (Upper Musi); BULLEN (1906): Mount Sago and Loeboek Bangko (Padang Highlands); ROLLE (1908): Kotoe Baroe, western slope of Mount Singalang (Padang Highlands); PARAVICINI (1935) referred to : Kamang Mountains near Fort de Kock, Mount Sago, Peak of Indrapoera, Kota Baroe on Mount Singalang, 1300 m altitude; all localities in the Padang Highlands. VAN BENTHEM JUTTING (1925 and 1941) mentioned a specimen of *sumatrana* from the island of Sebesi; this refers to a specimen of *Ps. obesa* MARTS. however.

Habitat. The species is known from the mountains of the „Palembang Highlands" and Benkulen and from the „Padang Highlands". Biotope (see VON MARTENS statement on the type-locality): "in stony places". All localities are in the Sumatran mountain range.

Localities: I studied specimens from the following localities (all of them in the Padang Highlands); those labelled „Sumatra" only, are not recorded.

Padangselie (U.S.N.M. no. 408819, 4)[1])
dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
28.0	4.9	6.2	4.5	11
25.0	5.3	5.8	4.5	10½
25.3	5.2	6.5	4.7	10
24.6	5.6	6.3	4.7	10

The first has 4, the other ones have 5 plicae palatales in addition to the principal plica.

Padang Pandjang (S.M.F. no. 61067, 2)

27.4	5.6	7.0	5.4	10
26.1	6.5	7.4	5.4	9

Each has 5 plicae palatales below the principalis.

Kota Baru, western slope of Mount Singgalang, 1300 m (E. PARAVICINI collection no. 685a, 1)

27.9	5.8	—	—	11

It has 6 plicae palatales, in addition to the principalis.

Kota Baru, 1300 m (M.H.P., 2; U.S.N.M. no. 224615, 2; B.M.L., 2 and K. L. PFEIFFER collection no. 9268a, 1)

	24.2—28.2	5.5—6.3	6.4—7.5	4.6—5.4	9½—10½
averages :	26.2	5.9	7.0	5.0	

Below the principalis there are 4, 5 or 6 palatal plicae.

[1]) vide note on p. 21.

Fort de Kock, 920 m, leg. E. JACOBSON, 1925 (Z.M.A., 2 + 1 juv.)

28.0	6.1	7.2	4.8	10
28.6	5.7	6.0	4.5	11

Both have 4 plicae palatales in addition to the principalis.

Pajakombo, leg. E. F. JOCHIM, 1914 (Z.M.A., 2 ; R.M.L., 6)

23.6—28.7	4.8—6.1	5.8—6.4	4.3—5.4	10—11
averages: 26.2	5.2	6.0	4.6	

All have 4 plicae below the principalis, except one, which has only 3, but these lie in such an abnormal position that the shell must be regarded as a monstrosity. It is without any doubt a specimen of *sumatrana*.

Mount Sago (E. PARAVICINI collection no. 685d, 1 ; B. M. L. no. 1907.7.21.12, 1)

25.9	5.5	6.4	4.9	11
30.2	5.4	6.8	5.0	11½

The latter specimen was reproduced by BULLEN (1906). I counted respectively 5 and 4 plicae palatales below the principalis.

Lubuk Bangku, 18 km from Pajakombo (B.M.L. no. 1906.7.21.23—25, 3)

25.1	5.5	6.7	4.8	10
—	5.5	6.6	4.6	—
24.4	5.2	6.2	4.7	10

These are the specimens recorded by BULLEN (1906). They have 4 and 5 plicae palatales below the principalis.

Pseudonenia penangensis (STOLICZKA, 1873)

KEY TO THE SUBSPECIES.

1. shell of medium size, shorter than 23 mm.....
Malay Peninsula ..... **Ps. p. orites** (LAIDLAW) (p. 89)

— shell large, longer than 23 mm .....
Malay Peninsula ... **Ps. p. penangensis** (STOLICZKA) (p. 85)

Pseudonenia penangensis penangensis (STOLICZKA, 1873) (fig. 23)

1873 STOLICZKA, p. 27 (*Clausilia* (*Phaedusa*) *Penangensis*)
1877 PFEIFFER, p. 465 (*Clausilia penangensis*)
1878 NEVILL, p. 183 (*Clausilia* (*Phaedusa*) *penangensis*)
1885 DE MORGAN, p. 363 and 391 (*Phaedusa penangensis*)
1902 VON MOELLENDORFF, p. 161 (*Phaedusa* (*Pseudonenia*) *penangensis*)
1902 COLLINGE, p. 84 (*Clausilia penangensis*)
1903 COLLINGE, p. 212 (*Clausilia penangense* (sic!))

DESCRIPTION of the material. Shell large, ventricose fusiform, solid, usually reddish- to violet-brown, dull or slightly glossy, opaque. Spire thick, conical, with straight lateral outlines, exceptionally slightly concave. Whorls 9—11, usually 10, rather convex, not or only vaguely striated, almost smooth, the neck is also sculptured with only very fine transverse striae. There is often a cream-coloured zone on the whorls below the rather deep suture. The nuclear whorls form a rather blunt apex. Some-

times they are a little narrower than the following whorl, hence the profile of this part of the shell may be faintly concave. The neck is slowly bent towards the base of the aperture.

A p e r t u r e pear-shaped, small in comparison to the large broad shell, chestnut within. The sinulus is extremely large. There is a distinct angle in the upper margin of the peristome, in the place where it is touched by the superior lamella. The base of the aperture recedes a little. The peristome is continuous, whitish and shining, sharp or a little reflexed; the upper margin is clear of the preceding whorl. From the sinulus the outer margin is regularly but slightly curved downward, the parieto-columellar margin is regularly and distinctly bent.

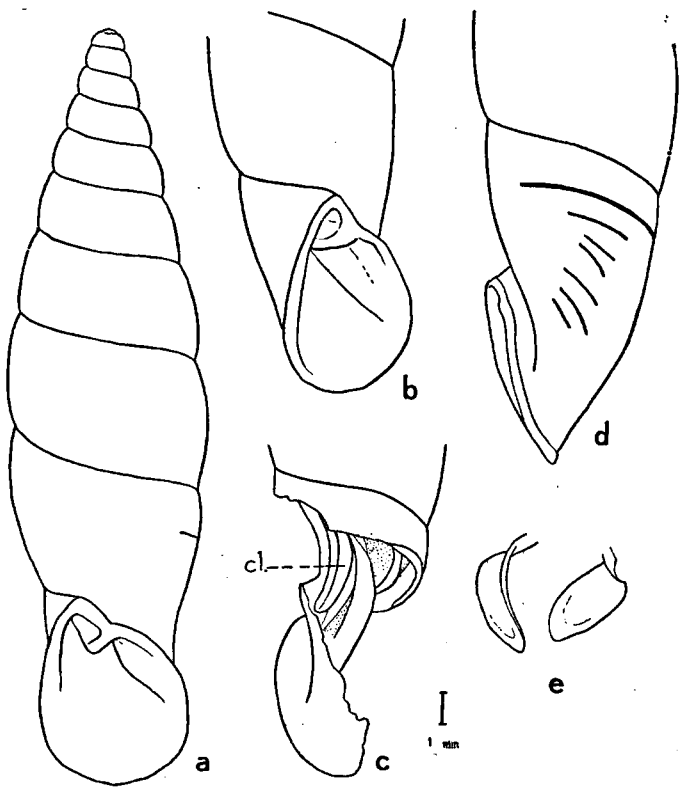

Fig. 23. **Pseudonenia p. penangensis** (STOLICZKA)
Loc. Penang Island.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** dorsolateral-right side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium (cl.) is present; **d.** right side of the last whorl with the plicae seen through the shell; **e.** 2 views of the clausilium.

L a m e l l a s u p e r i o r is high and reaches the margin, it is connected with lamella spiralis, which ends ventrally. Lamella inferior is low and, in a front view, distinctly visible at the columellar side, where it does not reach the margin. It runs rather steeply upward and inward, its base is not visible if one looks obliquely from below into the aperture.

Sometimes the columella protrudes inward as a well-marked edge and gives the impression that the lamella inferior is forked. The inferior lamella ends inward together with the lamella subcolumellaris beyond the spiral lamella. Lamella subcolumellaris is not visible if one looks into the aperture, as its end lies behind the lamella inferior.
The closing apparatus is situated at the right side. The plica palatalis principalis runs from the right to the left side, it is about a half whorl long and ends close behind the outer margin of the peristome. Below it are 4 to 8 rather long, more or less parallel, palatal plicae, of which 4 or more at least are nearly equally long. They are fairly regularly distributed over the whorl. Lamella subcolumellaris is scarcely visible through the shell. The plate of the clausilium is long and has parallel sides. The top is only slightly thickened, length 3.4, width 1.6 mm.
Length of the shells: 23.0 to 30.4 mm, diam. 5.5 to 7.3 mm; aperture: height 5.8 to 8.1 mm, width 4.2 to 5.7 mm. About 50 specimens were studied. The ventrosity of the shells l/d is 3.8 to 5.0, the average is 4.1.

According to STOLICZKA there are 3 varieties; the dimensions (in mm) given by him are:

shell		aperture	
length	diam.	height	width
24	6.2	6	4.5
26.3	6.2	6.9	4.7
27	6	6.3	4.6

The original specimens were in the Indian Museum, Calcutta. I can only regard these varieties as modifications: the specimens I studied provide a fairly regular curve, no matter whether we make a graph of the length, of the diameter or of the ventrosity. As STOLICZKA stated the shape of the shell of *Ps. penangensis* is extremely variable. He compared it with *Ph. gouldiana* PFR., *Ps. insignis* GOULD and *Ps. sumatrana* MARTS. According to STOLICZKA the last mentioned species comes closest to it in proportions. Indeed an unmistakable relation exists between both forms, even to such a degree that I have considered taking both as subspecies of one and the same species.
PFEIFFER (1877) only copied STOLICZKA's description.

ANATOMY. From the original description by STOLICZKA I quote: "The animal is uniform grey, covered with small pale brown warts, darker on the back, paler on the pedicles, which have very small black eyes, tentacles very short. The only appendage of the genital organs is that of the seminal receptacle, which is comparatively small and narrow, situated at the end of a long peduncle. The radula consists of about 125 rows, with 61 teeth in each row. All are provided with a strongly curved cusp; after about the fifteenth tooth, they rather radiply decrease in length. Towards the end of each row they become multiserrated, while the basal plate almost entirely disappears. The last teeth are very short, but broad, almost linear and entire".

DISTRIBUTION : Penang Island and Malay Peninsula.

Type-locality: Penang Hill.

The original specimens were found on Penang Hill in great numbers (STOLICZKA, 1873).

Other localities recorded since are: NEVILL (1878): Andamans (?). If indeed the specimen is from the Andaman Islands, it would be the only *Clausilia* found there. DE MORGAN (1885) gave altitudes at which the species occurs, viz. 100 to 400 m. VON MOELLENDORFF (1902) was the first to record *Ps. penangensis* from Perak. COLLINGE (1902): „Belimbing, State of Ligeh". He recorded a variety, without further indication, from: "Bukit Besar, 2,000 feet. State of Nawng Chik and of Patalung, State of Raman". COLLINGE (1903): "Bukit Besar, Nawngchik, 2,500 feet, found on dead trees, feeding on fungi". These localities are in Siam, but still south of the Isthmus of Kra. VAN BENTHEM JUTTING (1949) recorded *penangensis* from the Cameron Highlands. This shell belongs, however, to the subspecies *orites*.

Habitat. The subspecies is living in the western and northern part of the Malay Peninsula at altitudes of 100 to 400 m.

Biotope apparently: old, decaying trees, as two records mention fallen trees. Both records indicate: "feeding on fungi", and one mentions the presence of the animals under the bark. The ventrosity of the shells might confirm that we have to do with a non-climbing species.

Localities. I saw specimens from the following localities:

Penang Island.
(B.M.L. no. 1268.03.7.1, 3; no. 4026.03.7.1, 2; no. 91.3.17.155, 1; no. 61.7.22.9, 1 and no. 1906.2.2.392, 2; S.M.F. no. 62646, 1 and no. 62647, 1; U.S.N.M. no. 318140, 2 and F. E. LOOSJES collection, 1)

	23.0—26.0	5.5—6.4	5.8—6.8	4.4—5.1	9—10
averages:	24.3	6.1	6.2	4.7	

Malay Peninsula.
Perak (B.M.L., 3; no. 1901.12.13.49—50, 2 and no. 4093.03.7.1, 5; K.B.I.N., 2; M.H.P., 4; U.S.N.M. no. 110026, 2; S.M.F. no. 62648, 3; no. 62649, 2; no. 62650, 2; no. 62651, 6 and no. 30148, 1)

	23.6—30.4	5.5—6.8	5.7—7.4	4.6—5.5	9½—11
averages:	26.1	6.2	6.4	4.9	

Perak, Kuala Kangsar (S.M.F. no. 30153, 2)

26.5	6.2	6.5	5.0	10
27.3	6.1	7.2	5.4	10

Kedah, Mount Baling, leg. M. W. F. TWEEDIE, 1935 and 1938 (R.M.S., 5)

	23.6—27.4	6.2—6.9	5.9—6.5	4.2—5.2	10—11
averages:	25.3	6.5	6.2	4.5	

Siam, Mount Besar, Nawachin (Nawng Chik?), under bark of fallen tree in jungle, feeding on fungus (B.M.L. no. 1904.5.26-57-62, 6)

28.4	7.1	6.8	5.2	10
—	7.3	8.1	5.7	—
—	6.9	7.1	5.7	—
—	7.3	7.4	5.4	—
—	7.0	—	—	—
—	7.1	7.2	5.4	—

The first and the fifth specimen are not violet-brown, opaque and solid, but horn-coloured and fragile. These two shells are moreover transparent.

[1]) vide note on p. 21.

Pseudonenia penangensis orites (LAIDLAW, 1931)
(fig. 24)

1931 LAIDLAW, p. 163 and textf. (*Clausilia orites*)
1949 VAN BENTHEM JUTTING, p. 61 (*Phaedusa orites*) and p. 62 (*Phaedusa penangensis*)

DIAGNOSIS of the material (the holotype included). Shell of medium size, ventricose fusiform, rather solid, yellowish- or reddish- to violet-brown, glossy, semitransparent. Whorls 9½—10, moderately convex, sculptured with fine, even, transverse striae (about 18 to the mm on the whorl above the aperture), which are hardly any stronger on the neck.

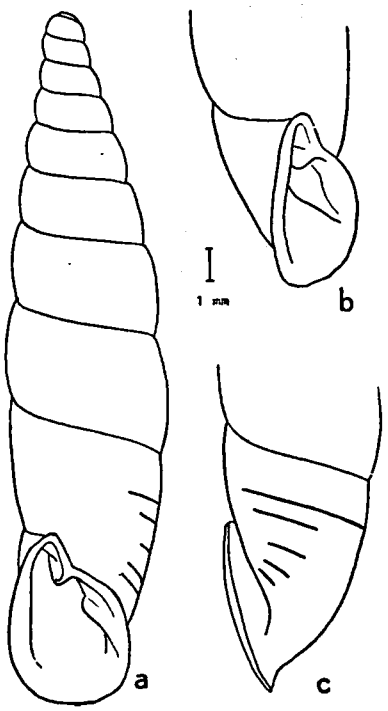

Fig. 24. **Pseudonenia penangensis orites** (LAIDLAW)
Loc. Malay Peninsula, Cameron Highlands, Sungei Abu ; paratype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell.

A white thread may occur below the rather shallow suture. The embryonic whorls are smooth and whitish, sometimes a little irregularly attached to the next whorl. The neck is rather strongly bent towards the base of the aperture.
Aperture oblique, auriform, brownish within. The base of the aperture recedes. The peristome is continuous, white and shining, distinctly reflexed ; the upper margin is clear of the preceding whorl and distinctly bent. From the sinulus, the outer margin is regularly curved downward, whereas the parieto-columellar one is mainly curved in its upper parts. Lamella superior is moderately high and reaches the margin ; it

is connected with lamella spiralis; the latter ends inward together with lamella inferior. Lamella inferior is rather low. It has a cordlike edge and does not reach the margin. This lamella soon runs inward and upward, in such a way that its base is not visible if one looks obliquely from below into the aperture. The columella may be visible in the aperture as a distinct edge. One gets the impression that the lamella inferior is forked. Lamella subcolumellaris is not visible if one looks into the aperture.
The closing apparatus is situated at the right side, the plica palatalis principalis runs from beyond the ventral to a little beyond the dorsal side. It is a half whorl long. Below it there are 4, sometimes 5 plicae palatales, rather regularly distributed over the whorl; at least 3 are relatively long, the lowest being the shortest. Below them the lamella subcolumellaris is sometimes visible through the shell. The plate of the clausilium is long and narrow with parallel sides, the top is hardly thickened, length 3.1, width 1.3 mm.
Length of the shells: 21.2 to 22.9 mm, diam. 5.3 to 5.8 mm; aperture: height 5.4 to 6.5 mm, width 3.8 to 4.8 mm. I studied 12 specimens. The ventrosity of the shells l/d is 3.8 to 4.3, the average is 4.1.

I studied the holotype in the British Museum (Nat. Hist.). LAIDLAW gave the following dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
22	5.5	6	4	10

LAIDLAW already pointed out the resemblance between his species and *penangensis*. VAN BENTHEM JUTTING (1949) published some specimens of this subspecies under the name of *penangensis*.
The measurements and the extremely high sinulus, however, provide striking differences. It may constitute a mountain race of *Ps. penangensis*.

ANATOMY unknown.

DISTRIBUTION: Malay Peninsula, Western Pahang, Cameron Highlands.
Type-locality: Cameron Highlands, Sungei Abu, 4,500 feet. Miss VAN BENTHEM JUTTING (1949) recorded the subspecies under the name of *penangensis* from Kuala Terla, Telom Valley, Pahang, 4,000—5,000 feet and from Mount Brinchang, Pahang 4,500—5,500 feet, both also in the Cameron Highlands.
Habitat and biology unknown.
Localities. The specimens studied by me are the same as those recorded in literature, all from the Cameron Highlands.

Malay Peninsula.
Sungei Abu, 1500 m, leg. F. F. LAIDLAW, 1931 (R.M.S., 1 and F. E. LOOSJES collection, 1)[1])

[1]) vide note on p. 21.

paratypes					
	21.2	5.3	5.5	3.8	10
	22.5	5.3	5.4	3.8	10
Mount Brinchang, 1500—1800 m, 1935 (R.M.S., 1)					
	—	5.4	5.7	4.1	—
Ginting Kial, 1300—1700 m, leg. M. W. F. Tweedie, 1937 (R.M.S., 7)					
	22.5	5.5	6.0	4.3	9½
	—	5.6	6.1	4.2	—
	21.9	5.8	6.0	4.3	10
	—	5.4	6.0	4.3	—
	—	5.5	6.5	4.8	—
	—	5.5	5.6	4.1	—
	—	5.4	5.8	4.2	—
Kuala Terla, 1300—1700 m, 1935 (R.M.S., 2)					
	22.7	5.4	5.5	4.3	10
	—	5.3	5.4	3.9	—

Pseudonenia abbreviata (Von Martens, 1867) (fig. 25)

1864 Von Martens, p. 270 (*Clausilia sumatrana* part.)
1867 Von Martens, p. 379, f. 1 on p. 378, pl. 22, f. 17 (*Clausilia sumatrana* var. *b*, in the explanation of pl. 22 on p. 447 called var. *abbreviata*, group *Phaedusa*)
1868 Pfeiffer, p. 410 (*Clausilia sumatrana* var. *brevior*)
1877 Boettger, p. 60 (*Clausilia sumatrana* part., sectio *Phaedusa*, group *Pseudonenia*, "Formenkreis" of *sumatrana*)
1881 Bock, p. 631 (*Clausilia sumatrana* part.)
1891 Von Martens, p. 253 (*Clausilia sumatrensis* (sic) part.)
1892 Cooke, p. 468 (*Clausilia sumatrana* part.)
1893 Sykes, p. 28 (*Clausilia sumatrana* var. *brevior*)
1906 Ashington Bullen, p. 127, textf. (*Clausilia robustior*)
1915 Cooke, p. 265 (*Euphaedusa robustior*)

Description of the material. Shell of medium height, ventricose fusiform, rather solid, usually reddish- to violet-brown, rather dull, not or scarcely transparent. Spire thick, short and conical with convex or straight lateral outlines. The length of the shell is less than 2.2 times the lengths of the aperture and the preceding whorl together, measured along the ventral side. Whorls 8 to 10, rather convex, sculptured with numerous fine, faint, oblique striae (rather more than 20 to the mm on the whorl above the aperture), which stand a little wider apart on the neck. A cream-coloured band runs below the suture, it is about one-fifth of the height of the whorl concerned. There is often a thread below the suture, in the colour of the shell. The nuclear whorls are smooth and form a rather blunt apex.
Aperture broad, pear-shaped to ovate, the sinulus is broad, but usually not very high. The angle in the upper peristomal margin where it is touched by the superior lamella is either failing, faint or distinct. The base of the peristome recedes. The peristome is continuous, white and often shining, broadly reflexed. The upper margin is clear of the preceding whorl. From the sinulus the outer peristomal margin is regularly and distinctly bent down, as is the parieto-columellar margin.

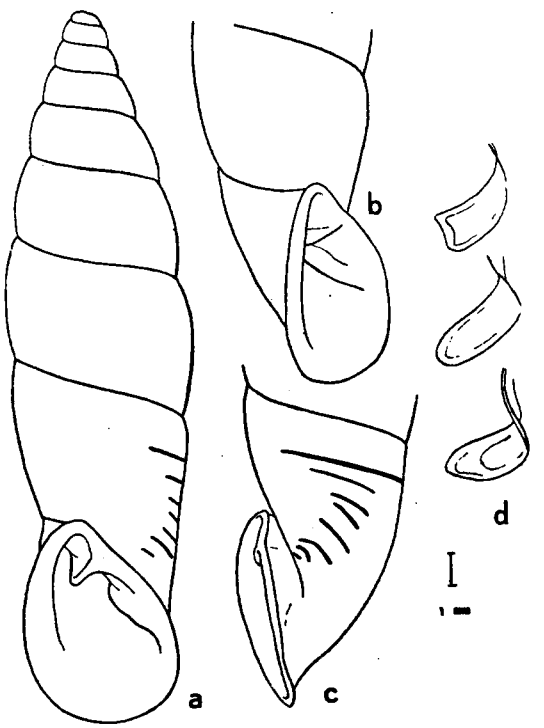

Fig. 25. **Pseudonenia abbreviata** (VON MARTENS)
Loc. (a—c) Sumatra
(d) Sumatra, Mount Kerintji
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell ; **d.** 3 views of the clausilium.

Lamella superior oblique and high, reaching the margin, connected with lamella spiralis, which ends at the ventral side, above the aperture. Lamella inferior is not very low, not reaching the margin externally. It is clearly visible in a front view, turning inward and upward moderately steeply, not quite horizontally. It ends inward beyond the inner end of the spiral lamella, ventrolateral-right. Its inner base is not or hardly visible if one looks from below and from the right side into the aperture. Lamella subcolumellaris is not visible in a full front view of the aperture, its inner end lies at the right side, just beyond the end of lamella inferior.

The closing apparatus lies at the right side or slightly ventrally at that side. The plica palatalis principalis extends from ventrolateral at the right side to beyond the dorsal side. It is almost a half whorl long. Below it are 4 to 6 almost parallel plicae, rather regularly distributed over the height of the whorl, four of which are rather long ; when there are more they may be either long or short. So the number and position of the palatal plicae in this species is rather variable, as in *Ps. sumatrana*. The clausilium has a long narrow, tongue-shaped plate, with practically parallel sides. It is slightly curved, the top is a little

thickened. The transition to the pedicle is regular. Length of the plate 3.7 mm, width 1.5 mm.

Length of the shells: 21.1 to 27.7 mm, diam. 5.4 to 6.8 mm; aperture: height 5.6 to 7.4 mm, width 4.2 to 6.1 mm. About 70 specimens were measured. The ventrosity of the shells l/d is 3.5 to 4.3, the average is 3.9.

The original shells are in the Berlin "Museum für Naturkunde" and in the Senckenberg Museum at Frankfort on the Main.

VON MARTENS (1867) recorded the following dimensions: "Long. 23½, diam 5½; apert. long. 8, lat. inclus. perist. 5½, exclus. 3½ mm". VON MARTENS (1864) gave a description of *Ps. sumatrana*, which also included this species. In 1867 he mentioned two varieties, *a* and *b*, of his *sumatrana*. PFEIFFER (1868) mentioned them under the first word of VON MARTENS's description, viz. for var. *b*: var. *brevior*. SYKES (1893) adopted this name also.

BULLEN (1906) regarded VON MARTENS's var. *a* and *b* as separate species. So var. *a* was called *sumatrana* and, as *brevior* is already in use for another species of *Phaedusinae*, he proposed a new name for var. *b*: *robustior*. The differences he mentioned are: the more delicate striation of the broad form and the length of the two last whorls in proportion to the total length of the shell, which is greater in var. *b* than in var. *a*. I agree with BULLEN that the short broad form may indeed be an independent species, but instead of BULLEN's new designation "*robustior*", the name used by VON MARTENS (1867) in the explication of his figure of *sumatrana* var. *b*, viz. *abbreviata*, has priority. In this respect I agree with Dr. ZILCH, who wrote me on the subject.

ANATOMY unknown.

DISTRIBUTION: Sumatra.

Type-locality: near Kepahiang.

According to VON MARTENS the type-locality is on stony soil, along the new road from Tibingtingi to Benkulen, a short distance before Kepahiang, Southern Sumatra. BULLEN (1906) mentioned Kepahiang.

Habitat. All the specimens I know are from the mountain range (Barisan Mountains) in the region between the "Palembang Highlands" and Benkulen in Southern Sumatra, and in the Padang Highlands at 1500 m altitude. According to VON MARTENS (1867) it may be a terrestrial species; this was confirmed by the find of Mr. J. DRIJVER.

Localities. I saw specimens from the following localities:

Type-locality, paratypes (S.M.F. no. 61064, 2 and no. 61065, 1)[1])
dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
22.4	5.9	6.5	4.8	8½
—	5.4	6.8	5.3	—
22.4	5.7	6.1	5.2	8½

In addition to the principal plica 5 or 6 plicae palatales occur.

Kepahiang (B.M.L. no. 83.10. 22.1372, 3)

23.1	5.8	7.2	5.1	8½

[1]) vide note on p. 21.

22.7	6.0	6.8	5.1	8½
21.8	5.6	6.5	5.1	8½

Below the principalis are 4 or 5 plicae palatales.

Environs of the sources of River Musi, leg A. STRUBELL, 1897 (S.M.F. no. 61106, 1 and no. 61068, 1)

—	5.6	6.4	4.8	—
21.6	5.4	5.6	4.2	8½

Below the principalis each has 5 plicae palatales.

River Musi (B.M.L. no. 1933.3.1.80—81, 2)

22.8	6.0	7.2	5.5	8
21.1	5.6	6.2	4.7	8

Both have 5 plicae palatales below the principalis.

Mount Kerintji, Kaju Aru plantation, under tea-plants by the side of the road on the ground, 1500 m, leg. J. DRIJVER, 1952 (J. DRIJVER collection, 30; F. E. LOOSJES collection, 30).

	21.7—27.7	5.5—6.8	6.1—7.4	4.7—6.1	8½—10
averages:	24.1	6.1	6.8	5.3	

The variation in the length of the plicae is fairly great; the number of plicae is usually 5 tot 6 below the principalis.

Pseudonenia vicaria (O. BOETTGER, 1893)
(fig. 26)

1893 BOETTGER in SYKES, p. 29, f. on p. 30 (*Clausilia Sumatrana*, var. *vicaria*)
1906 ASHINGTON BULLEN, p. 128 (*Clausilia sumatrana* var. *vicaria*)
1935 PARAVICINI, p. 61 (*Phaedusa vicaria*)

DESCRIPTION of the material (the holotype included). Shell small, fusiform, rather fragile, yellowish- to horn-brown, shining, usually transparent. Spire thin, conical, with straight lateral outlines. Whorls 9½ to 11, slightly convex or almost flat, sculptured with numerous fine, transverse striae (about 12 to 15 to the mm on the whorl above the aperture), which stand wider apart and are stronger on the neck. A cream-coloured or white zone often runs on the whorls below the shallow suture. Sometimes there is a thread in the colour of the shell below the suture. The 3 nuclear whorls, are smooth and form a rather blunt apex. The neck is regularly and, as a rule, slowly bent towards the base of the peristome.

Aperture small in proportion to the length of the shell, pear-shaped, a little trumpet-like, yellowish within. The sinulus is broad, but not very high. There is no, or only a faint angle in the upper peristomal margin. The base of the peristome and the sinulus are receding. The peristome is continuous, white and glossy, broadly reflexed, the upper margin is clear of the preceding whorl and not or scarcely curved at the right side of the sinulus. From the sinulus the outer margin is regularly but strongly curved outward and downward, just like the parieto-columellar margin, but in the latter a faint angle at the right side sometimes occurs.

Lamella superior is oblique and high, always connected with lamella spiralis, which is first low but gradually rises and ends abruptly in a ventral position together with the inferior lamella. Lamella inferior is low, its outer end is far separated from the peristomal margin, in a full front view it only looks like a little knot on the columella. Its edge

is not much thickened, it runs rather steeply inwards and upwards, the inner base is not visible, if one looks from below into the aperture. A columellar edge may be visible sometimes. Lamella subcolumellaris is not visible in the aperture, it ends inward beyond the two other lamellae.

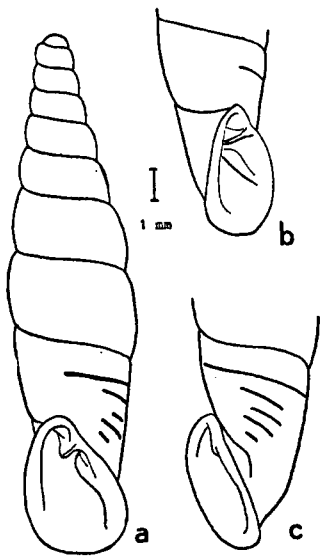

Fig. 26. **Pseudonenia vicaria** (O. BOETTGER)
Loc. Sumatra ; holotype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies at the right side. The plica palatalis principalis runs from the ventral side to beyond the dorsal side and is more than a half whorl long. Below it are 4 to 8 usually 5 to 6, almost parallel plicae, of which 4 at least are rather long. As a rule they are regularly distributed over the height of the last whorl. Lamella subcolumellaris is not or hardly visible through the shell. The plate of the clausilium has a scarcely thickened top, the sides run practically parallel, length 2.0 mm, width 0.9 mm.
Length of the shells: 16.3 to 20.9 mm, diam. 3.5 to 4.6 mm ; aperture : height 3.8 to 5.2 mm, width 2.7 to 3.8 mm. About 85 specimens were measured. The ventrosity of the shells l/d is 3.9 to 5.4, the average is 4.9.

BOETTGER (in SYKES, 1893), describing the "variety", gave the following dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
18—20	4½—4½	5	3¼—3¾	9½—10½

SYKES recorded for one of the two syntypes:

17½	4	4¾	3

I measured this specimen in the British Museum (Nat. Hist.) (B.M.L. no. 1930.1.21.18,1)

17.7	4.3	4.8	3.4	9½

The other specimen is in the Senckenberg Museum (S.M.F. no. 61069), its dimensions are:

19.8	4.3	5.1	3.7	10½

As SYKES in connection with BOETTGER's description, published the dimensions and a sketch of one of the two syntypes, we must regard, this specimen, which is preserved in London, as the holotype.

BOETTGER (in SYKES, 1893) was inclined to consider this form only as a variety of *Ps. sumatrana*. As the differences are, however, very distinct, and as I have not seen any intermediate specimens, I consider *vicaria* to be a real species. BULLEN (1906) already foresaw the necessity of this procedure. PARAVICINI (1935) giving a list of localities of several Sumatran species, recorded *vicaria* also as a distinct species.

ANATOMY unknown.

DISTRIBUTION: Sumatra.

Type-locality: Sumatra.

Probably *vicaria* was not among the specimens described by VON MARTENS as *sumatrana*, so the type-locality must be that of the two specimens recorded by BOETTGER. It is not mentioned, however, in the publication. On the labels of the above-mentioned type-specimens only "Sumatra" is given as the locality.

Records in literature are: SYKES (1893): Paio and Kepahiang; BULLEN (1906); Mount Singalong, Mount Sago; PARAVICINI (1935): Pajakombo.

The species is found both in the mountain-region between the Palembang Highlands and Benkulen and in the Padang Highlands.

Habitat and biology unknown.

Localities: Besides the two syntypes recorded, and specimens only labelled "Sumatra", I saw shells from the following localities:

Kepahiang (B.M.L. no. 83.10.22.1369-71, 3)[1])

20.1	4.5	5.2	3.6	10
19.8	4.4	5.1	3.8	10
19.0	4.3	5.2	3.6	9½

Padang Highlands, Mount Singgalang (B.M.L. no. 1906.7.21.13, 1)

16.3	3.5	3.9	3.0	—

Padang Highlands, Pajakombo, leg. E. F. JOCHIM, 1914 (R.M.L. no. 105a, 9); leg. H. ROUYER, 1905 (K.B.I.N, 10) and without recording a collector (M.H.P., 2; S.M.F. no. 61072, 3; B.M.L. 1906. 7.21.14—22, 9 and without number 2 specimens; E. PARAVICINI collection no. 688a, 3 and 730a, 18)

	17.6—20.4	3.5—4.4	3.8—4.8	2.8—3.5	10—11½
averages:	18.9	3.8	4.3	3.2	

[1]) vide note on p. 21.

Pseudonenia brachyptycta n.sp.
(fig. 27)

DIAGNOSIS. The new species differs from all *Pseudonenia* species known from Indonesia by the extreme shortness of its principal plica. A yellow-horn-coloured, not very firm shell, occurs in other *Pseudonenia* species too, although rarely, and is therefore not a striking difference. By these features *Ps. brachyptycta* recalls an *Acrophaedusa* species.

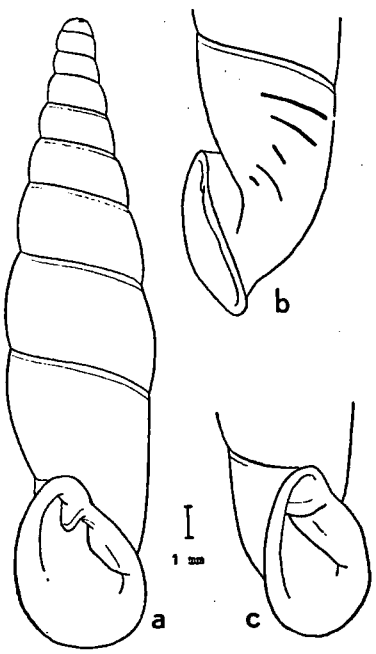

Fig. 27. **Pseudonenia brachyptycta** n.sp.
Loc. Sumatra, Redjang ; holotype.
a, ventral side of the shell ; **b**, ventrolateral-right side of the last whorl with the plicae seen through the shell ; **c**, ventrolateral-left side of the last whorl.

DESCRIPTION. Shell of medium size, fusiform, slightly ventricose, not very solid ; horn-coloured, slightly glossy, transparent. Spire rather thick, with slightly concave or almost straight lateral outlines. Whorls 9—10, slightly convex, especially the lower ones, the upper ones are as usual more convex ; sculptured with fine regularly placed transverse striae (about 16—20 to the mm on the whorl above the aperture), which are scarcely coarser on the neck. A distinct thread in the colour of the shell sometimes occurs below the shallow suture. Nuclear whorls 2, almost smooth, they form the rather blunt apex. The outlines of the shell are sometimes a little concave where these whorls merge into the lower ones. In a side view the neck is rather sharply bent down towards the base of the peristome.

Aperture oblique, triangular-ovate, horn-coloured within, the sinulus is high, formed by the lamella superior and by the almost vertical position of the peristomal margin. The plane in which the peristome lies

converges downward with the axis of the shell. The peristome is continuous, light horn-coloured, thin, more or less reflexed ; the upper margin is far away from the preceding whorl. Where the lamella superior reaches the peristomal margin, the latter is bent sharply upwards, forming a distinct angle. From the sinulus the outer peristomal edge descends in a regular curve ; the parieto-columellar margin runs downwards in a regular faint curve. Sometimes the aperture slightly resembles a trumpet. Lamella superior oblique, of moderate height, reaching the margin, regularly connected with lamella spiralis, which ends abruptly at the ventral side. Lamella inferior is first short and low, halfway up the columella it runs inward and upward rather steeply ; it is not high and has a cord-like edge, which never runs horizontally ; it ends inward beyond the lamella spiralis. When looking obliquely into the aperture, it is not or hardly poss.ble to see the base of the inferior lamella turning upward. The lamella subcolumellaris can easily be seen from aside behind the lamella inferior. In a full front view it is not visible in the aperture, it ends inward beyond the lamella inferior and the lamella spiralis at the left side.

The closing apparatus lies laterally at the right side. The plica palatalis principalis is extremely short, it runs from the dorsal side to the right side and is ¼ whorl long. Below the principal plica we count 3 palatal plicae, rather regularly distributed over the height of the whorl, the second is a little shorter than the other two. There is sometimes a very small fourth plica below the other ones. The lowest end of the lamella subcolumellaris is visible through the shell, near the closed umbilical slit. Clausilium narrow, with a blunt apex.

Length of the shells: 20.0 to 21.5 mm, diam. : 4.4 to 4.9 mm ; aperture : height 5.0 to 5.5 mm, width 3.7 to 4.1 mm. I only know 4 specimens. The ventrosity l/d is 4.3, 4.4, 4.5 and 4.6, that is 4.3 to 4.6, average 4.4.

The holotype and the paratypes are preserved in the Senckenberg Museum at Frankfort on the Main (resp. no. 61071,2 (one of which is the holotype) and no. 61066,1).

The dimensions of the holotype are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21.5	4.9	5.5	4.0	10

and of the paratypes :

21.1	4.7	5.4	4.1	10
20.0	4.6	5.1	3.7	9½

ANATOMY : unknown.

DISTRIBUTION : Sumatra.

Type-locality: Redjang.

The type-locality is Redjang, north-east of Kepahiang, Southern Sumatra, where the shells were collected by A. STRUBELL in 1897. Nothing is known on the biotope or mode of life.

Localities. Besides the type-specimens I have only seen one other specimen.

Area of the sources of River Musi (K. L. PFEIFFER collection, no. 9268b, 1)

20.2 4.4 5.0 3.7 10

Pseudonenia mentaweiensis (EHRMANN, 1928)

1928 EHRMANN in DEGNER, p. 332, 1 textfig. (*Phaedusa* (*Phaedusa*) *mentaweiensis*).

Description (As the species is unknown to me, I give a translation of EHRMANN's original description). "Shell sinistral, ventricose fu-"siform, solid, transparent, glossy, with fine and regular striae, which "are slightly coarser on the last whorl. Dark reddish-brown with a light "coloured top. Aperture internally dark violet-brown. Whorls 8¾, the "two upper ones form a thick blunt apex. The lateral lines of the spire "are hardly concave, all the whorls, except the last are rather convex, "separated by a simple suture. The penultimate whorl looks as if it were "somewhat blown up dorsally against the flat last whorl, it is almost "scalariform, particularly on the dorsal side. The last whorl is rather "narrow near the base and slightly contracted in the region of the prin-"cipalis. Base rounded; umbilical slit distinct but not sharply incised, "curved.

"Aperture almost vertical, short, pear-shaped with a moderately "high sinulus, its lower half semicircular. Peristome scarcely clear of the "preceding whorl, regularly and distinctly widened; the margin is "narrow but thickened. The parietal margin above the superior lamella, "with a blunt angle.

"Lamella superior high, reaching the margin, protruding slight-"ly beyond the peristome, distinctly concave at the left side, with a blunt, "weakly bent edge. It is connected with the spiral lamella, which in-"creases inward to a thin high fold, leaning over towards the palatal "wall. It is highest lateroventrally at the right side, decreases quickly "and extends a little beyond the ventral side. Lamella inferior is visible "in a front view of the aperture as a moderately protruding blunt "lamella, ending at the outside as a weak fold, half way up the "columellar side, internally it ascends steeply and straight after having "passed the scarcely visible columellar edge. It is hardly spirally twist-"ed; if one looks from aside and from below into the aperture one can "just see below its base. The inferior lamella decreases gradually and "extends up to the left side. The lamella subcolumellaris is not visible "from outside, it is high and thin and with the inferior lamella forms a "niche, which is narrow at the top and wide below. The subcolumellar "lamella ends lateroventrally at the left side.

"The closing apparatus lies at the right side; the principal plica "runs, almost parallel with the suture, from the left almost to the ventral "side. Lunella replaced by 4 to 5 palatal plicae, diverging from the prin-"cipalis in the direction of the aperture, the lowest diverging more than "the upper ones. The first is longest (almost ¼ whorl long), the second "short and weak or entirely absent, the third and the fourth are equally "long, the fifth is very weak. Clausilium: pedicle narrow, merging gra-"dually into the plate, without incision at the inner side. Plate narrow,

"its lower end bends down in a gentle curve and the upper part in a "stronger one ; gutter-shaped, in such a way that the outer edge, par- "ticularly in its upper part, is bent upward more than the inner edge. "The lowest parts of the plate grow rapidly narrower, pointed, a little "spoon-shaped, turned towards the palatal side.
„dimensions :

"	shell		aperture	
"	length	diam.	height	width
"	19.3	5.3	5.2	4.1
"	18.8	5	5.2	± 4.2

" Dr. E. DEGNER of Hamburg very kindly placed two specimens at "my disposal for investigation, the first of which shows a slightly de- "formed aperture caused by a former injury, repaired by the snail. It "only distinguishes itself from the other, normal specimen by the ab- "sence of the small second palatal plica. Similar deviations also occur in "related species. The identity of species of the two specimens is in- "dubitable".

Both specimens were preserved in the collection of the Hamburg Mu- seum, where they were destroyed during the last war.

ANATOMY unknown.

DISTRIBUTION : Mentawei Islands.
Type-locality: Mentawei Islands, two specimens collected by Dr. KARNY.
Habitat and biology unknown.

Pseudonenia jacobsoni n.sp.
(fig. 28)

DIAGNOSIS. This species shows great external similarity with *Pseudo- nenia javana* PFR. but differs from it in internal structure of the shell. The subcolumellar lamella is immersed. The closing apparatus lies ventro- laterally. There is only one (upper)palatal plica below the principalis and the clausilium is not tongue-shaped with parallel sides as in javana, but more triangular.

DESCRIPTION. Shell of medium height, fusiform to almost turreted, rather solid, reddish- to violet-brown, often covered by a whitish varnish, glossy, not or scarcely transparent. Spire thick or rather slender, with convex or straight lateral outlines. Whorls 9½ to 11, slightly convex, sculptured with numerous fine, closely planted, oblique, straight, trans- verse striae (about 20 to 25 to the mm on the whorl above the aperture), which are only slightly coarser on the neck. The suture is shallow and there is no thread. The nuclear whorls are smooth and form a not very

blunt top. The neck is rather flat. The last whorl is only slightly higher above the aperture than the penultimate one.

The aperture is angular, ovate and widened a little in the shape of a trumpet. It has a moderately high but wide sinulus. The top of the sinulus and the base of the peristome recede a little from the plane in which the peristome lies. The peristome is continuous, whitish, glossy, reflexed and slightly thickened. The parietal margin is adnate to (the holotype) or clear of the preceding whorl and usually shows a distinct angle in the place where it touches the superior lamella. From the sinulus the outer margin descends in a wide curve ; the parieto-columellar margin first runs to the right and then soon turns down rather sharply after which it is practically straight and only runs to the lower right side in a faint curve. The base of the peristome is semicircular.

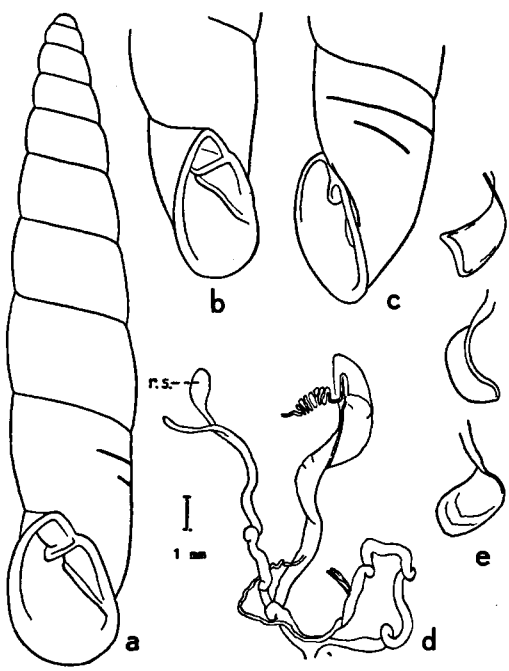

Fig. 28. **Pseudonenia jacobsoni** n.sp.
Loc. (**a**—**c**) Simalur Island, Sibogo ; holotype.
(**d**—**e**) Simalur Island, Sibogo ; paratype.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell ; **d.** reproductive organs (r.s. = receptaculum seminis); **e.** 3 views of the clausilium.

Lamella superior is high and oblique, reaching the margin, continuous with the spiral lamella, which ends at the ventral side. Lamella inferior, which is clearly visible in the aperture, almost reaches the peristome and turns upwards and inwards rather spirally. At the dorsal side it is high and has a distinctly thickened edge, after that it slowly decreases in height and ends inward just beyond the end of the spiral

lamella, lateroventrally-left. It is just possible to look past the inner curve of the inferior lamella via the aperture. Lamella subcolumellaris is immersed, it is invisible through the aperture and ends just beyond the two other lamellae near the left side.

The closing apparatus lies lateroventrally at the right side. The principal plica runs from ventral to dorsal and so traverses ½ whorl. Below it we find only one fairly long palatal plica, the plica palatalis superior, which traverses about ¼ whorl, between the ventral and the left side. The lamella subcolumellaris is not visible through the shell on the palatal side. The clausilium has a rather short, slightly triangular plate, curved in the shape of a saddle, which reminds more of a *Phaedusa*, than of a *Pseudonenia*. The plate is broadest near the top which is only slightly thickened. Its sides merge regularly into the pedicle. The length of the plate is 2.4 mm, the width 1.3 mm.

Length of the shells: 20.1 to 24.1 mm, diam. 3.6 to 4.9 mm; aperture: height 4.4 to 5.4 mm, width 3.0 to 3.7 mm. I studied 17 specimens. The ventrosity l/d is 4.2 to 6.7, the average is 5.1.

The dimensions of the holotype are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21.3	4.2	4.9	3.7	10

and of the 8 paratypes:

20.1—22.8	4.1—4.8	4.7—5.4	3.2—3.7	9½—10½
averages: 21.4	4.3	4.9	3.4	

Holotype and paratypes are preserved in the Leyden Museum.

ANATOMY. I studied the genital organs of one of the specimens. There is an appendix to the duct of the receptaculum seminis. There are no further special appendices. The retractor of the left upper tentacle passes between the penis and the vagina. The dimensions (rounded off to mm) of some ducts and organs, measured in a snail with a length of 22 mm and a width of 5 mm, are: penis 7 mm, epiphallus as far as the retractor muscle 3 mm, vas deferens from the retractor upward 9 mm, prostate and uterus 7 mm, vagina as far as the orifice of the duct of the receptaculum seminis 2 mm, from there to the uterus 2 mm, duct of the receptaculum seminis to the attachment of the appendix 9 mm, from there to the end of the receptaculum 2 mm, length of the appendix 2 mm. The duct of the receptaculum seminis and the appendix lie close to the prostate and the uterus.

DISTRIBUTION: Simalur.

Type-locality: Sibogo in Simalur.

The type-locality is Sibogo in Simalur, where the original set was collected by Mr. E. JACOBSON in 1913.

Habitat. A.o. in hollow, decayed trunks of sago-palms.

Localities. In addition to the original set I saw the following specimens:

Simalur, leg. E. JACOBSON, 1913 (R.M.L., 1)[1])

24.1	3.6	4.4	3.0	11

[1]) vide note on p. 21.

Simalur (?), mainly in hollow decayed trunks of sago-palms, leg. E. JACOBSON (R.M.L., 7)

	21.3—23.6	4.2—4.9	4.7—5.4	3.3—3.7	10—11
averages:	22.2	4.4	5.0	3.5	

The species is dedicated to the Dutch naturalist Mr. E. JACOBSON, who contributed so much to the knowledge of the fauna of the Malay Archipelago and especially of Simalur Island.

Sectio **Oospira** BLANFORD, 1872

1872 BLANFORD, p. 206
1927 EHRMANN, p. 32

Shell more or less ovate and with a very blunt apex.
Type-species: *Pseudonenia philippiana* (L. PFEIFFER), indicated by BLANFORD 1872, p. 206.

Distribution: Eastern and South-Eastern Asia.

In the area concerned only one species has been found.

Pseudonenia johorensis (TOMLIN, 1939)
(fig. 29)

1939 TOMLIN, p. 14, pl. 12, f. 3 (*Oospira johorensis*)

DESCRIPTION of the material (the holotype included). Shell of medium height to large, fusiform, solid, dark chestnut-brown, dull, not transparent. Spire thick with a very broad, blunt apex and with convex lateral outlines. Whorls 7½ to 8, slightly convex, almost smooth, only the neck is distinctly striated. A thread in the colour of the shell may run below the rather deep suture. The 2½ nuclear whorls are broad and form the blunt apex. In a side view the neck slowly and regularly runs down towards the base of the aperture.
Aperture almost circular, reddish-brown within; the sinulus is wide, not high. The upper peristomal margin is curved where it is touched by the superior lamella. The base of the peristome recedes slightly. The peristome is continuous, violet, broadly reflexed and slightly thickened, the upper margin is clear of the preceding whorl. From the sinulus the outer peristomal margin is regularly and distinctly curved downward, as is the parieto-columellar edge.
Lamella superior violet, oblique and rather high, reaching the margin, always connected with lamella spiralis. Lamella inferior violet, not very low, thick, soon turning inward and upward into the shell. Outside it does not reach the margin. When looking obliquely from below into the aperture the base of the inferior lamella is not or hardly visible. Lamella subcolumellaris is clearly visible in a full front view of the aperture, it reaches the margin.

The closing apparatus lies at the right side. The plica palatalis principalis runs from the left side to somewhat beyond the ventral side, it is almost ¾ whorl long. Below it are 5 to 6 rather long plicae, almost parallel to the suture, 4 particularly are very large. Lamella subcolumellaris is hardly visible through the shell. The inner ends of the lamellae and the clausilium could not be studied.
Length of the shells: 24.3 to 29.4 mm, diam. 5.9 to 6.8 mm; aperture: height 6.5 to 7.7 mm, width 5.0 to 6.4 mm. Only the holotype and 5 paratypes were studied. The ventrosity l/d is 3.6 to 4.3, the average is 4.1.

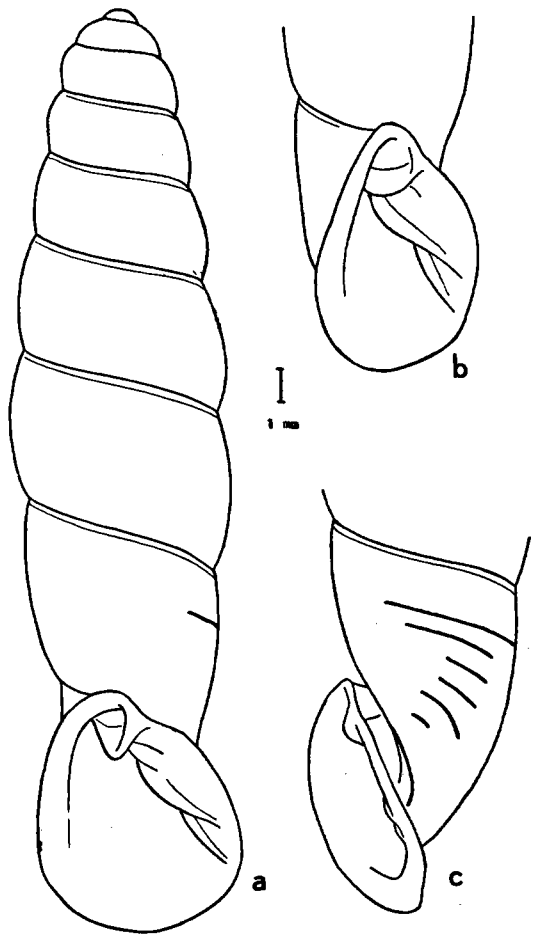

Fig. 29. **Pseudonenia johorensis** (TOMLIN)
Loc. Malay Peninsula, Johore, Mount Panti; holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

The holotype is in the British Museum (Nat. Hist.) (no. 1948.8. 27.1, 1).

The dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
29.4	6.8	7.7	6.4	8

TOMLIN recorded:

29	6.5	—	—	9

For the paratypes (R.M.S., 4 and F. E. LOOSJES collection, [1]), I noted:

26.5	6.2	6.9	5.9	8
24.3	6.8	7.1	6.1	7½
25.5	5.9	6.5	5.0	8
—	6.2	—	—	8
26.0	6.3	6.8	5.9	8

The stout spire and the blunt apex are very striking, but they need not be systematically important. TOMLIN (1939) regarded *Oospira* as a genus. EHRMANN (1927) on the contrary recorded *Oospira* as a section; he saw in these shells "Kontraktions-formen" (contracted forms), derived from a normal *Phaedusa*-group, e.g. from *penangensis* STOL. According to him such "contractions" may have occurred several times in *Clausiliidae*, as Tonkinese and Japanese species of similar shape are known. It remains to be seen whether the anatomy will provide a key to the problem. In accordance with EHRMANN it is my opinion that on account of the shell there is no justification for keeping *Oospira* as a separate group (vide p. 200). I maintain it till the anatomy is known.

ANATOMY unknown.

DISTRIBUTION: Malay Peninsula, Johore.
Type-locality: Mount Panti.
The type-locality is: Mount Panti, in lowland jungle, 1938.
Habitat and biology unknown.

Genus **EUPHAEDUSA** O. BOETTGER, 1877

1877 BOETTGER, p. 57
1927 EHRMANN, p. 32

Shell relatively small and narrow; lamella inferior not far from the lamella superior and bending inward spirally; lamella subcolumellaris not visible in a front view; lunella more or less rudimentary or entirely absent; clausilium wide. Probably all the south-eastern-asiatic representatives of the genus are viviparous.
Type-species: *Euphaedusa shanghaiensis* (L. PFEIFFER), designated by O. BOETTGER, 1877, p. 57.

Distribution: Eastern and South-Eastern Asia.

KEY TO THE INDO-AUSTRALIAN SPECIES.

[1]) vide note on p. 21.

1. shell longer than 12 mm .....
   Philippines, Moluccas, Celebes and some adjacent islands, Lesser Sunda Isles.....
   Eu. cumingiana (PFEIFFER) (p. 106)

— shell smaller than 12 mm.....
   Celebes .....
   Eu. alternata (VON MOELLENDORFF) (p. 121)

Euphaedusa cumingiana (L. PFEIFFER, 1845)

KEY TO THE SUBSPECIES.

1. papillae clearly visible only on the last whorls, sculpture not very strong..... 2.

— papillae also clear on the top-whorls, sculpture rather strong..... 3.

2. shell rather dull.....
   Philippines .....
   Eu. c. cumingiana (PFEIFFER) (p. 106)

— shell more shining.....
   Sumbawa, Flores, Timor.....
   Eu. c. recondita (SYKES) (p. 119)

3. papillae in the colour of the shell, peristome very broadly reflexed and whitish, almost quadrangular.....
   North Moluccas, Northern Celebes.....
   Eu. c. moluccensis (VON MARTENS) (p. 110)

— papillae usually whitish, sometimes merged to a light-coloured band along the suture, peristome not so broadly reflexed and less quadrangular .....
   South Celebes and adjacent islands .....
   Eu. c. simillima (SMITH) (p. 114)

Euphaedusa cumingiana cumingiana (L. PFEIFFER, 1845)
(fig. 30)

1845 PFEIFFER, p. 158 (*Clausilia Cumingiana*)
1847 KÜSTER, p. 101 pl. 11, f. 17—19 (*Clausilia Cumingiana*)
1848 PFEIFFER, p. 406 (*Clausilia Cumingiana*)
1877 BOETTGER, p. 59 (*Clausilia Cumingiana*, sectio *Phaedusa*, group *Euphaedusa* "Formenkreis" of *moluccensis*)
1879 BOETTGER, p. 107 (*Clausilia Cumingiana*)
1891 VON MOELLENDORFF, p. 47 (*Clausilia (Euphaedusa) cumingiana*)
1892 COOKE, p. 468 (*Clausilia cumingiana*)
1915 COOKE, p. 265 (*Euphaedusa cumingiana*)

DESCRIPTION of the material. Shell small to medium height, turreted fusiform, not very delicate, purplish- to yellowish-brown, faintly glossy to dull, slightly transparent. Spire slender, tapering regularly into the rather small apex, with straight lateral outlines. Whorls 9½ to 12, rather convex, sculptured with oblique, faint, transverse striae (about 10 to 15 to the mm on the whorl above the aperture), which are stronger and stand wider apart on the neck. Below the rather deep suture, especially of the lowest whorls, are usually faint papillae in the colour of the shell. They have been overlooked by many authors. Sometimes the whorls show a cream-coloured zone below the suture. Nuclear whorls 2½, smooth; they may be a little irregularly attached to the lower whorls, thus forming a somewhat separate top. The neck is rather abruptly bent towards the base of the aperture, it looks a little swollen.

Aperture longitudinal pear-shaped, light-brown within; the sinulus is rather high, formed by the lamella superior and by the margin of the peristome, although the angle in the latter is not always distinct. The base of the peristome recedes a little. The peristome is continuous, whitish, rather broadly reflexed, a little thickened; the upper margin is quite clear of the preceding whorl. In the place where the superior lamella reaches the margin, the latter is more or less distinctly bent. From the sinulus the outer peristomal margin descends slowly and regularly curved, whereas the margin at the parieto-columellar side of the sinulus

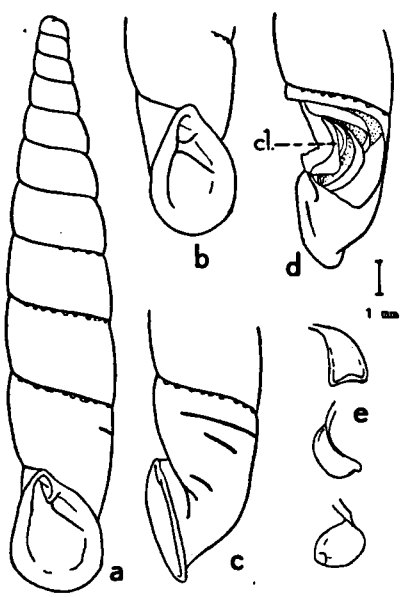

Fig. 30. **Euphaedusa c. cumingiana** (L. PFEIFFER)
Loc. (**a—c**) Philippines, Siquijor; paratype.
(**d—e**) Philippines, Siquijor.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** dorsolateral-right side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium (cl.) is present; **e.** 3 views of the clausilium.

runs rather straightly towards the right and at the same time downwards, forming a more or less distinct angle at the right side, near the umbilical slit, before it descends rather straight. The base of the aperture is regularly rounded.

Lamella superior is rather low, it reaches the margin, it often continues into the lamella spiralis, but it may also be touched by the lamella spiralis at its left side, in which case it has a free inner end. Both lamellae may be completely separated from each other, sometimes even by quite a large gap. In a dextral position the spiral lamella is rather high, it ends internally almost together with the lamella inferior and the lamella subcolumellaris in a lateroventral position at the left side. Lamella inferior is very clearly visible in the aperture, it does not reach the margin, its thickened edge runs spirally inward, it is dorsally not exceedingly high; the columellar edge is not clearly visible. When looking obliquely from below into the aperture it is possible to see the inner side of the base of the inferior lamella. Lamella subcolumellaris is not visible in a full front view of the aperture, its outer end lies behind the lamella inferior.

The closing apparatus lies at the right side. The plica palatalis principalis runs from dorsolateral-left to ventrolateral-right and is about half a whorl long. Below the principal plica, are two palatal plicae, relatively widely separated from each other. They are of about the same length and diverge more or less inward. The upper one lies near the principal plica, the lower one lies a little further inside, half way between the upper one and the right topside of the peristome. Sometimes the two plicae are connected by a callous lunella-like patch. The outer end of lamella subcolumellaris is visible at the right side of the umbilical slit. It is often impossible to see the plicae and the subcolumellar lamella through the shell. The clausilium has a short, relatively wide, strongly curved, saddle-shaped plate, with a rather blunt, slightly thickened apex. The dimensions of the plate are roughly: length 2, width 1 mm.

Length of the shells: 16.8 to 21.9 mm, diam. 3.2 to 4.0 mm; aperture: height 3.5 to 4.2 mm, width 2.5 to 3.2 mm. About 50 specimens were studied, the averages are: shell: length 18.9, diam. 3.5 mm; aperture: height 3.8, width 2.8 mm. The ventrosity l/d is 4.7 to 6.0, the average is 5.4.

In his first description PFEIFFER (1845) stated: "11 whorls, long. 21, diam. 4 mill.". He did not mention the papillae. In 1848 he recorded (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
21	4	4	$3^1/_3$	11

As in the original description, PFEIFFER only mentioned 2 palatal plicae, the principalis included. KÜSTER (1847) agrees with him.

It is not very likely that PFEIFFER indicated a holotype, except by recording the above-mentioned dimensions. At any rate it is not known where it is preserved.

Paratypes, so probably syntypes, are in the Senckenberg Museum at Frankfort on the Main, from the H. CUMING and L. PFEIFFER collections (S.M.F. no. 61144, 2; no 61143, 3 and no. 61142, 1) [1])

The dimensions (in mm) taken by me are:

18.8	3.5	3.9	2.8	11
15.7	3.5	3.6	2.7	9½ [2])
21.9	3.6	4.2	2.9	12
21.1	3.4	4.0	2.9	11½
19.1	3.6	4.0	3.0	11
19.6	3.6	4.0	2.8	11

None of these dimensions agrees with PFEIFFER's record.

BOETTGER (1879) mentioned some characters of *cumingiana* typica in a discussion of the differences from subsp. *moluccensis* MARTS. On the whole his data refer to individual characters of a small number of specimens, e.g. number of whorls, colour, colour of the inside of the aperture, and length of the shells.

ANATOMY unknown.

DISTRIBUTION: Philippines.

Type-locality: Philippines.

The subspecies *cumingiana* was described originally from the Philippines without further indication. It was not until 1891 that VON MOELLENDORFF recorded the island of Siquijor as the locality in a study on the molluscs collected in that island by KOCH and QUADRAS. I was therefore quite astonished when I found the indication Siquijor on the labels of the paratypes mentioned.

Habitat. So far this is the only Phaedusoid species known from the Philippines. It is also the one which is known to live near the shore at sea-level. Its habitat on roots of grasses is no exception among *Phaedusinae*. The species is closely related to some Chinese species in the same genus, e.g. *aculus* BENSON.

Localities. The material of this species studied by me, was labelled "Philippines" for the smaller part, the great majority bore the indication Siquijor. Only once I found the locality "Philippines: Palmas Isld (?)" with a couple of specimens agreeing more with the subspecies *moluccensis* MARTS. (to be dealt with later) than with *cumingiana* typica, so that I shall not discuss them any further here. In addition to the data on the paratypes just mentioned I give here the origin and any other data of the material studied by me from:

Siquijor, on roots of grasses, on the beach (Z.M.K., 3 + 3) and without further indications (K.B.I.N., 2; M.H.P., 1 + 4; B.M.L., 4; S.M.F. no. 30102, 1; no. 30103, 4; no. 61145, 7; 61446, 4; U.S.N.M. no. 184482, 2; 428680, 2 and F. E. LOOSJES collection, 2)

	16.8—20.4	3.2—4.0	3.5—4.2	2.5—3.2	10—11½
averages:	18.7	3.5	3.8	2.8	

[1]) vide note on p. 21.

[2]) This shell is not normal and extremely short, it has evidently developed its aperture too early.

Euphaedusa cumingiana moluccensis (VON MARTENS, 1864) (fig. 31)

1863 VON MARTENS, p. 73 (*Clausilia* n.sp.)
1864 VON MARTENS, p. 270 (*Clausilia Moluccensis*)
1867 VON MARTENS, p. 38, f. 5 on p. 378, pl. 22, fig. 19 (*Clausilia Moluccensis, Phaedusa*)
1868 PFEIFFER, p. 412 (*Clausilia Moluccensis*)
1877 BOETTGER, p. 59 (*Clausilia moluccensis*, sectio *Phaedusa*, group *Euphaedusa*, "Formenkreis" of *moluccensis*)
1879 BOETTGER, p. 107 (*Clausilia moluccensis*)
1891 BOETTGER, p. 271 (*Clausilia cumingiana* var. *moluccana*)
1892 VON MARTENS, p. 245 (*Clausilia moluccensis, Phaedusa*)
1892 COOKE, p. 468 (*Clausilia moluccensis*)
1894 SYKES, p. 48 (*Clausilia moluccensis*)
1897 KOBELT, p. 80 (*Clausilia* (*Phaedusa*) *moluccensis*)
1899 FULTON, p. 214 (*Clausilia moluccensis* ?)
1899 BOETTGER, p. 59 (*Clausilia cumingiana var. moluccensis*)
1899 SARASIN, p. 217 (*Clausilia moluccensis*)
1915 COOKE, p. 265 (*Euphaedusa cumingiana* var. *moluccensis*)
1918 BOLLINGER, p. 334 (*Clausilia cumingiana* var. *moluccana, Euphaedusa*)
1941 VAN BENTHEM JUTTING, p. 11 (*Phaedusa* (*Euphaedusa*) *cumingiana*)

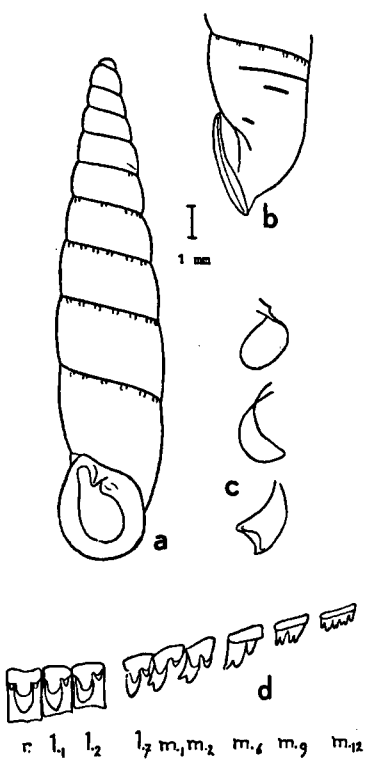

Fig. 31. **Euphaedusa c. moluccensis** (VON MARTENS)
Loc. (**a**—**c**) Halmahera.
(**d**) Talaud Archipelago.
a. ventral side of the shell ; **b.** right side of the last whorl with the plicae seen through the shell ; **c.** 3 views of the clausilium ; **d.** some elements of the radula (× 390).

DIAGNOSIS of the material. The colour of the shell is usually a little lighter than in *cumingiana* typica. Whorls 9½—12, the striae are usually distinctly stronger and more regular (about 10 to the mm on the whorl above the aperture); the papillae are much more distinct, they are visible on all the whorls except on the embryonic ones. The papillae are of the colour of the shell. Exceptionally they are replaced by a thread along the suture; it then looks as if the papillae have merged into each other. The embryonic whorls sometimes have a slightly sharper top than in *cumingiana* typica.

The aperture gives the impression of being more quadrangular than in *Eu. c. cumingiana*; the peristome is very broadly reflexed and flat, its upper margin is only hardly clear of the preceding whorl.

The lamellae and the plicae show no differences with those of *cumingiana* typica.

Length of the shells: 15.0 to 21.0 mm, diam. 3.1 to 3.9 mm; aperture: height 3.0 to 4.1 mm, width 2.3 to 3.0 mm. A total number of 130 specimens were studied. The ventrosity l/d is 4.4 to 6.2, the average is 5.3.

In his original description VON MARTENS (1864) gave the following dimensions: "Long 17, diam. 3, apert. long 3, lat. 2⅓ mill.". I saw 16 paratypes, possibly syntypes, present in the Senckenberg Museum at Frankfort on the Main, the dimensions are (in mm):

	shell		aperture		number of whorls
	length	diam.	height	width	
	15.0—17.1	3.1—3.5	3.0—3.5	2.4—2.7	9½—11
averages	16.3	3.3	3.3	2.5	

VON MARTENS (1864) did not record the papillae in his description, but he did mention already the three palatal plicae; as a difference from *Eu. c. cumingiana* he mentioned the much weaker striation of the latter. In 1867 he also drew attention to the smaller size of *moluccensis* as a point of difference. PFEIFFER (1868) copied VON MARTENS's description literally. BOETTGER (1877) combined *moluccensis* MARTS. and *cumingiana* PFR. in one "Formenkreis" of *moluccensis* in the group of *shanghaiensis* (called *Euphaedusa* by him). He first pointed out the papillae along the suture. In 1879 he discussed differences between *Eu. c. cumingiana* and *Eu. c. moluccensis*, which in my opinion are to be regarded mainly as individual variations. He recorded a.o. that the colour of the inside of the aperture as well as the colour of the shell is a little darker in *moluccensis*; *moluccensis* has only 10½ whorls. BOETTGER (1891) regarded *moluccensis* as a variety of *Eu. cumingiana*, differing by having 11 instead of 10 whorls, a broader peristomal edge and a slightly lighter brown colour. He studied specimens from Ternate. I found that *moluccensis* sets from the different islands sometimes differ a little in some points. Consequently, subspecies *moluccensis* is a conglomeration of closely related forms. There is no sense in distinguishing separate subspecies yet; the numbers of specimens showing differences are too small. In comparing these forms of *moluccensis* it appears, however, that some may be more easily distinguished from related species, than others, especially if one has a small number of specimens at one's disposal.

Among the specimens from Karakelang Island, Talaud Archipelago, which I studied, VAN BENTHEM JUTTING (1941) found a fairly wide range of variation, both as to size, and as to sculpture. In my opinion this variation is not wider, than that which I found in many *Phaedusa* populations.

ANATOMY. I studied the radula of this subspecies in a specimen from a place between Pulutan and Piapi on Karakelang Island in the Talaud Archipelago. Dental formula: more than 70 × $\frac{1}{3}+\frac{7}{2}+\frac{15}{3-\nu}$. In the first marginal tooth the third cusp is just visible; in the third the third cusp is as large as the main one.

DISTRIBUTION: North Moluccas, Northern Celebes, Sangihe & Talaud Archipelago.

Type-locality: Halmahera Island.

The discovery of a *Clausilia* in the North Moluccas was reported by VON MARTENS as early as 1863, but he did not mention the species. He found an immature specimen, smooth, without lunella and with two weakly developed palatal plicae, in Ternate. Afterwards he discovered a considerable number of living specimens among roots of trees in Halmahera near Dodinga. In his original description, a year later, VON MARTENS, indicated as the locality only "Halmahera (Djilolo)". And in 1867: "Moluccas, Ternate Group, Halmahera Island (Djilolo) near Dodinga on the road across the isthmus, on the ground among roots of trees and neglected pine-apple bushes, numerous. In the island of Ternate itself a dead specimen was found". Further he recorded: "a *Clausilia* I cannot distinguish from the others, I found in the Leyden Museum, with the indication that it had been collected by FORSTEN near Menado (Northern Celebes)". These specimens of FORSTEN's indeed turned out to belong to the relationship of moluccensis. The shells are still in Leyden and will be dealt with later (p. 114).

BOETTGER (1891) recorded a small number of specimens from Ternate, 18½ to 19½ mm long and with a maximum diameter of 3½ mm.

VON MARTENS (1892) mentioned *Eu. c. moluccensis* from South Celebes, but in agreement with P. and F. SARASIN (1899) and BOLLINGER (1918) I class the South Celebes forms with subspecies *Eu. c. simillima* SMITH (cf. p. 114).

SYKES (1894) recorded the occurrence in Sangir, where DOHERTY collected some shells. As SYKES was considering whether these might belong to the variety *majuscula* TAPPARONE CANEFRI, he must have dealt with long specimens. It is questionable, however, if they really belong to var. *majuscula*, a form which I prefer to class with *simillima* SMITH (cf. p. 115). KOBELT (1897) recorded the occurrence near Oba (Halmahera Island) in damp woods on decaying tree-trunks. FULTON (1899) recorded "*Clausilia moluccensis* ?" from the material collected in Talaud Island by DOHERTY, while VAN BENTHEM JUTTING (1941) mentioned the subspecies from the collection brought from Karakelang Island in the Talaud Archipelago by Dr. H. J. LAM (Poeloetan and Piapi, Karakelang Island; Lobo, Karakelang Island and Koeala Bahewa and Koeala Tatamboeë, above Lobo, Karakelang Island).

Habitat. Information on the biotope in which the subspecies lives, is given by VON MARTENS in his description of the type-locality: "among roots of trees" and by KOBELT (1897): "on decaying tree-trunks".

Localities. The following material was studied by me:

Sangihe & Talaud Archipelago.

Palmas Island? (U.S.N.M. no. 256554, 2)[1])

18.6	3.4	3.8	2.7	10½
19.1	3.5	3.7	2.5	11

These specimens agree more with the forms of *Eu. c. moluccensis* than with those of *cumingiana* typica; papillae and sculpture are clear, both shells are slightly ventricose.

LAM collected on Palmas Island, but did not find any molluscs (VAN BENTHEM JUTTING, 1941).

Sangihe (B.M.L. no. 98.12.3.88, 1)

14.1	2.9	2.9	2.4	10

This specimen is exceptionally small, it has weak striae and papillae and thus resembles *cumingiana* typica. As DOHERTY probably happened to bring long specimens from Sangihe (SYKES, 1894) we shall have to suspend our judgement on the local forms until more material is known.

Karakelang Island, between Pulutan and Piapi, leg. H. J. LAM, 1926 (Z.M.A., 38 + 14 juv.)

	17.0—20.6	3.4—3.8	3.4—3.9	2.2—2.8	9½—10½
averages:	18.6	3.6	3.6	2.6	

Among these specimens there are some that remind very strongly of *cumingiana* typica by their weaker striae and papillae. These specimens have been discussed by VAN BENTHEM JUTTING (1941).

Karakelang Island, Lobo, leg. H. J. LAM, 1926 (Z.M.A., 1)

18.2	3.4	3.6	2.5	10

Karakelang Island, between Kuala Bahewa and Kuala Tatambuë, upstream from Lobo, leg. H. J. LAM, 1926 (Z.M.A., 1)

20.4	3.6	3.9	2.7	11

Talaud Island (U.S.N.M. no. 428665, 2; B.M.L. no. 98.12.3.213—215, 3 and S.M.F. no. 61147, 2)

	17.8—21.0	3.4—3.7	3.7—4.1	2.6—3.0	10½—11
averages:	19.6	3.5	3.9	2.8	

Talaud Island, Salibabu (S.M.F. no. 30101, 3)

19.8	3.8	4.0	3.0	10½
19.4	3.7	3.9	2.9	10½
—	3.6	—	—	—

The papillae of the shells from the Sangihe and Talaud Archipelago are a little fainter than the ones of the Moluccan shells.

North Moluccas.

Ternate Island, leg. A. STRUBELL, 1890 (S.M.F. no. 61154, 2) and without any other indication (B.M.L. no. 98.12.3.336—338, 7 and no. 1933.3.1.58—64, 7; K.B.I.N., 4; M.H.P., 1 and S.M.F. no. 61153, 1 and no. 61155, 3)

	16.9—20.8	3.3—3.9	3.4—4.0	2.4—2.9	10—12
averages:	18.9	3.6	3.7	2.8	

Halmahera Island (= Gilolo), Dodinga, leg. E. VON MARTENS, paratypes (S.M.F. no. 61148, 2; no. 61149, 4 and no. 61150, 10); leg. DOHERTY (B.M.L. no. 3734.03.7.1, 6) and without recording a collector (B.M.L. no. 95.12.3.446—450, 5)

	15.0—20.4	3.1—3.7	3.0—4.0	2.4—3.0	10—12
averages:	17.0	3.4	3.4	2.6	

Halmahera Island (= Gilolo), leg. LANDAUER (Z.M.A., 2) and without recording a collector (B.M.L. no. 83.10.22.878—879, 2; B.M.L., 2; S.M.F. no. 61151, 2; no. 61152, 2 and no. 30100, 1 and F. E. LOOSJES collection, 1)

	16.0—19.1	3.3—3.7	3.2—3.8	2.3—2.9	10—12
averages:	17.6	3.5	3.5	2.5	

[1]) vide note on p. 21.

These specimens from "Halmahera", as well as the ones from "Dodinga", are distinctly smaller than the ones from the Talaud Island or from Ternate.

Moreover there were some shells only labelled "Moluccas" (B.M.L. no. 91.3.17.157—158, 2; K.B.I.N., 8; M.H.P., 2 and Z.M.A., 1)

	17.3—19.1	3.4—3.8	3.2—3.8	2.4—2.9	10½—11
averages:	18.2	3.6	3.6	2.7	

These figures seem to refer to material from Ternate and Halmahera.

Northern Celebes.

Menado, leg. FORSTEN (R.M.L. no. 129a, 2). These are the specimens mentioned by VON MARTENS in 1867.

18.1	3.5	3.6	2.9	10½
16.9	3.5	3.6	2.9	10½

Kandi (A.M.N.H. — N.Y. no. 67346, 3)

18.4	4.0	3.8	2.8	10½
19.1	4.0	4.1	3.0	11
17.5	3.8	3.8	3.0	10½

These shells, found near the north-west point of Celebes are the most westerly specimens ever found of *moluccensis*.

The shells from Ternate and Halmahera are slightly more ventricose (l/d resp. 5.1 and 5.0) compared with those from the Talaud Islands (average 5.3).

Euphaedusa cumingiana simillima (SMITH, 1896) (fig. 32)

1883 TAPPARONE CANEFRI, p. 171 (*Clausilia* (*Euphaedusa*) *moluccensis* var. *majuscula*)
1892 VON MARTENS, p. 245 (*Clausilia moluccensis, Phaedusa*)
1893 WIEGMANN, p. 229, pl. 16, f. 18—21 (*Clausilia moluccensis, Phaedusa*)
1896a SMITH, p. 99, pl. 7, f. 25 (*Clausilia simillima*)
1896b SMITH, p. 149 (*Clausilia simillima* var. *laevior*)
1896 BOETTGER in KOBELT, p. 3 (*Clausilia celebensis*, non *celebensis* SMITH)
1897 SYKES, p. 23 (*Clausilia simillima*) and p. 24 (*Clausilia balantensis*)
1899 SARASIN, p. 217 (*Clausilia moluccensis* var. *simillima*)
1899 BOETTGER, p. 59 (*Clausilia cumingiana* var. *simillima*)
1912 HAAS, p. 415 (*Clausilia simillima* subsp. *kabaënae*)
1915 COOKE, p. 265 (*Euphaedusa cumingiana* var. *simillima*)
1918 BOLLINGER, p. 335 (*Clausilia* (*Euphaedusa*) *cumingiana* var. *moluccana* forma *simillima*)
1941 VAN BENTHEM JUTTING, p. 11 (*Phaedusa* (*Euphaedusa*) *cumingiana*)

DIAGNOSIS of the material (the holotype included). The colour of the shell is usually darker than in *cumingiana* typica, whorls 9 to 12, the striae are mostly distinctly stronger, even than in subspecies *moluccensis* (about 10 to the mm on the whorl above the aperture), the papillae are even more distinct than in *moluccensis*, they are often whitish and sometimes merge to a whitish thread along the suture of nearly all the whorls, except on the embryonic ones.

The aperture is less quadrangular and has usually a less pronounced flat and wide peristome than is the case in most *moluccensis* specimens. The lamellae and plicae do not differ from those of *cumingiana* typica.

Length of the shells: 15.9 to 22.5 mm, diam. 3.4 to 4.2 mm; aperture: height 3.4 to 4.5 mm, width 2.3 to 3.4 mm. About 90 specimens were studied. The ventrosity l/d = 4.3 to 5.7, the average is 5.1.

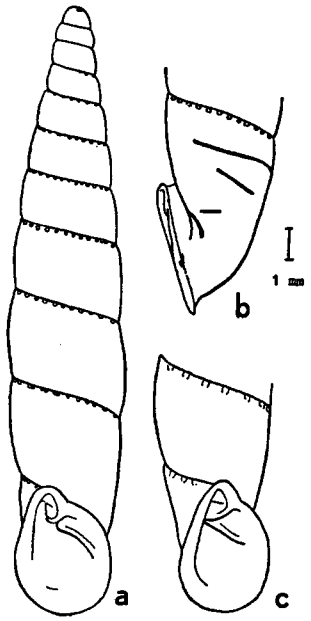

Fig. 32. **Euphaedusa c. simillima** (SMITH)
Loc. South Celebes; holotype.
a. ventral side of the shell; **b.** right side of the last whorl with the plicae seen through the shell; **c.** ventrolateral-left side of the last whorl.

In his original description SMITH (1896a) gave the following dimensions: "Anfractus 10—11, longit. 20.5, diam. 4 mm". Studying the holotype and the paratypes at the British Museum (Nat. Hist.) (B.M.L. no. 96.4.30.9—11 and 96.5.1.11—12, 4), I noted:

shell		aperture		number of whorls
length	diam.	height	width	
20.5	3.9	4.3	3.1	11
18.7	3.6	3.8	2.9	10½
20.9	3.8	4.4	3.2	11
18.0	3.7	4.0	2.9	10

The first mentioned specimen is the holotype.

SMITH drew attention to the resemblance with *moluccensis* and gave the main differences, mentioning colour, striation and dentation. It is noteworthy, however, that he described specimens which showed the differences very clearly. Before him TAPPARONE CANEFRI (1883) mentioned large specimens (from Kandari, Celebes) under the name: *moluccensis* var. *maiuscula*. As we do not know how long the shells were, we cannot pay much attention to this statement (cf. VAN BENTHEM JUTTING, 1941), but probably the shells belonged to a more *moluccensis*-like strain of *simillima* than those of SMITH. As I have not seen the material myself and there is hardly question of a "description", I will not drop *simillima* in favour of *majuscula*.

VON MARTENS (1892) published shells from Palopo in Luwu (Celebes), calling them *moluccensis*. He gave the dimensions of the largest and of the smallest specimen.

19	3½	4	3½
16	3	4	3½

On comparison with *moluccensis* specimens from Halmahera Island he found few differences, but according to P. and F. SARASIN (1899) they fit in better with subsp. *simillima*.

SMITH (1896a) published his *simillima* from "South Celebes" and BOETTGER (1896) his *celebensis* (non SMITH) from Balante in Celebes; the latter based on a very large specimen, measuring:

27½	5	5	4	11

BOETTGER pointed out the relationship with *Eu. c. cumingiana* PFR. and *Eu. c. moluccensis* MARTS. and was the first to mention the similarity through the possession of papillae along the suture, which neither PFEIFFER (1845) nor VON MARTENS (1864) had recorded. The differences he named were the stronger striation and the less thick and less expanded peristome of his *celebensis*.

SYKES (1897) stated that SMITH's publication of *simillima* and *celebensis* (non BTTG.) (1896a) deserved priority over BOETTGER's (1896). He proposed *balantensis* as a new name for *celebensis* BOETTGER (non SMITH), which is synonymous with *simillima* SMITH.

Since then the relation between the subspecies, described as separate species, has been recognised more and more.

P. & F. SARASIN (1899) spoke of *moluccensis* var. *majuscula* and var. *simillima*; under the former they brought the form of TAPPARONE CANEFRI and *celebensis* BOETTGER, under the latter all other forms known from Celebes.

BOETTGER (1899) took together the forms from South Celebes under *simillima* SMITH and regarded them as a variety of *Eu. cumingiana* like *moluccensis*. I share his opinion entirely, except that I regard *simillima* SMITH as a geographical race.

BOLLINGER (1918) regarded *simillima* SMITH, in which he included all specimens known from South Celebes, only as an unimportant form of var. *moluccana* MARTS. of *cumingiana* PFR. VAN BENTHEM JUTTING (1941) finally would even go still a step further and include *moluccensis, majuscula, simillima, laevior, kabaënae, balantensis* and *recondita* all in the "Rassenkreis" of *Eu. cumingiana* PFEIFFER".

SMITH (1896b) and HAAS (1912) respectively described a new variety and a new subspecies of *simillima*, called *laevior* from Salayar and *kabaënae* from Kabaëna Island.

Eu. c. simillima indeed like *Eu. c. moluccensis*, within its area of distribution, shows an inclinaton to fall apart into a number of more or less easily distinguishable forms. According to me it would be premature, to establish subspecies for the different islands already. Within the relatively small numbers of specimens I saw from any one island, there was always an important percentage showing no difference at all with specimens from one of the other islands. It is no use to establish subspecies solely because of their isolated geographical origins. Only a sufficient

amount of material, collected in several localities in each of the islands will be able to provide a decisive answer.

ANATOMY. The radula of the subspecies was studied by WIEGMANN (1893) from a specimen from Luwu (Celebes). According to him the dental formula is $88—98 \times \frac{1}{3} + \frac{10}{2} + \frac{14-18}{3-\omega}$. From the third marginal tooth the number of cusps sometimes increases to 5, besides the always present "cloven" main cusp. According to WIEGMANN the subspecies is ovoviviparous.

DISTRIBUTION: Celebes, Salayar Island, Kabaëna Island.

Type-locality: South-Celebes.

As has been mentioned the first record of *simillima* was from Kandari (Celebes) by TAPPARONE CANEFRI (1883); VON MARTENS (1892) stated that he found shells near Palopo in Luwu (Celebes). The type-locality is "South Celebes, at 2,000 feet" (SMITH, 1896a), the original set was collected by A. EVERETT. In the same year (1896b) SMITH described var. *laevior* from Salayar Island. Balante (Celebes) was recorded by BOETTGER (in KOBELT, 1896); further localities are: "in the neighbourhood of Ussu and Paloppo" (P. and F. SARASIN, 1899); "Kabaëna (HAAS, 1912); BOLLINGER (1918) recorded the subspecies from the following localities, all in South or South-Eastern Celebes; Malawa-spring; north of Bowonglangi; Birue; Lamontjong; Tjamba (5 specimens on banana); Opa-Moor and Kolaka.

Habitat. Specimens of *simillima* were found at altitudes from 700 to 1700 m (2,000—5,000 feet). Nothing has been published on the sites where shells were collected.

Localities. I saw specimens from the localities mentioned below:

Celebes.

Palopo, leg. P. & F. SARASIN (N.M.B. no. 2327c, 1)

18.7	3.9	4.0	3.3	10

Along the road from Makale to Kalossi, near K.M. 5, 700—800 m above sea-level, leg. Mrs. G. A. TAMMES-BOLT, 1948 (Z.M.A., 1)

17.1	3.5	3.5	2.7	10½

Lamontjong (N.M.B. no. 2327d, 4)

17.7	3.6	3.8	2.8	10½
18.1	3.8	3.7	2.9	11
17.4	3.7	3.7	2.8	10½
—	3.7	3.7	2.8	—

Malawa-spring Bowonglangi (N.M.B. no. 2327e, 4)

18.1	3.7	3.9	2.8	11
17.1	3.5	3.7	2.6	10
19.1	3.7	4.1	2.8	11
—	3.6	3.9	2.9	—

Tjamba, near Makassar, (N.M.B. no. 2327i, 4)

18.4	3.8	4.0	2.9	10
17.5	3.8	4.0	2.9	10
—	3.8	3.7	3.0	—
—	3.7	—	—	10½

near Makassar, leg. W. DOHERTY (B.M.L. no. 97.7.30.27—28, 2)

18.5	3.5	3.8	3.0	10
19.4	3.5	4.0	3.0	11

Lompobatang (= Peak of Bonthain). 1000 m, leg. H. FRUHSTORFER, 1896 S.M.F. no. 30099, 1) and 1898 (S.M.F. no. 61156, 3 and N.M.B. no. 2327a, 4)

	18.1—21.4	3.5—4.1	3.6—4.4	2.8—3.3	10—11
averages:	19.9	3.8	4.1	3.1	

Bua Kraeng, near Bonthain, 1700 m, leg. H. FRUHSTORFER, 1896 (K.B.I.N.,4 and S.M.F. no. 61157, 4)

	17.8—21.6	3.6—4.2	3.8—4.3	2.8—3.1	10—11
averages:	20.1	3.9	4.1	3.0	

Birue, Boni, ± 650 m (N.M.B. no. 2327h, 4)

18.6	3.5	3.7	2.8	11
16.5	3.4	3.7	2.8	10
18.2	3.6	3.9	2.8	10½
18.9	3.8	3.9	2.9	11

Ussu (N.M.B. no. 2327b, 4)

15.9	3.6	—	—	9½
16.8	3.7	3.9	2.9	9½
17.5	3.8	4.0	3.0	10
20.4	4.1	4.4	3.2	10½

Kolaka (N.M.B. no. 2327f, 4)

17.6	3.8	3.9	2.9	10
16.0	3.7	3.9	2.8	9
16.5	3.8	3.8	2.9	9
17.3	3.8	3.9	3.0	9½

Opa-Moor, north of Kendari (N.M.B. no. 2327g, 2)

19.5	3.7	3.9	3.0	11
16.0	3.5	3.4	2.6	10

Rumbi-Mengkoka, leg. J. ELBERT, 1909 (S.M.F. no. 61158, 4)

17.9	3.5	3.7	3.0	11
18.5	3.6	3.9	2.8	11
16.3	3.4	3.7	2.8	10
16.6	3.4	3.8	2.9	10

Salayar Island, leg. A. EVERETT (B.M.L. no. 96.5.16.88—90, 3) and without collector (B.M.L. no. 1933.3.1.75—76, 2 ; Z.M.A., 2 ; S.M.F. no. 61160, 2 and R.M.L. no. 169a, 3)

	20.3—22.3	3.8—4.2	4.0—4.4	2.9—3.4	11—11½
averages:	21.2	4.0	4.2	3.2	

It is obvious that the shells from Salayar are all long and slender, while at the same time they are less strongly striated than is the case in some long *simillima* specimens from Celebes ; the papillae too are sometimes less distinct. The characters mentioned, all fall within the range of variation of *Eu. c. simillima* from Celebes. The shells from Salayar Island, however, vary much less proportionally. I already stated that SMITH (1896b) described the form as a distinct variety under the name *laevior*. The shells in the London Museum, no. 96.5.16.88—90 may be the original set.

To my opinion the establishment of a distinct subspecies is not justified in this case.

Kabaëna Island, leg J. ELBERT, 1909 (R.M.L., 1 ; S.M.F. no. 5904, 1 and 5905, 4)

	17.5—18.9	3.4—3.8	3.8—4.1	2.8—3.2	10—10½
averages:	18.1	3.6	3.9	2.9	

HAAS (1912) regarded it as a form of *simillima* and described it as subsp. *kabaënae*, characterized by smaller dimensions and a wider, oval aperture. In my opinion there is still less reason than in the case of var. *laevior*

to speak of a distinct subspecies. As in this latter case, the variation comes quite within the range of variation of Celebes specimens. I studied HAAS's holotype and 4 paratypes preserved in the Senckenberg Museum at Frankfort on the Main. The holotype measures:

18.9	3.8	4.1	3.2	10

Euphaedusa cumingiana recondita (SYKES, 1894)
(fig. 33)

1894 SYKES, p. 49 and textf. (*Clausilia* (*Pseudonenia*) *recondita*)
1915 COOKE, p. 265 (*Pseudonenia recondita*)
1932 RENSCH, p. 116, f. 48, 49 (*Phaedusa cumingiana recondita*)
1935 RENSCH, p. 320 (*Phaedusa cumingiana* aff. *recondita*)
1941 VAN BENTHEM JUTTING, p. 11 (*Phaedusa* (*Euphaedusa*) *cumingiana*)

DIAGNOSIS of the material (the holotype included). This subspecies is again very like the typical form. It is usually horn-coloured but more shining than subsp. *cumingiana*. Whorls 9½—11½, the lowest usually flatter than in *Eu. c. cumingiana*. The striation is rather vague (about 10 to the mm on the whorl above the aperture) as are the papillae, which are of the same colour as the shell and are only distinctly visible on the lower whorls.

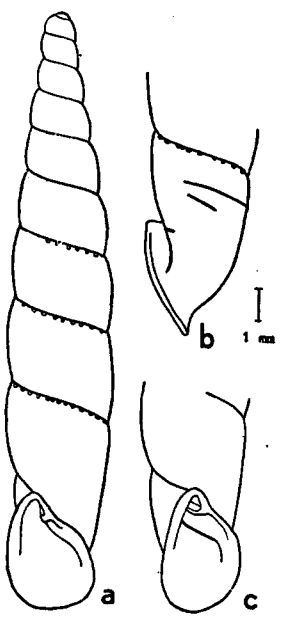

Fig. 33. **Euphaedusa c. recondita** (SYKES)
Loc. Sumbawa, Dongo Mountains; holotype.
a. ventral side of the shell; **b.** right side of the last whorl with the plicae seen through the shell; **c.** ventrolateral-left side of the last whorl.

The aperture is less quadrangular and the peristome is less thickened than is the case in subsp. *moluccensis*.
The position and appearance of the lamellae and plicae do not differ from those typical in *cumingiana* proper.
Length of the shells: 15.9 to 21.8 mm, diam. 3.2 to 3.8 mm; aperture: height 3.2 to 4.1 mm, width 2.2 to 3.1 mm. I studied 35 specimens. The ventrosity l/d is 4.8 to 6.3, the average is 5.5.

According to SYKES (1894) the dimensions (in mm) of the specimen in the figure are:

shell		aperture		
length	diam.	height	width	
18.8	3	3.5	2.5	

and of the longest specimen:

21	3	3.6	2.6	

Studying the holotype in the British Museum (Nat. Hist.) (B.M.L. no. 98.10.25.177,1) I noted:

19.0	3.4	3.8	2.8	10

The dimensions of the three paratypes (B.M.L. no. 4053.03.7.1,3) are:

20.9	3.5	3.9	2.8	11
20.4	3.4	4.0	2.9	11
21.4	3.4	4.0	2.9	11

In his original description SYKES mentioned only one plica palatalis below the principalis.

RENSCH (1932) was the first to bring *Clausilia recondita* as a subspecies under *Eu. cumingiana*. It is remarkable that, in spite of the great resemblance with *Eu. c. cumingiana*, nobody ever arrived at this conclusion, as both *Eu. c. moluccensis* and *Eu. c. simillima* were brought under *Eu. cumingiana* before 1900 already.

ANATOMY. Some data on the outward appearance of the soft parts and on the anatomy of this subspecies were provided by RENSCH (1932). The foot of the live animal is pale reddish-brown, it is darker brown on the front part of the back with two still darker longitudinal streaks in the direction of the upper pair of tentacles. The formula of the radula is: about $96 \times \frac{1}{3} + \frac{7\text{-}8}{2} + \frac{20}{3\text{-}\omega}$.

The genital organs have a proportionally long receptaculum seminis, the appendix of which is longer than the distal part of the bursa. The penis is small. In the uterus two fully developed young snails were found, so the subspecies is viviparous.

DISTRIBUTION: Sumbawa, Flores, Timor.
Type-locality: Sumbawa, Tongo Mountains.

The subspecies was first collected by DOHERTY in the Tongo or Dongo Mountains in eastern Sumbawa; RENSCH (1932) found it under decaying wood and under mosses in the mountain forests of Sumbawa at Batoe Doelang (1000—1300 m) and in Flores at Rana Mesé (1200—1300 m) and Waë Reno (1000 m). The dimensions (in mm) of his Sumbawa series were (58 specimens):

	length	diam.
	16.2—19.2	3.2—4.3
averages :	17.4	3.7

and of his Flores specimens (5 specimens):

	18.6—19.8	3.6—4.0
averages :	19.2	3.9

In 1935 RENSCH recorded an allied form from Timor, only one juvenile shell was found.

Habitat. This subspecies was found in mountain forests under decaying wood and under mosses.

Localities. Besides the original set I saw the following specimens :

Sumbawa Island.
Batu Dulang, 1000—1200 m, leg. B. RENSCH, 1927 (K.B.I.N., 3 ; S.M.F. no. 61162, 6 and Z M.A., 7)

	15.9—18.2	3.2—3.6	3 2—3.5	2.2—2.7	9½—11
averages :	17.0	3.3	3.4	2.5	

The other shells studied were only labelled Sumbawa. They are not mentioned in detail.

Flores Island.
Rana Mese, 1200—1300 m, leg. B. RENSCH, 1927 (S.M.F. no. 61163, 2)

18.7	3.6	3.6	2.7	10½
—	3.8	—	—	—

Euphaedusa alternata (VON MOELLENDORFF, 1896)

1896 VON MOELLENDORFF, p. 147 (*Clausilia* (*Euphaedusa*) *alternata*)
1915 COOKE, p. 265 (*Euphaedusa alternata*)
1949 EHRMANN in ZILCH, p. 83 (*Paraphaeduse* (sic) *alternata*)

DESCRIPTION (according to VON MOELLENDORFF). Shell ventricose fusiform, spire ventricose below, with, up to the top, almost concave lateral outlines, solid, brown or yellowish. Whorls 8, convex, sculptured with closely set ribs, the topwhorls are slightly distorted, the neck is a little swollen and rounded.

Aperture ovate, rather wide, lying in a vertical plane, peristome continuous, somewhat expanded.

Lamella superior is rather low and a little oblique ; lamella inferior is strong, distinctly spirally curved.

Plica palatalis principalis rather short, 3 palatal plicae, of which the middle one is shortest and the lower one is longest.

Only the holotype is known ; its dimensions according to VON MOELLENDORF are : length 10.5, diam. 3 mm ; aperture : height 2.8, width 2.2 mm.

As this holotype is no more in the Senckenberg Museum (in the tube labelled *"alternata"* a specimen of *Paraphaedusa subpolita* is found), the only information on this species is VON MOELLENDORFF's original publication, which is rather incomplete. Nothing e.g. is reported on the lamella subcolumellaris, on the inner ends of the lamellae or on the position of the closing apparatus. I am quite sure that in a full front view the subcolumellar lamella was not visible in the aperture, because other-

wise VON MOELLENDORFF would have mentioned it and because VON MOELLENDORFF quotes the relationship with the *aculus* group. It is not clear why EHRMANN (in ZILCH, 1949) placed the species in the genus *Paraphaedusa*. The characters required for putting a species in that genus are not recorded by VON MOELLENDORFF and the only one mentioned (striation) rather points in a different direction. Neither does VON MOELLENDORFF refer for comparison to the *Paraphaedusae* he knew.

DISTRIBUTION : Celebes.
Type-locality: near Bua Kraeng.
The species was found near Bua Kraeng in South Celebes.

Genus **PARAPHAEDUSA** O. BOETTGER, 1899

1899 BOETTGER, p. 56
1949 EHRMANN in ZILCH, p. 69.

Shell with a subcolumellar lamella which is clearly visible in the aperture and usually reaches the peristome; at the dorsal or laterodorsal-right side the inferior lamella is very high, wing-like; besides the principal plica usually 2 more palatal plicae, rather far apart, which may be either or not connected by a callous, lunella-like thickening. The plate of the clausilium is short and wide, gutter-shaped with a more or less clear notch at the top and at the columellar side near the pedicle, hence there is no regular transition from the plate to the pedicle on that side.
Type-species: *Paraphaedusa subpolita* (SMITH), designated by BOETTGER, 1899.

Distribution: Celebes, Borneo and Laut Island.

KEY TO THE SPECIES:

1. closing apparatus ventrally ..... 2.

— closing apparatus ventro-laterally or right-laterally ..... 3.

2. shell longer than 18 mm and wider than 4 mm .....
South Celebes ..... **P. celebensis** (SMITH) (p. 126)

shell less than 18 mm long and less than 4 mm wide .....
South Celebes ..... **P. subpolita** (SMITH) (p. 123)

3. shell fragile, on the last whorl it is hammered, violet, shining .....
South Celebes ..... **P. bonthainensis** (P. & F. SARASIN) (p. 134)

— shell fragile, horn-coloured or dark yellowish-brown, in the latter case usually more solid ..... 4.

4. shell usually with a clear and regular delicate striation as a rule not stronger on the neck than on the previous whorl; rather strong, fairly glossy, not very transparent ..... 5.

— shell striated faintly and irregularly on the whorls, horn-coloured, glossy, usually transparent ..... 6.

5. shell less than 16 mm long .....
South Celebes ..... **P. makassarensis** (SYKES) (p. 139)

— shell longer than 16 mm .....
South Celebes ..... **P. pyrrha** (SYKES) (p. 142)

6. shell very slender, striation faint, hardly any clearer on the neck, very shining, very transparent, fragile; superior lamella and spiral lamella widely separated; the latter not visible through the aperture .....
Northern Celebes ..... **P. minahassae** (P. & F. SARASIN) (p. 137)

— shell different, striae on the neck very distinct in comparison to the almost smooth whorls ..... 7.

7. the striae on the neck are usually strongly developed; lamella superior and lamella spiralis are in a direct line. They are either connected or only separated by a small space .....
Borneo and Laut Island .....
P. schwaneri (VON MARTENS) (p. 144)

— the striae on the neck are distinct; lamella superior and lamella spiralis are separated; at best the spiral lamella ends laterally in the superior lamella .....
South Celebes ..... **P. usitata** (SMITH) (p. 130)

Paraphaedusa subpolita (SMITH, 1896)
(fig. 34)

1896a SMITH, p. 99, pl. 7, f. 26 (*Clausilia subpolita*)
1896 VON MOELLENDORFF, p. 147 (*Clausilia* (*Euphaedusa*) *subpolita*)
1899 BOETTGER, p. 56 (*Clausilia subpolita, Paraphaedusa*)
1915 COOKE, p. 265 (*Paraphaedusa subpolita*)
1918 BOLLINGER, p. 334 (*Clausilia* (*Paraphaedusa*) *subpolita* part.)
1949 EHRMANN in ZILCH, p. 70, pl. 4, f. 1 (*Paraphaedusa subpolita*)

DESCRIPTION of the material (the holotype included). Shell small, turreted fusiform, delicate, reddish- or yellowish-horn-coloured, shining and transparent. Spire rather slender, tapering regularly into the narrow apex. The lateral outlines are straight or slightly convex. Whorls 8½ to 10½, usually 9½—10, moderately convex, sculptured with very faint irregular transverse striae (about 10 striae to the mm on the whorl above the aperture), the striae are a little coarser on the neck and stand wider apart there. The nuclear whorls, 2½, are remarkable because of their "drawn- out appearance", as SMITH calls it. The third whorl does not

enclose the preceding one as strongly as usual, but it turns down more readily, in such a way that a larger part of the previous whorl remains visible. The suture is shallow, there may be a thread below it. The neck is flat, which means that it turns forward and downward regularly and slowly towards the base of the peristome.

Aperture ear-shaped, horn-coloured within; the sinulus is not high, rather wide, formed partly by the lamella superior and partly by the peristome, because there is often a distinct angle in the latter, where it joins the superior lamella. The base of the peristome and the sinulus are receding. The peristome is continuous, the upper edge is only just clear of or adnate to the preceding whorl, it is whitish or horn-coloured, slightly widened, not reflexed, the edge is often thickened. As has been mentioned before, the upper margin has a distinct angle. From the sinulus the outer margin runs down fairly straight, whereas the parieto-columellar margin descends slowly towards the right and then turns down abruptly; the base of the peristome is semicircular.

Lamella superior is distinct; it reaches the margin; its inner end is not connected with the spiral lamella; the opening between the two folds lies rather dorsally; the end of the lamella superior lies closer to the axis of the shell than the beginning of the lamella spiralis. The spiral lamella increases in height towards ventrolateral-right and ends on the left side, just beyond the end of the inferior lamella. The outer end of the inferior lamella is low, it ascends rather straight along the columella and then turns inward horizontally and spirally. In a dorsal position it increases in height very rapidly, in such a way that a wing-like structure with a right angle is formed, which decreases very suddenly towards ventrolateral-right, to be low again in a ventral position; it

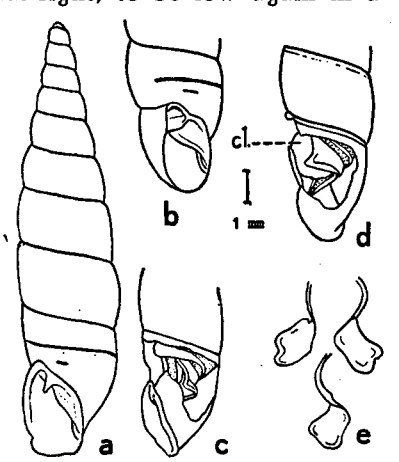

Fig. 34. **Paraphaedusa subpolita** (SMITH)
Loc. (**a**—**c**) South Celebes; holotype.
(**d**—**e**) South Celebes.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl with the plicae seen through the shell; **c.** ventrolateral-right side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium has been removed; **d.** dorsolateral-right side of the last whorl, the palatal wall has been broken away, the clausilium (cl.) is present; **e.** 3 views of the clausilium.

ends at the left side. When looking obliquely from below into the aperture, one can see the inner side of the base of the lamella inferior. Lamella subcolumellaris is clearly visible in a full front view of the aperture; it reaches the margin; its inner end lies at the left side beside or beyond the other two lamellae.

The closing apparatus lies ventrally, above the aperture. The plica palatalis principalis runs from the right side to beyond the ventral side, it is about $^3/_8$ whorl long. Below it are two, often faint, fairly short palatal plicae, parallel to the principalis; the upper one lies near the principalis, the lower one lies very low, it is partly covered by the peristome and therefore not visible through the shell; it may be connected with the right side with a white callous patch, which is elongated upwards in the direction of the upper palatal plica. The clausilium has a quadrangular, short, wide, strongly curved plate, incised below, in such a way that a distinct separate lobe is formed at the palatal side. At the columellar side the transition into the pedicle is very abrupt, whereas at the palatal side it is very regular. Length of the plate 1.6, width 1.1 mm.

Length of the shells: 11.7 to 15.2 mm, diam. 2.6 to 3.2 mm; aperture: height 2.5 to 3.1 mm, width 1.5 to 2.3 mm. About 60 shells were studied. The ventrosity l/d = 4.2 to 5.0, the average is 4.5.

The holotype and four paratypes are in the British Museum (Nat. Hist.) (B.M.L. no. 96.4.30.12—14, 3 and no. 96.5.1.7—8, 2). [1])

Dimensions of the holotype (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
14.2	3.1	3.0	—	10
and of the paratypes				
15.2	3.2	3.0	2.0	10½
14.1	2.9	3.0	2.0	10
13.0	3.0	3.0	1.9	9½
13.6	3.1	3.0	2.1	10

SMITH (1896a) only recorded a plica suturalis (meaning the principalis) and no other palatal plicae. According to him, the dimensions of the shell are: "longit. 14, diam. 3 mm". The inferior lamella, which is extremely high in a dorsal position, was first recorded by VON MOELLENDORFF (1896), who also referred to the extraordinarily broad clausilium. The first detailed description of the inner structure of the shells of *P. subpolita,* however, was given by BOETTGER (1899). The only incorrectness is his statement of the relation of the superior lamella to the spiral lamella, which he called "merged so completely" that the transition between the two cannot be determined. BOETTGER based his "Formenkreis" *Paraphaedusa* on the situation found in *P. subpolita.* Evidently the differences between this species and *P. usitata* were not quite clear to BOLLINGER (1918). The length he recorded for *P. subpolita* is 12 to 14 mm. The last and best descriptions of the characters of the shells of the Paraphaedusoid species were given by EHRMANN in notes which

[1]) vide note on p. 21.

were published by ZILCH (1949) after EHRMANN's death. In this paper the plicae palatales are recorded correctly for the first time.

ANATOMY unknown.

DISTRIBUTION : South Celebes.

Type-locality: South Celebes.

The type-locality is : South Celebes at 2,000 feet, where A. EVERETT collected the species (SMITH, 1896a); VON MOELLENDORFF (1896) recorded Bua Kraeng (leg. H. FRUHSTORFER). BOLLINGER (1918) added Bowonglangi. The record of 3 specimens from "Tjamba, Lamontjong Gebiet" is erroneous, as these were specimens of *P. usitata tjambensis*. ZILCH (1949) recorded Lompo-Battan, at an altitude of 3,000 feet, as a new locality. For specimens from Bowonglangi, 1500 m, he gave the following dimensions (in mm) (summarized by me):

	11.6—14.1	2.6—3.1	2.7—3.0	1.8—2.2
averages :	13.0	2.9	2.8	2.0

Habitat. Most of the labels indicating South Celebes as locality, referred to an altitude of 2,000 feet (ca 650 m). This is in accordance with the data on the type-locality. The shells occur at altitudes from 650 to 1700 m. No further details are known on the locality or the biology of the species.

Localities. Besides the holotype and the 4 paratypes, I studied the specimens mentioned below. Specimens only labelled "South Celebes" were studied but are not recorded here.

South Celebes.

Bua Kraeng, 1700 m, leg. H. FRUHSTORFER (K.B.I.N., 7 ; S.M.F. no. 61170, 6 and no. 61173, 1)

	11.9—13.1	2.7—3.0	2.5—2.8	1.6—1.9	9—10
averages :	12.6	2.8	2.7	1.8	

Bowonglangi, 1500 m, leg. P. & F. SARASIN (N.M.B. no. 2368b, 4 ; S.M.F. no. 30112, 1 and no. 30113, 2)

	12.7—14.7	2.9—3.0	2.8—3.0	1.8—2.1	9—10
averages :	13.5	2.9	2.9	2.0	

Lompobatang, 1000 m, leg. H. FRUHSTORFER (S.M.F. no. 61169, 6 and no. 30110, 2)

	12.0—13.6	2.8—2.9	2.8—2.9	1.8—2.1	9—10
averages :	12.9	2.8	2.8	1.9	

These localities are all in the south-western peninsula of Celebes.

Paraphaedusa celebensis (SMITH, 1896 (non BOETTGER, 1896)) (fig. 35)

1896a SMITH, p. 99, pl. 7, f. 24 (*Clausilia celebensis*)
1896 VON MOELLENDORFF, p. 147 (*Clausilia (Hemiphaedusa) celebensis*)
1899 BOETTGER, p. 57 (*Clausilia celebensis, Paraphaedusa*)
1915 COOKE, p. 265 (*Paraphaedusa celebensis*)
1949 EHRMANN in ZILCH, p. 71, pl. 4, f. 2 (*Paraphaedusa celebensis*)

DESCRIPTION of the material (the holotype included). Shell of medium height, ventricose-fusiform, slightly clavate, usually solid, but specimens

are known that have a thin delicate shell, which are at the same time usually yellowish-horn-coloured in contrast with the ordinary shells, which are reddish- to purplish-brown ; shining, more or less transparent. Spire rather thick, with slightly concave lateral outlines. Whorls 9 to 11, usually 10, slightly convex, sculptured with faint irregular transverse striae (about 8 to the mm on the whorl above the aperture); they are a little stronger on the neck. The nuclear whorls are rather thick, mamillate. They usually stand out against the lower whorls, because these lower whorls often grow suddenly wider, which is the cause of the concave lateral outlines. The top-whorls are nearly always whitish or cream-coloured, so are the parts of the whorls immediately below the rather deep suture ; a faint thread along the suture is sometimes visible. The last whorl is distinctly less wide than the previous one, which adds to the fusiform appearance of the shell. The neck is curved down regularly and slowly towards the base of the peristome.

Aperture ear-shaped, rather small in comparison to the plump shell,

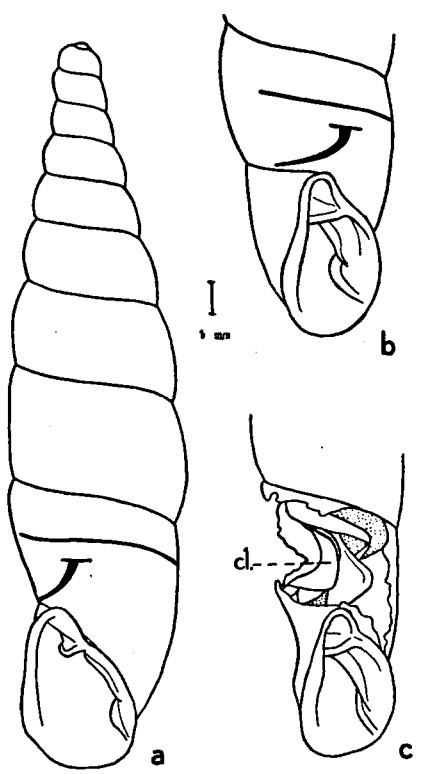

Fig. 35. **Paraphaedusa celebensis** (SMITH)
Loc. (a—b) South Celebes, Bonthain Peak ; holotype.
(c) South Celebes.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl with the plicae seen through the shell ; **c.** ventrolateral-left side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium (cl.) is present.

yellowish within ; the sinulus is high and wide, formed for the largest part by the peristome, as the latter is distinctly curved upward towards the left in the contact place with the superior lamella. The base of the peristome recedes. The peristome is continuous, the upper edge, especially the sinulus, is scarcely clear, or adnate, it is whitish, widening regularly, not reflexed, the edge is thickened. From the sinulus the outer margin runs down in a faint curve, whereas the parieto-columellar one descends regularly but in a distinct curve. The base of the peristome is semicircular.
Lamella superior is rather strong, touching the margin ; it is clear of the lamella spiralis, or touched by it at the side of the suture, a little before the inner end ; in the latter case particularly, the two lamellae overlap at the left side of the shell. Curving upwards the spiral lamella slowly increases in height, reaching its maximum height in a latero-ventral position at the left side in the whorl above the aperture, then it decreases very rapidly and ends beyond the inferior lamella and the lamella subcolumellaris at the left side. Lamella inferior is visible in the aperture as a low edge on the columella, its outer end is far from the margin, nearly touching the subcolumellar lamella ; it ascends inward in a regular curve. In a dorsal position it increases rapidly, forming a lobe at the right side, the top of which curves towards the right ; inward it decreases regularly, ending a little beyond the ventral side. When looking into the aperture from below one can hardly see beyond the inferior lamella. Lamella subcolumellaris protrudes up to the margin of the peristome, curving upward and inward sharply and ending near the left side.
The closing apparatus lies ventrally. Only in horn-coloured thin shells the plicae are clearly visible through the shell. Plica palatalis principalis is visible in the aperture and runs from the left to the dorsal side up to ventrolateral-left and is almost ¾ whorl long. At the ventral side, just above the aperture we find below and parallel to it a faint and short upper palatal plica, from the middle of which a distinct callous patch, the lunella, runs to below and to the left, its lower end united with a lower palatal plica that descends inward to the left side and is visible through the shell just above the top of the sinulus ; often the lunella is connected with this plica in such a way that the plica is only the protruding part of the lunella. The strongly curved plate of the clausilium is short and wide, with a little notch at the palatal side near the top ; at the columellar side the plate does not merge regularly into the pedicle, for it is incised there. The dimensions of the plate are : length 2.5, width 2 mm.
Length of the shells: 20.4 to 26.4 mm, diam. 4.8 to 5.9 mm ; aperture : height 4.6 to 5.9 mm, width 3.0 to 3.9 mm. About 50 specimens were studied. The ventrosity l/d is 3.9 to 4.9, the average is 4.4.

Smith (1896a) recorded : "anfractus 10. Longit. 24, diam. fere 6 mm.". He quoted specimens of 23—25 mm length and diam. 5 and 6 mm. The holotype and some paratypes are in the British Museum (Nat. Hist.) (B.M.L. no. 94.4.30.2—8, 6), where I could study them.
Dimensions of the holotype (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
24.0	5.7	5.3	3.8	10
and of the 5 paratypes:				
20.4—25.0	4.8—5.8	4.7—5.3	3.1—3.7	10—10½
averages: 23.0	5.3	4.9	3.4	

In the original description SMITH (1896a) did not mention the peculiarities of the inferior lamella nor the presence of a lower palatal plica. The fragile horn-coloured shells were already known to him. As he stated, the shells often have a decomposed surface; especially along the suture they are often worn away and have a chalky appearance.

VON MOELLENDORFF (1896) brought the species to *Hemiphaedusa* because of the "rather narrow acuminate clausilium, the ventral strong almost straight lunella and the clearly visible lamella subcolumellaris". Why he wrote of a narrow clausilium is not clear to me. The other characters would allow of another classification than with *Hemiphaedusa* only.

BOETTGER (1899) brought the species to his new section *Paraphaedusa*, where it actually belongs.

EHRMANN, in a paper published by ZILCH (1949), came to the same conclusion.

ANATOMY unknown.

DISTRIBUTION: South Celebes.

Type-locality: Bonthain Peak.

The type-locality is Bonthain Peak, South Celebes, at 5,000 to 6,000 feet, where A. EVERETT collected the species for the first time. In the original publication an altitude of 2,000 feet was also recorded.

VON MOELLLENDORFF (1896) added Bua Kraeng, where FRUHSTORFER found it. BOETTGER (1899) decided to bring this species to *Paraphaedusa* when he studied a specimen from Lompobatang collected by FRUHSTORFER at 3,000 feet.

A specimen from the same locality was also studied by EHRMANN (ZILCH, 1949).

Habitat: The species is only known from a very limited area round Bonthain Peak at altitudes from about 700 to 2000 m. In view of its ventricose form it might be a ground-dwelling species. Nothing, however, is known on its biotope or biology.

Localities. In addition to the original set, I studied the following specimens (the lots only labelled "South Celebes", are not recorded).

South Celebes.

Bua Kraeng, ca 1700 m, leg. H. FRUHSTORFER, 1896 (K.B.I.N., 4; M.H.P., 2 and S.M.F. no. 61167, 3)[1])

	21.2—24.0	4.9—5.5	4.7—5.2	3.2—3.7	10
averages:	23.0	5.3	5.0	3.4	

Horn-coloured, transparent shells are known, both from this locality and from the type-locality (Bonthain Peak).

[1]) vide note on p. 21.

Wawo-Karaeng (N.M.B. no. 2326a), 2). According to P. and F. SARASIN this is the correct name for Bua Kraeng.

23.6	5.8	5.2	3.4	9½
21.9	5.0	4.7	3.2	9½

Lompobatang (= Bonthain Peak), 1000 m, leg. H. FRUHSTORFER, 1898 (S.M.F. no. 61166, 1 and no. 30107, 1)

21.8	5.0	4.9	3.7	9½
22.0	5.0	4.9	3.3	—

Paraphaedusa usitata (SMITH, 1896)

KEY TO THE SUBSPECIES.

1. closing apparatus lateral right, the two plicae palatales diverging outwards ..... South Celebes .....
P. u. usitata (SMITH) (p. 130)

— shell slightly smaller and slenderer than the preceding one, closing apparatus more ventro-lateral, plicae palatales practically parallel ... South Celebes .....
P. u. tjambensis EHRMANN (p. 134)

Paraphaedusa usitata usitata (SMITH, 1896)
(fig. 36)

1896a SMITH, p. 100, pl. 7, f. 27 (*Clausilia usitata*)
1896 VON MOELLENDORFF, p. 147 (*Clausilia* (*Euphaedusa*) *usitata*)
1899 BOETTGER, p. 56 (*Clausilia usitata, Paraphaedusa*)
1915 COOKE, p. 265 (*Paraphaedusa usitata*)
1918 BOLLINGER, p. 334 (*Clausilia* (*Paraphaedusa*) *usitata* part.)
1949 EHRMANN in ZILCH, p. 70 (*Paraphaedusa usitata*)

DESCRIPTION of the material (the holotype included). Shell rather small, turreted fusiform, delicate, reddish- to yellowish-horn-coloured, shining and transparent. Spire rather slender, tapering regularly into the pointed apex, the lateral outlines are usually straight but sometimes they may be faintly concave. Whorls 9—10, rather convex, sculptured with very faint irregular, transverse striae (about 8—10 to the mm on the whorl above the aperture), the striae are more distinct on the neck. Nuclear whorls often a little lighter in colour than the lower whorls; they may sometimes have the drawn-out appearance which is characteristic of *P. subpolita*. Below the shallow suture of the lower whorls a thread may be visible and there is usually a light coloured band. The neck regularly and slowly bends down towards the base of the peristome.
Aperture broadly oval, sometimes nearly quadrangular, whitish to horn-coloured within; the sinulus is rather high and wide, the first because of the distinct angle in the upper peristomal margin in the contact

place with the superior lamella. The base of the peristome recedes distinctly. The peristome is continuous, whitish, slightly widened, scarcely reflexed, the margin is thickened, the upper margin is just clear of the preceding whorl. From the sinulus the outer margin runs rather straight down, whereas the parieto-columellar margin first runs to the right and then also descends rather straight. All these features together cause the sides of the aperture run almost parallel. The base of the peristome is semicircular.

Lamella superior is rather strong, reaching the margin, usually not connected with the lamella spiralis, but there are specimens in which the two lamellae are connected not only by a faint connection, but in which they really merge into each other. Lamella spiralis increases to a maximum height at the right side, then rather quickly decreases to end in a ventral position, just above the sinulus. Lamella inferior is visible in the aperture as a low fold on the columella, not reaching the margin; half way up the visible part of the columella, it increases, its edge at the same time turning inward horizontally; dorsally it attains its utmost height, forming the wing-like structure, typical for *Paraphaedusa*. It gradually decreases and ends about together with the spiral lamella at the ventral side. Lamella subcolumellaris is clearly visible in the aperture, it reaches the margin and turns sharply inward and upward ending a little further inward than the other two lamellae.

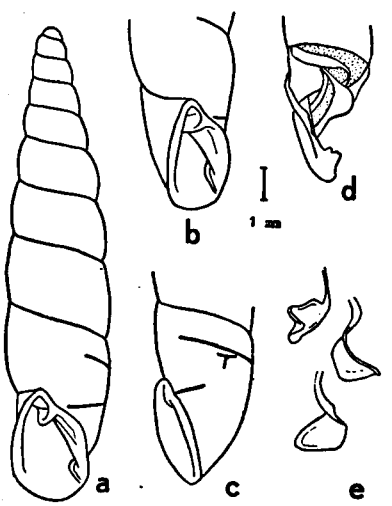

Fig. 36. **Paraphaedusa u. usitata** (SMITH)
Loc. (**a—c**) South Celebes; holotype.
(**d—e**) South Celebes.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell; **d.** dorsolateral-right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium has been removed; **e.** 3 views of the clausilium.

The closing apparatus lies at the right side. Plica palatalis principalis runs from the dorsal to the ventral side; it is $^3/_8$ to $^1/_2$ whorl

long. At the right side we find below it two palatal plicae, an upper plica near and almost parallel to the principalis and a lower one near the right upper angle of the peristome, converging with the first plica towards the outside of the shell. Both plicae may be connected near their outer ends by a lunella-like callosity. The plate of the clausilium is short and wide (especially the lower part is wide and strongly bent), its top is not notched at the palatal side, the columellar side of the plate is incised at the connection with the pedicle, which therefore does not taper regularly into the pedicle, as it does at the right side. Length of the plate 1.8, width 1.3 mm.

Length of the shells: 13.9 to 18.2 mm, diam. 2.9 to 3.9 mm; aperture: height 2.9 to 3.8 mm, width 2.1 to 2.8 mm. About 40 specimens were studied. The ventrosity l/d is 4.0 to 4.9, the average is 4.5.

In the original description the dimensions given are: "Longit. 16, diam. 3—5 mm". Studying the holotype in the British Museum (Nat. Hist.) (B.M.L. no. 96.5.1.5, 1) I noted:

shell		aperture		number of whorls
length	diam.	height	width	
15.8	3.4	3.5	2.6	10

The dimensions of the paratype (B.M.L. no. 96.5.1.6, 1) are:

15.9	3.4	3.3	2.4	10

In his original description SMITH (1896a) did not record the exact place of the closing apparatus, nor the plicae palatales (except the principalis), nor the typical wing-like lobe of the inferior lamella.

In contrast with SMITH, VON MOELLENDORFF (1896) remarked quite rightly that the lunella can hardly be called distinct and is sometimes even almost absent; further he recorded the two palatal plicae besides the principalis. BOETTGER (1899) completely based himself on SMITH's data, when he brought *usitata* to *Paraphaedusa*. On account of the original description BOLLINGER (1918) saw the differences between *usitata* and *subpolita* mainly in the absence or presence of lunella and palatal plicae. He therefore reached the conclusion that we have two species here, which it is hard to distinguish and which occur together in the localities. The species can be distinguished completely, however, by their internal structure. According to BOLLINGER the length of *usitata* varied from 13.6 to 16 mm.

EHRMANN (in ZILCH, 1949) in an accurate description, gave many characters their full advantage. He also noted the dimensions of a number of specimens, the extremes of which are:

13.7—16.5	3.0—3.7	2.8—3.4	2.1—2.6

ANATOMY unknown.

DISTRIBUTION: South Celebes.

Type-locality: South Celebes.

The type-locality is South Celebes, at 2,000 feet, collector A. EVERETT. VON MOELLENDORFF (1896a) mentioned that it was found by FRUHSTOR-

FER together with *P. subpolita* at Bua Kraeng. BOLLINGER (1918) recorded the species from Lamontjong; Tjamba; above Biru, Lamontjong region; Bontario, Lamontjong region and Malawa Spring, north of Bowonglangi. The record of "Tjamba" concerns specimens of the subspecies *tjambensis* (see below).

EHRMANN (in ZILCH, 1949) recorded Wawo-Karaeng (= Bua Kraeng), leg. FRUHSTORFER and the localities already mentioned by BOLLINGER; his Biru specimens come from an altitude of 650 m and measure:

13.7—16.4	3.0—3.5		2.8—3.4	2.1—2.6
averages: 15	3.18		3.1	2.37

His Malawa specimens measure 14—16.1 mm long. The specimens from Tjamba are regarded as a distinct subspecies by EHRMANN: *P. u. tjambensis* (see below).

H a b i t a t. The species was collected at altitudes between 650 and 1700 m. Biotope and biology unknown.

L o c a l i t i e s. In addition to the original set I studied specimens from the following localities:

South Celebes.

Bua Kraeng, about 1700 m, leg. H. FRUHSTORFER, 1896 (K.B.I.N., 4; S.M.F. no. 61168, 6 and Z.M.A., 3)[1])

	14.8—18.2	3.4—3.9	3.3—3.8	2.4—2.8	9—10
averages:	15.9	3.7	3.5	2.5	

Wawo-Karaeng (vide p. 00) (N.M.B. no. 2367f, 3)

15.4	3.7	3.8	2.7	9
15.2	3.6	3.5	2.6	9½
16.4	3.4	3.4	2.7	10

Lompobatang, 1000 m, leg. H. FRUHSTORFER, 1896 (B.M.L. no. 1933.3.1.67, 1 and S.M.F. no. 30109, 1)

15.9	3.7	3.6	2.8	9
15.4	3.7	3.5	2.5	9

Biru, Lamontjong, 650 m, leg. SARASIN (N.M.B. no. 2367a, 4 and S.M.F. no. 30106, 2)

	14.3—15.9	3.0—3.4	2.9—3.3	2.1—2.5	9½—10
averages:	15.1	3.2	3.1	2.3	

Lamontjong (N.M.B. no. 2367b, 2)

15.9	3.2	3.1	2.5	10
14.0	2.9	2.9	2.3	9½

Bontario, Lamontjong (N.M.B. no. 2367c, 4)

14.6	3.1	3.0	2.2	9½
13.9	3.1	3.0	2.3	9
14.2	3.4	3.1	2.3	9
15.3	3.2	3.1	2.3	10

Malawa-Spring, north of Bowonglangi (N.M.B. no. 2367d, 2)

15.6	3.3	3.2	2.4	10
15.3	3.3	3.2	2.4	9½

Along the highway from Makale to Kalossi, near K.M. 5, 700—800 m, leg. Mrs. G. A. TAMMES-BOLT, 1948 (Z.M.A., 1 fragment).

[1]) vide note on p. 21.

Paraphaedusa usitata tjambensis EHRMANN, 1949

1918 BOLLINGER, p. 334 (*Clausilia* (*Paraphaedusa*) *subpolita* part. and *C.* (*P.*) *usitata*, part.)
1949 EHRMANN in ZILCH, p. 74, pl. 4, f. 4 (*Paraphaedusa usitata tjambensis*)

DIAGNOSIS according to EHRMANN (in ZILCH, 1949). The differences with the typical form are: shell slenderer, closing apparatus slightly more ventral and plica palatalis inferior parallel or almost parallel to plica palatalis superior.

Length of the shells: 13.2—16.1 mm, diam. 2.8—3.3 mm; aperture: height 2.7—3.2 mm, width 1.9—2.5 mm. I studied 7 specimens, all paratypes. The ventrosity l/d is 4.3 to 5.3, the average is 4.8.

EHRMANN based his new subspecies on 32 specimens. The dimensions of 12 specimens given by him are summarized as follows:

shell		aperture
length	diam.	height
13.8—16.1	2.9—3.3	2.8—3.2
averages: 14.9	3.1	3.0

The ventrosity, as calculated from his data, is 4.6—5.4, average 4.9.

A lectotype was indicated by Dr. L. FORCART (N.M.B. no. 5249a) and figured by ZILCH (1949); according to kind information of Dr. FORCART the dimensions are:

15.2 3 3.2 2.2 and 12 whorls.

I studied 7 specimens (paratypes) of this subspecies. The differences from *usitata* proper are such that I would not have established a new subspecies on this material. But as I have only seen 7 specimens and EHRMANN saw 32, I defer to his authority in this matter.

ANATOMY unknown.

DISTRIBUTION: South Celebes.

Type-locality: Tjamba.

The subspecies is only known from the type-locality, Tjamba, near Makassar, where it was collected by P. and F. SARASIN. Before EHRMANN studied these shells, BOLLINGER reported on them, partly under the name *usitata* and partly under the name *subpolita* (3 specimens).

Habitat and biology unknown.

The 7 shells (all paratypes of this subspecies (N.M.B., 2367e, 6 and S.M.F. no. 30108,1) [1]) studied by me measured:

13.2—16.0	2.8—3.2	2.7—3.2	1.9—2.5	9—10½
averages: 14.4	3.0	3.0	2.1	

Paraphaedusa bonthainensis (P. & F. SARASIN, 1899)
(fig. 37)

1899 SARASIN, p. 218, pl. 26, f. 265—266 (*Clausilia bonthainensis*)
1899 SYKES, p. 86 (*Clausilia bouthainensis* (sic))
1915 COOKE, p. 265 (*Euphaedusa bonthainensis*)
1949 EHRMANN in ZILCH, p. 76, pl. 4, f. 6—9 (*Paraphaedusa bonthainensis*)

[1]) vide note on p. 21.

DESCRIPTION of the material. Shell small, fusiform, rather solid, the lower whorls violet-chestnut-brown, the upper ones and especially the top whorls more cream-coloured, shining, transparent. Spire rather slender, with straight lateral outlines. Whorls 9½—10, rather convex, smooth, with faint irregular growth-lines, which are only visible as distinct striae on the last whorl, especially on the neck. The nuclear whorls are smooth and cream-coloured, just like the band that runs below the shallow suture on each whorl. The apex is rather pointed, the nuclear whorls are often connected with the lower whorls by means of a "drawn-out" whorl, which is less completely enclosed by the next whorl than usual, the same as in *P. subpolita*. The penultimate whorl sometimes has a "hammered" appearance ventrally. This is always the case with the last whorl. The neck slowly runs down towards the base of the peristome.

Aperture ear-shaped, almost trapezoid, fairly large in comparison to the shell, the sinulus is not very broad and not high. The peristome is whitish, thickened, hardly widened or reflexed. The upper margin is connected with or only just clear of the preceding whorl, it has a slight angle where it is touched by the superior lamella. From the sinulus the outer margin runs downward in a faint and regular curve. The parieto-columellar margin first slowly descends to the right side and then gradually bends down. Both sides of the aperture are more or less parallel; the base of the peristome is semicircular.

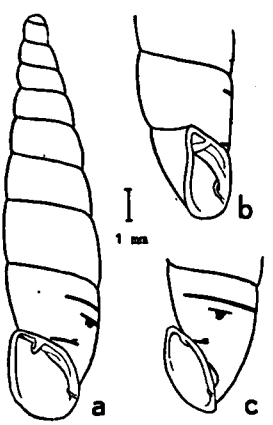

Fig. 37. **Paraphaedusa bonthainensis** (P. & F. SARASIN)
Loc. South Celebes, Bonthain Peak; paratype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

Lamella superior thin and rather high, reaching the margin, ending at the central side of the spiral lamella. The outer end of the lamella spiralis is rather low and thin, it runs at the sutural side along the end of the superior lamella and bends towards the superior lamella, touching it at the right side. Internally the lamella spiralis ends ventrolaterally at the left side. Lamella inferior is visible in the aperture as a low cordlike fold on the columella, not extending to the margin; more than halfway up the columella it bends spirally inward, increasing in

height at the same time (according to EHRMANN) until it forms a high obtuse-triangular plate, which pretty well exactly points to the right and does not lean over. Inwards this "wing" rapidly decreases in height until it forms a thread-like fold, the end of which remains behind the end of the spiral lamella. Lamella subcolumellaris ends close to the margin. The closing apparatus lies ventrolaterally at the right side. The plica palatalis principalis runs from laterodorsal to lateroventral at the right side, so it is not more than ¼ whorl long. Straight underneath and near the principalis lies a short upper palatal plica, which is connected with a short lower palatal plica by a lunella-like callous patch. This callous patch is weakest in the middle of the whorl; the lower plica lies near the right upper angle of the peristome. According to EHRMANN the plate of the clausilium is short and broad. Downwards the palatal edge shows a wing-like widening, then grows rapidly narrower towards the top and has a light notch before the top. Normally this notch rests on the lowest palatal plica. The columellar edge is straight but notched near the transition to the pedicle.

Length of the shells: 13.7 to 15.1 mm, diam. 3.2 to 3.3 mm; aperture: height 2.9 to 3.3 mm, width 2.1 to 2.3 mm. I only studied 3 specimens. The ventrosity l/d = 4.2 to 4.7, the average is 4.4.

The dimensions given by P. & F. SARASIN are:

shell		aperture		number of whorls
length	diam.	height	width	
16.5	3.5	3.5	2.5	11
15.5	3.25	3.5	2.25	—
15.5	3	3.5	2.25	—

Only the original set of this species is known, it is preserved in the Basel Museum (N.M.B. no. 2324). EHRMANN (in ZILCH, 1949) studied 4 of them and recorded:

14.8	3.3	3.3	3.2 (err. typ. ?)
14.8	3.3	3.2	2.2
13.7	3.3	3.1	2.2
15.1	3.3	3.2	2.3

A lectotype was indicated by Dr. L. FORCART (N.M.B. no. 2324a) and figured by ZILCH (1949); according to kind information of Dr. FORCART the dimensions are:

15.2	3.3	3.3	2.3 and 10 whorls.

The original description (1899) shows many shortcomings, as so many descriptions written in those times do. EHRMANN gave a new one, which needs no comment.

SYKES (1899) thought this species to be conspecific with his *Clausilia pyrrha*. This is absolutely incorrect. I compared paratypes (formerly syntypes) of the one species with the holotype of the other (compare the descriptions on p. 135 and p. 142).

ANATOMY unknown.

DISTRIBUTION : South Celebes.
Type-locality: Bonthain Peak.
P. & F. SARASIN (1899) collected this fine species on the Peak of Bonthain (Lompobatang) at ca 2000 m under decaying trunks.
The dimensions of the paratypes I saw are :

13.8	3.3	2.9	2.1	9½
14.9	3.2	3.2	2.1	9½
13.8	3.3	3.0	2.1	9½

Habitat. Under decaying trunks at ca 2000 m. Biology unknown.

Paraphaedusa minahassae (P. & F. SARASIN, 1899)
(fig. 38)

1899 SARASIN, p. 218, pl. 26, f. 267—268 (*Clausilia minahassae*)
1915 COOKE, p. 265 (*Euphaedusa minahassae*)
1949 EHRMANN in ZILCH, p. 77, pl. 4, f. 10 (*Paraphaedusa minahassae*)

DESCRIPTION of the material. Shell turreted fusiform, fragile, yellowish-horn-coloured, only the top whorls are almost colourless, shining brightly, transparent. Spire slender, tapering regularly into the rather small apex, with straight lateral outlines. Whorls 9½—10½, rather convex, smooth, the growth-lines are only weak and they are not distinctly stronger on the neck. The nuclear whorls are narrow, they are attached to the lower ones by a whorl that has a peculiar drawn-out appearance. The apex is placed on the lower whorls a little obliquely, there may be a faint thread running along the rather deep suture. The neck runs slowly down towards the base of the peristome.
Aperture ear-shaped, almost trapezoid, rather large, vertical, the sinulus is not very wide and not high. The peristome is yellowish, more or less thickened, not reflexed, scarcely widened. The upper margin is adnate or only just clear of the preceding whorl ; it has a slight angle where it is touched by the superior lamella. From the sinulus the outer margin descends almost straight, whereas the parieto-columellar margin first runs more or less horizontally to the right side and then descends almost straight, parallel to the left margin. The base of the peristome is semicircular.
Lamella superior low and thin, reaching the margin, rather long, internally closer to the columella than the lamella spiralis and not connected with the latter. Lamella spiralis is hardly or not visible through the aperture. According to EHRMANN (in ZILCH, 1949) it ends ventrolaterally at the left side. The lower end of the inferior lamella is visible in the aperture as a low fold on the columella, touching the margin ; halfway up the columella it turns inward and upward, at the same time increasing so much that its edge enters the shell horizontally. According to EHRMANN it develops in the mean time rapidly into a high, straight triangular plate, pointing towards the dorsal side and a little towards the right side. Inwards this wing suddenly becomes low, thread-like and ends together with the spiral lamella. Lamella subcolumellaris

ends on the margin of the peristome, while its inner end lies beyond that of lamella inferior.

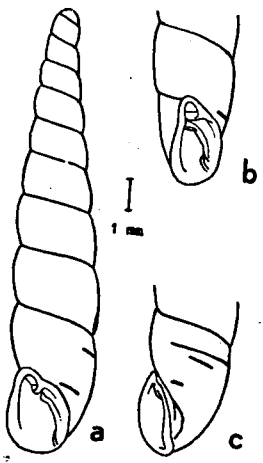

Fig. 38. **Paraphaedusa minahassae** (P. & F. SARASIN)
Loc. Northern Celebes, Mount Klabat ; paratypes.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies a little ventrally from the right side. The plica palatalis principalis runs from the dorsal side to half way between the right side and the ventral side and is 3/8 whorl long. Below it is a short upper palatal plica and above the right upper angle of the peristome is a short lower palatal plica, both of which run practically parallel to the principalis. There is no distinct lunella-like callus. According to EHRMANN the plate of the clausilium looks like a shallow gutter, trapezoid, wide, but the wing-like broadening of the lower part of the palatal edge is, just like the notch near the top, much weaker than in the related species. The notch at the columellar side near the pedicle is distinct.

Length of the shells: 13.6 to 15.3 mm, diam. 2.8 to 3.1 mm; aperture : height 2.6 to 3.0 mm, width 1.7 to 2.1 mm. Three specimens were studied. The ventrosity l/d is 4.9 to 5.4, the average is 5.2.

P. & F. SARASIN (1899) recorded in the original publication :

shell		aperture		number of whorls
length	diam.	height	width	10—11
15.5	3	3	2	—
15	3	3	2	—
14.75	2.75	2.75	2	—

The original set is in the Basel Museum (N.M.B. no. 2325a). EHRMANN (in ZILCH, 1949) who studied 5 of them, recorded :

	15.0—15.3	2.8—3.1	2.8—3.0	1.9—2
averages :	15.1	2.9	2.9	2

A lectotype was indicated by Dr. L. FORCART (N.M.B. no. 2325a) and

figured by ZILCH (1949); according to kind information of Dr. FORCART the dimensions are:

15	3	3.2	1.9	and 10 whorls

The original description (P. & F. SARASIN, 1899) was corrected and completed by EHRMANN in his excellent way. SYKES (1899) wondered whether this species might be identical with his species *makassarensis*, but this is definitely not the case, cf. my descriptions.

ANATOMY unknown.

DISTRIBUTION: Northern Celebes.
Type-locality: Klabat Volcano.
P. & F. SARASIN (1899) collected the species on Klabat Volcano, at 1500 m alt., under mosses on tree trunks; this is the typelocality. They also found it on Soputan Volcano, at 1150 m alt. and on the summit of Mount Lokon. As has been mentioned before, EHRMANN studied syntypes from Klabat Volcano, but he also saw two specimens from Soputan Volcano. For these specimens he gave the following dimensions:

13.8	2.8	2.8	1.8
13.6	2.9	2.6	1.8

Localities: I only saw three paratypes from Klabat Volcano. Their dimensions (in mm) are:

13.9	2.8	2.7	1.7	10
15.0	2.8	2.7	2.0	10½
15.1	2.9	2.9	2.1	10½

Habitat. Only the specimens collected by Messrs SARASIN are known. They were found at 1150—1500 m alt., under mosses on tree trunks.

Paraphaedusa makassarensis (SYKES, 1897)
(fig. 39)

1897 SYKES, p. 23, pl. 4, f. 4—6 (*Clausilia makassarensis*)
1915 COOKE, p. 265 (*Euphaedusa makassarensis*)
1949 EHRMANN in ZILCH, p. 79, pl. 4, f. 11 (*Paraphaedusa makassarensis*)

DESCRIPTION of the material (the holotype included). Shell small, fusiform, rather solid, brown-horn-coloured, not very glossy, not transparent. Spire slender, with usually straight lateral outlines. Whorls 8½ to 10, rather convex, sculptured with numerous distinct, fine, parallel, transverse striae (about 15 to the mm on the whorl above the aperture) which are not coarser or wider apart on the last whorl. The nuclear whorls are smooth and light-coloured, they have a narrow apex and they sometimes form a little cylinder, which may merge into the lower whorls more or less abruptly. In the last case the outlines may be slightly concave. The nuclear whorls are sometimes attached to the lower ones a little obliquely. The third whorl may have the drawn-out appearance

known of *subpolita*. The lower whorls may have a light-coloured band below the rather deep suture. The neck runs down slowly towards the base of the peristome ; it is flat.

Aperture ear-shaped, almost quadrangular, yellowish-brown within ; the sinulus is rather wide and high. The base of the aperture and the sinulus recede a little. The peristome is yellowish-white, widened, slightly reflexed and thickened. The upper margin is scarcely clear of the preceding whorl, it has a distinct angle where it is touched by the superior lamella, whence the sinulus is rather high. From the sinulus the outer margin runs down in a regular curve ; the parieto-columellar margin runs to the right almost horizontally and then bends down abruptly, descending straight. The base of the aperture is semicircular.

Lamella superior rather strong, reaching the margin ; its inner end points more or less to the right ; it is either connected with the spiral lamella, forming an angle, as the lamella spiralis runs more at the side of the suture, or the end of the lamella is clear. In the last case the spiral lamella may bend to the right to touch the lamella superior at its left side near the end or the two lamellae may not be connected at all. Lamella spiralis slowly increases, being highest on the ventro-lateral-right side ; it ends slightly to the left of the ventral side, about together with lamella inferior. Lamella inferior is visible in the aperture as a thickened edge on the columella. It does not reach the margin. Half way up the visible part of the columella it increases rapidly, bending inward and upward at the same time. The edge is almost horizontal,

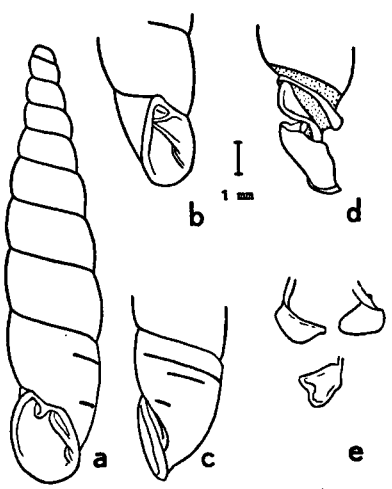

Fig. 39. **Paraphaedusa makassarensis** (SYKES)
Loc. (**a—c**) South Celebes, between Maros and Tjamba near Makassar ; holotype.
(**d—e**) South Celebes.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** right side of the last whorl with the plicae seen through the shell ; **d.** dorsal side of the last whorl. the palatal wall has been broken away to show the inner structure of the shell, the clausilium has been removed ; **e.** 3 views of the clausilium.

when it disappears into the shell. In a dorsal position it attains its greatest height, forming the wing-like structure ; it decreases again to become a low fold on the right side near the clausilium and ends ventrally. Looking from below into the aperture one can hardly see the base of the inferior lamella. Lamella subcolumellaris reaches the margin and ends inward near the left side beyond the other two lamellae.

The closing apparatus lies at the right side. The plica palatalis principalis runs from dorsal to lateroventral-right and is about 3/8 whorl long. Below it are a short upper and lower palatal plica, almost parallel, the first lying near the principalis, the second above the right upper angle of the peristome. These two plicae may be connected by a callous lunella-like patch, but this is not a rule. The strongly curved plate of the clausilium is slightly triangular, broad below ; it is not distinctly notched at the palatal side. The columellar side of the plate is incised near the pedicle ; its dimensions are : length 1.7, width 1.2 mm.

Length of the shells: 12.5 to 15.8 mm, diam. 2.9 to 3.3 mm ; aperture : height 2.8 to 3.3 mm, width 1.9 to 2.4 mm. I studied 25 specimens. The ventrosity l/d is 4.2 to 5.1, the average is 4.6.

The dimensions given by SYKES (1897) are : "Anfr. 9, alt. 13.7, lat. 3 mill., alt. apert. 2.8, lat. apert. 2 mill."

I had the opportunity to study SYKES's types in the British Museum (Nat. Hist.). The dimensions of the holotype (B.M.L. no. 1930. 1.21.16, 1) are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
13.9	3.0	2.8	2.1	9½
and of the paratypes (B.M.L. no. 97.7.30.25—26, 2)				
13.8	3.1	3.2	2.3	9
14.2	3.1	3.1	2.3	9½

SYKES's description (1897) is not very complete, e.g. he did not study the inner structure of the shell. According to him the subcolumellar lamella is "subconspicua" ; in reality, however, it runs to the margin of the peristome in all the specimens of the original set.

EHRMANN (in ZILCH, 1949) included *makassarensis* in the genus *Paraphaedusa*. His description of the inner structure of the shells is complete.

ANATOMY unknown.

DISTRIBUTION : South Celebes.

Type-locality: between Maros and Tjamba.

The type-specimens were collected by W. DOHERTY between Maros and Tjamba, near Makassar. The two specimens studied by EHRMANN came from the same locality. They measured :

14.7	3.2	3.1	2.3
14.3	3	3.1	2.4

Habitat and biology unknown.

Localities. Besides the holotype and paratypes quoted before, I studied the specimens mentioned below. Specimens labelled "South Celebes" only, are not recorded here.

South Celebes.
Between Maros and Tjamba near Makassar (S.M.F. no. 30105, 2 and no. 61172, 2). The first two are from EHRMANN's collection and were used as a basis for his description. Their dimensions have already been given. Those of the other two shells are:

15.4	3.0	3.2	2.3	10
15.3	3.0	3.3	2.3	10

Makassar; the samples with this indication were either obtained from FULTON or the source was not mentioned. As the types also came from FULTON like the other specimens from Maros and Tjamba, the indication Makassar may denote the same locality (K.B.I. N., 2 obtained from FULTON in 1897 !; M.H.P., 2; U.S.N.M. no. 428660, 2; B.M.L. no. 1915.12.31.22—24, 2; P. BOHNY collection, 2 and F. E. LOOSJES collection, 2)

	12.5—15.8	2.9—3.3	2.8—3.3	1.9—2.4	8½—10
averages:	14.1	3.1	3.1	2.2	

Paraphaedusa pyrrha (SYKES, 1897)
(fig. 40)

1897 SYKES, p. 23, pl. 4, f. 1—2 (*Clausilia pyrrha*)
1899 SYKES, p. 86 (*Clausilia pyrrha*)
1915 COOKE, p. 265 (*Euphaedusa pyrrha*)
1949 EHRMANN in ZILCH, p. 80 (*Paraphaedusa pyrrha*)

REDESCRIPTION of the holotype, the only specimen known. Shell small, fusiform, rather solid, reddish-horn-brown, slightly glossy, semitransparent. Spire slender, with rather straight lateral outlines. Whorls 10, rather convex, sculptured with fine fading striae, which are hardly coarser on the neck. Nuclear whorls not very wide, smooth, lighter in colour than the lower whorls; they are attached to the lower whorls a little obliquely by a whorl with a somewhat drawn-out appearance; a thread along the shallow suture is hardly visible. The neck is distinctly bent down towards the base of the peristome.
The aperture is ovate, reddish-horn-coloured within, ear-shaped, sinulus rather high and wide, receding a little, as does the base of the peristome. The peristome is whitish, thickened, only slightly reflexed; its upper margin is only just clear of the preceding whorl, it has a distinct angle where it touches lamella superior. From the sinulus the outer margin is bent down regularly and distinctly, while the parieto-columellar margin first runs to the right, while slowly descending, it then turns down, still running a little to the right. The base of the peristome is semicircular.
Lamella superior is rather high, it reaches the margin, the inner end is clear. The spiral lamella runs at the left (sutural) side of it, bends towards it and touches it in its course. Lamella inferior is visible in the aperture as a low cord on the columella, the outer end hardly reaches the margin. Its edge turns inward spirally, almost horizontally, as it increases very quickly. Lamella subcolumellaris reaches the margin. As the holotype is the only specimen known, the inner structure could not be studied because I did not want to do damage to the shell.
The closing apparatus lies a little ventrally from the right side. The principal plica runs from the dorsal side to half way between

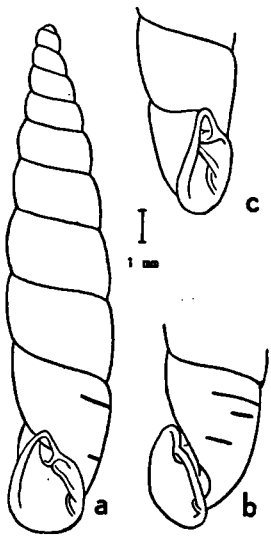

Fig. 40. **Paraphaedusa pyrrha** (SYKES)
Loc. South Celebes, between Maros and Tjamba near Makassar; holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

the right and the ventral side. Below and parallel to it are two rather small plicae, the upper one lying almost laterally near the principalis, the lower one lying on the right side of the right upper angle of the peristome. A callous lunella-like patch is not visible through the shell. The clausilium is not known.

Dimensions recorded by SYKES (1897):

shell		aperture		number of whorls
length	diam.	height	width	
17	3.3	3.3	2.25	9½—10

I studied the holotype in the British Museum (Nat. Hist.) (B.M.L. no. 1930, 1.21.10, 1) and noted:

17.2	3.3	3.3	2.4	10

The original description is not sufficient to recognize the species among the other *Paraphaedusae*. EHRMANN (in ZILCH, 1949), who did not see the specimen, gave a new and really better description, only by confronting the first description with those of other Paraphaedusoid species.

SYKES (1899) presumed *pyrrha* to be synonymous with *P. bonthainensis*, but this is certainly not true.

To my opinion the shell ought to be placed near the species *makassarensis*. It may be a big, slightly different form of the latter. A study of the inner structure of the shell might elucidate its relations, but it is not advisable to break the only specimen. More material may clear this up.

ANATOMY unknown.

DISTRIBUTION : South Celebes.
Type-locality: between Maros and Tjamba.
The type was collected by DOHERTY, between Maros and Tjamba, near Makassar, perhaps together with *makassarensis* SYKES.
Habitat and biology unknown.

Paraphaedusa schwaneri (VON MARTENS, 1867)
(fig. 41)

1867 VON MARTENS, p. 382 (*Clausilia Schwaneri*)
1868 PFEIFFER, p. 468 (*Clausilia Schwaneri*)
1889 BOETTGER in ALDRICH, p. 26, pl. 3, f. 4 (*Clausilia* (*Euphaedusa*) *dohertyi*)
1892 COOKE, p. 468 (*Clausilia schwaneri* and *C. dohertyi*)
1899 FULTON, p. 212 (*Clausilia Dohertyi*)
1908 VON MARTENS, p. 287 (*Clausilia schwaneri*)
1915 COOKE, p. 265 (*Formosana schwaneri* and *Euphaedusa dohertyi*)
1949 EHRMANN in ZILCH, p. 75, pl. 4, f. 5 (*Paraphaedusa dohertyi*).

DESCRIPTION of the material. Shell small, turreted fusiform, rather solid, reddish-brown, horn-coloured, glossy, transparent. Spire rather slender, usually with straight lateral outlines. Whorls 9 to 10, rather convex, almost smooth, fine growth-lines may be visible near the suture, distinct striae are only present on the last whorl near the aperture. The nuclear whorls are rather narrow, they sometimes form a little cylindric apex. They are often cream-coloured, as is also a narrow band on every whorl along the rather deep suture. The last whorl is rather flat dorsally, compared to the preceding whorl, which is distinctly swollen. The neck is very slowly and regularly bent towards the base of the aperture.
The aperture is pear-shaped, triangular, yellowish within. It has a somewhat pointed sinulus, which is not very high. The base of the peristome recedes from the vertical plane. The peristome is whitish, thickened, not reflexed, its upper margin is, at the top of the sinulus, scarcely clear of the preceding whorl. Usually the upper margin is faintly incised in the place where it is in contact with the superior lamella ; there may be a distinct, rather broad incision in some cases, however. From the sinulus the outer margin bends down regularly and distinctly, whereas the parieto-columellar margin usually runs to the right while slowly descending. The base of the peristome is semi-circular.
Lamella superior is strong, reaching the margin, it is continuous with the spiral lamella or only just clear of it. The spiral lamella gradually increases to be highest in a lateral right position, than it decreases rapidly to end at the ventral side, almost together with the two other lamellae. Lamella inferior is visible in the aperture as a low fold on the columella, its outer end reaches the margin. At ¾ of the visible part of the columella the inferior lamella increases rapidly, its thickened edge turning inward almost horizontally. In a dorsal position it is highest, forming the wing-like structure characteristic for *Paraphaedusa*, which has a regularly rounded top. The lamella inferior decreases rapidly, ending at the ventral side. Lamella subcolumellaris reaches the margin,

the inner end may run a little beyond the ends of the other two lamellae.

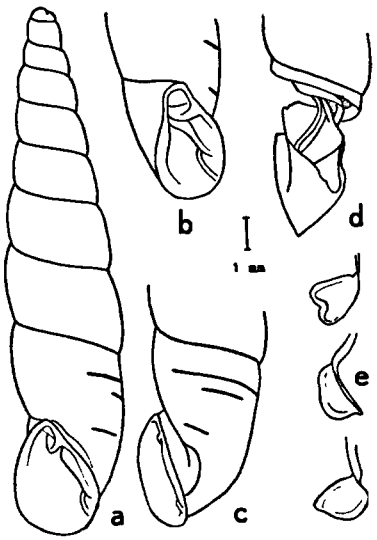

Fig. 41. **Paraphaedusa schwaneri** (VON MARTENS)
Loc. (**a**—**c**) South-Eastern Borneo ; holotype of dohertyi Boettger.
(**d**—**e**) South-Eastern Borneo.
a. ventral side of the shell ; **b.** ventrolateral-left side of the last whorl ; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell ; **d.** dorsolateral-right side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium has been removed ; **e.** 3 views of the clausilium.

The closing apparatus lies at the right side or a little ventrally from it. The plica palatalis principalis runs from dorsal to latero-ventral, it is about 3/8 whorl long. Below it are two rather short palatal plicae, the upper one near the principalis, diverging from it ; the lower one above the closed umbilical slit runs more or less parallel to the principalis ; both plicae are connected at their outer ends by a faint or distinct callous lunella-like patch. The plate of the clausilium is triangular, widest near the apex ; there it is also most distinctly curved ; it is not incised at the palatal side of the apex, it has therefore no palatal lobe. It has a distinct angle at the columellar side, where it merges into the pedicle.
The dimensions of the plate are : length 1.9, width 1.4 mm.
Length of the shells : 14.8 to 18.9 mm, diam. 3.2 to 4.2 mm ; aperture : height 3.2 to 4.0 mm, width 2.1 to 2.9 mm. I studied 35 specimens, among which were authentic specimens of *schwaneri* as well as of *dohertyi*. The ventrosity of the shells l/d = 4.2 to 5.1, the average is 4.6.

The dimensions given by VON MARTENS (1867) are :

shell		aperture		number of whorls
length	diam.	height	width	
18½	4½	4½	3	10—11

Specimens of the original set are in the Berlin and in the Leyden Museum. The dimensions are, according to Dr. S. JAECKEL, who kindly measured the Berlin shells for me:

16.5	4.0	3.5	2.5
17.5	3.5	4.0	2.5
18.5	4	4.0	2.5

(the last-mentioned may be the holotype),
and of the Leyden set, according to my measuring:

16.4	3.8	3.5	2.4	10
16.5	3.9	3.5	2.4	10
16.7	3.7	3.8	2.6	9
16.2	3.7	3.6	2.6	9½
17.2	3.9	3.6	2.7	—

VON MARTENS (1867) described: "*Clausilia Schwaneri* HERKLOTS" without indicating whether the name only or the description as well were due to HERKLOTS. Lateron HERKLOTS and VON MARTENS were alternately regarded as the author. As long as there is no proof, however, that the description is really HERKLOTS's VON MARTENS must be regarded as the author.

In the original description VON MARTENS (1867) mentioned only one plica palatalis, the principalis. The dimensions given by him are rather high when compared with mine. PFEIFFER (1868) only quoted VON MARTENS's description.

BOETTGER (in ALDRICH, 1889) gave a much more extensive description of the species under the name *dohertyi*. He noted the following dimensions:

17	3¾	3¾	2¾	9½

Both he and VON MARTENS recorded external resemblance with *Eu. cumingiana* PFR.

EHRMANN (in ZILCH, 1949) gave an excellent description of *P. dohertyi*, also of the inner structure. He noted the following dimensions:

16.5	3.5	3.6	2.7	9½
15.8	3.5	3.5	2.6	
15.3	3.5	3.4	2.5	
17.2	3.7	3.7	2.7	(holotype of *dohertyi*)

He already suggested that *P. schwaneri* and *P. dohertyi* might be synonyms.

ANATOMY unknown.

DISTRIBUTION: Eastern Borneo, Laut Island.
Type-locality: South-Eastern Borneo.

Paraphaedusa schwaneri was collected first by C. A. L. SCHWANER in the south-eastern part of Borneo. BOETTGER (1889) recorded also South-Eastern Borneo for *P. dohertyi*, where it was collected by W. DOHERTY.

FULTON (1899) recorded Pulu Laut at the south-eastern point of Borneo (leg. W. DOHERTY), VON MARTENS (1908) Banjir Massin Mindai and EHRMANN (in ZILCH, 1949) North-Eastern Borneo.

Habitat and biology unknown.
Localities. Shells from the above-mentioned localities were also studied by me.

North-Eastern Borneo (S.M.F. no. 30111, 1)[1])

16.5	3.5	3.6	2.7	9½

South-Eastern Borneo; leg. C. A. L. SCHWANER (R.M.L., 6 and Z.M.A., 3); leg. W. DOHERTY (S.M.F. no. 61164, 1) (this is the type of *dohertyi*) and without indication of collector (K.B.I.N., 1; M.H.P., 3; U.S.N.M. no. 428697, 2; P. BOHNY collection, 2 and F. E. LOOSJES, collection, 6)

	14.8—17.9	3.2—4.0	3.2—4.0	2.1—2.9	9—10
averages:	16.3	3.6	3.5	2.5	

Laut Island, leg. W. DOHERTY (B.M.L. no. 98.2.3.416—418, 3 and B.M.L., 3; S.M.F. no. 61165, 2 and Z.M.A., 2)

	15.8—18.9	3.4—4.2	3.3—4.0	2.4—3.2	9½—10
averages:	17.3	3.8	3.8	2.8	

Genus **ACROPHAEDUSA** O. BOETTGER, 1877

1877 BOETTGER, p. 64
1927 EHRMANN, p. 33

Shell more or less solid, usually horn-coloured; top as a rule cylindric, because the whorls increase in diameter little or not at all at first; as the lower whorls do show an increase in diameter, the spire usually has concave lateral outlines. The number of top-whorls that form the cylinder varies in the different species. Aperture pear-shaped, not trumpet-shaped; lamella superior connected with the spiral lamella; below the plica palatalis principalis are at least 2, usually 3, sometimes 4 palatal plicae, the lowest one of which is always one of the shortest; no lunella. Duct of the receptaculum seminis has an appendix.
Probably all the species lay eggs.
Type-species: *Acrophaedusa cornea* (PHILIPPI), designated by BOETTGER, 1877.

Distribution: Java, Sumatra and Nicobar Islands.

KEY TO THE SPECIES:

1. lamella subcolumellaris is visible on the peristome; at any rate not completely hidden behind the inferior lamella ..... 2.

— lamella subcolumellaris immersed ..... 4.

2. shell fragile, creamy white, horn-coloured with clear papillae along the suture ..... Sumatra ..... **A. thrausta** n.sp. (p. 154)

— shell does not have clear papillae ..... 3.

[1]) vide note on p. 21.

3. shell longer than 19 mm, diameter more than 4 mm. The last whorl short and only slightly narrower than the penultimate whorl; neck swollen, lateral margins of the aperture practically parallel .....
Java ..... **A. orientalis** (PFEIFFER) (p. 157)

— shell shorter than 19 mm, but if the shell is longer than 19 mm and wider than 4 mm, it has a distinctly long, narrow last whorl, which makes the shell definitely fusiform; neck flat .....
Java, Nusa Barung ..... **A. cornea** (PHILIPPI) (p. 149)

4. shell has at least 14 whorls and an extremely long, cylindric, fragile top, consisting of many whorls .....
Java ..... **A. fruhstorferi** (VON MOELLENDORFF) (p. 173)

— shell has no more than 12 whorls and not such a long cylindric top ..... 5.

5. below the principal plica is a distinct, not particularly long upper palatal plica; below that, in the lower half of the whorl are two more plicae of almost equal length; between the upper plica and the next there is a broad space in the middle of the whorl; shell usually brown with a fairly broad top .....
Java ..... **A. nubigena** (VON MOELLENDORFF) (p. 175)

— 3 or 4 plicae are to be found below the principal plica, distributed fairly regularly over the height of the whorl. From the top downwards we note: long, long, short, or when there is a short plica between the two long ones: long, short, long, short; this short fourth plica may reach the same length as the long ones: long, long, long, short; shell violet-brown or horn-coloured ..... 6.

6. shell violet-brown, shining, with fairly broad top, quite solid; spire with straight or even convex lateral outlines; closing apparatus ventrolateral .....
Nicobar Islands ..... **A. wuellerstorfi** (ZELEBOR) (p. 178)

— shell usually yellowish-horn-coloured, glossy, the spire always has distinctly concave lateral outlines; closing apparatus lateral ..... 7.

7. diameter 4.0 mm or less .....
Java ..... **A. schepmani** (VON MOELLENDORFF) (p. 167)

— diameter more than 4.0 mm ..... 8.

8. neck swollen, aperture fairly large and wide .....
Java, Sumatra ..... **A. junghuhni** (PHILIPPI) (p. 161)

— neck flat, aperture fairly small and narrow .....
Sumatra ..... **A. alticola** (VON MARTENS) (p. 171)

Acrophaedusa cornea (PHILIPPI, 1847) (fig. 42, 43)

1846 PFEIFFER, p. 63 (*Clausilia cornea*, nom. nud.)
1847 PHILIPPI in KÜSTER, p. 22, pl. 2, f. 1—4 (*Clausilia cornea*)
1848 PFEIFFER, p. 404 (*Clausilia cornea*)
1849 MOUSSON, p. 41, pl. 4, f. 8 (*Clausilia Moritzii*)
1853 PFEIFFER, p. 590 (*Clausilia Moritzii*)
1855 ADAMS, p. 184 (*Clausilia cornea, Phaedusa*)
1867 VON MARTENS, p. 383 (*Clausilia cornea* and *Clausilia Moritzi*)
1877 BOETTGER, p. 64 (*Clausilia cornea*, sectio *Phaedusa*, group *Acrophaedusa*)
1892 COOKE, p. 468 (*Clausilia cornea* and *Clausilia moritzii*)
1900 JOUSSEAUME, p. 11 (*Clausilia Postcornea*)
1914 LESCHKE, p. 238 (*Phaedusa cornea*), p. 239 (*Phaedusa moritzii*)
1915 COOKE, p. 265 (*Acrophaedusa cornea* and *Pseudonenia heldii*, var. *moritzii*)
1929 VAN BENTHEM JUTTING, p. 81 (*Phaedusa cornea* and *Phaedusa moritzii*)
1941 VAN BENTHEM JUTTING, p. 296 (*Hemiphaedusa* (*Acrophaedusa*) *cornea*, p. 298 (*Phaedusa* (*Pseudonenia*) *moritzi*)

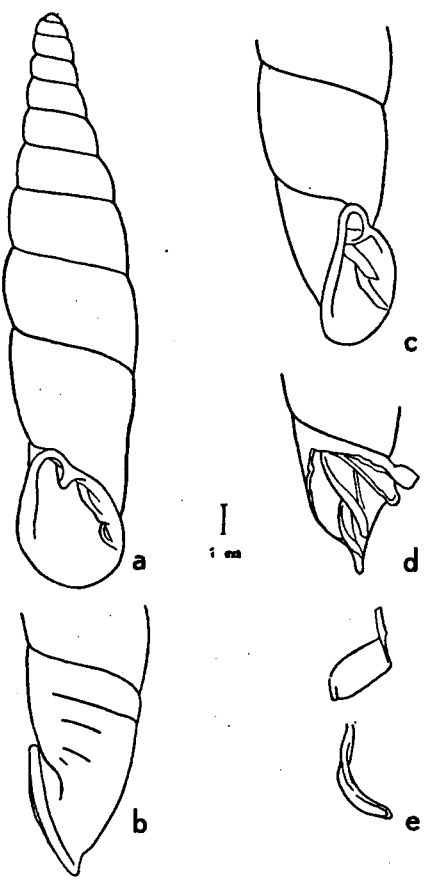

Fig. 42. **Acrophaedusa cornea** (PHILIPPI)
Loc. Java, Mount Gedeh.
a. ventral side of the shell ; **b.** right side of the last whorl with the plicae seen through the shell ; **c.** ventrolateral-left side of the last whorl ; **d.** left side of the last whorl, the outer wall of the aperture has been broken away ; **e.** 2 views of the clausilium.

DESCRIPTION of the material. Shell small or of medium size, fusiform, rather solid, yellowish- to brownish-horn-coloured, glossy, hardly to fairly transparent. Spire slender, with slightly concave lateral outlines. Whorls 9 to 12, rather convex, especially the top ones; sculptured with very fine regular, closely planted transverse striae (about 20 to the mm on the whorl above the aperture), which are only slightly coarser on the neck. There is no thread along the rather deep suture. The nuclear whorls are smooth; they form a cylindric top, sometimes together with a few of the following whorls. The neck is flat; the last whorl is distinctly narrower and higher than the penultimate one.

The aperture is pear-shaped and has a rather high, broad sinulus; the base of the peristome is receding. The peristome is continuous, white, only slightly reflexed and a little thickened. The upper margin is clear of the preceding whorl and shows a distinct angle in the place of the superior lamella. The vertical margins run more or less parallel, the outer one runs down straight or in a faint curve; the parieto-columellar margin descends towards the right in a regular faint curve. The base is semicircular.

Lamella superior distinct, reaching the margin, continuous with the spiral lamella, which ends lateroventrally-left. Lamella inferior low but clearly visible in a front view of the aperture. Starting from the peristome it runs slowly upward and inward, showing a faint curvature near the outer end; from dorsal the height of the inferior lamella decreases slowly and it ends together with the columellar lamella beyond the end of the lamella spiralis on the left side. When looking obliquely from below into the aperture, the inner side of the base of the lamella inferior is hardly visible. Lamella subcolumellaris runs up to the margin of the peristome and ends in the shell on the left side.

The closing apparatus lies at the right side. The principal plica runs from ventrolateral-right to dorsolateral-left and consequently traverses about a half whorl. Below it we usually find 3 plicae palatales, distributed fairly regularly over the height of the whorl; the two upper ones are fairly long, the lowest one is short and may even be absent. Exceptionally a fourth short plica may occur between the two longest, or there may be another very short plica between the principalis and the upper long plica.

The lamella subcolumellaris, finally, runs below the plicae on the palatal side. The plicae are often clearly visible through the shell. The clausilium has a fairly long plate in the shape of a saddle with parallel sides. The top is slightly thickened. On both sides the plate merges regularly into the pedicle. The plate is about 2.4 mm long and 1.3 mm broad.

Length of the shells: 14.5 to 22.4 mm, diam. 3.1 to 4.4 mm; aperture: height 3.4 to 5.2 mm, width 2.2 to 4.0 mm. I studied more than 150 shells. The ventrosity l/d is 4.0 to 5.3, the average is 4.4.

Where the original set is preserved I do not know. The dimensions given by PHILIPPI (in KÜSTER, 1847) are: "Höhe 10¼‴, Breite 2‴".

PHILIPPI's original description was very incomplete, but sufficient to recognize the species. PFEIFFER (1848) gave a completely different description, which certainly does not bear upon *A. cornea*, but I do not know what species he had under observation.

MOUSSON (1849) described *Clausilia moritzi*. I had the opportunity to study the only specimen known of his species and found, in accordance with MOUSSON a very close relationship with *A. cornea* and *A. junghuhni*. As many more specimens of the two last-mentioned species are known nowadays, I was able to fit the specimen into the series of *cornea*. The points of difference mentioned by MOUSSON are all connected by transitions. There are four plicae below the principalis (long, short, long, short), but this also occurs in *cornea*, as was shown above. Consequently I do not see why COOKE (1915) and VAN BENTHEM JUTTING (1941) put *moritzi* with *Pseudonenia*.

VON MARTENS (1867) obviously partly followed the characters which PFEIFFER (1848) used. "Lamella subcolumellaris immersed" e.g. is decidedly incorrect. BOETTGER (1877) used the characters of *A. cornea* as the basis of his group *Acrophaedusa*.

ANATOMY. Up to the present anatomical data were unknown.
The activities of Messrs. A. C. V. VAN BEMMEL and L. J. M. BUTOT, however, supplied me with a number of living specimens. Only those data have been recorded that are of systematic value.

The soft parts of the living animal have a very light colour, almost white, rarely yellowish-grey. The upper tentacles have a black eye-spot. The formula of the radula is: about 95 $\times \frac{1}{3} + \frac{8}{2} + \frac{13}{3-\omega}$, viz. about 95 rows, each consisting of 1 central tooth with 3 cusps, having on each side 8 lateral teeth, each with 2 cusps and 13 marginal teeth with 3 to many cusps.

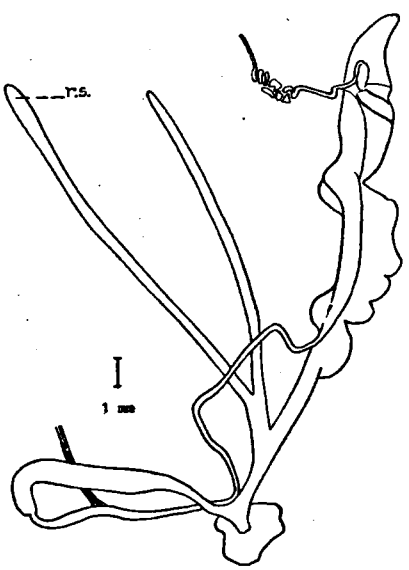

Fig. 43. **Acrophaedusa cornea** (PHILIPPI)
Loc. Java, Mount Gedeh.
reproductive organs (r.s. = receptaculum seminis)

Genital organs. There is an appendix to the duct of the re-

ceptaculum seminis, which is almost as long as the distal part of the duct itself. There are no further appendices. The retractor and the nerve of the left upper tentacle pass between the penis and the vagina. The dimensions (rounded off to mm) of some ducts and organs, measured in a snail with a shell of rather more than 18 mm length and 4 mm diam., are: penis 9 mm, epiphallus as far as the retractor muscle 2 mm, vas deferens measured from the retractor 16 mm, prostate and uterus 12 mm, vagina as far as the orifice of the duct of the receptaculum seminis 3 mm, from there to the uterus 4 mm, duct of the receptaculum seminis as far as the attachment of the appendix 2 mm, from there to the end of the receptaculum 12 mm, length of the appendix 11 mm. The duct of the receptaculum seminis and the appendix lie close to the prostate-gland and the uterus.

Acrophaedusa cornea is oviparous. In a few cases the eggs were found together with the animals and in my petri-dishes eggs were laid several times. The egg-shell is provided with scattered calcareous particles. The contents of an undeveloped egg are of a glassy clearness. The eggs vary from globular to oval. Diameter about 2 mm, e.g. 2.3 by 2.0 and 2.1 by 2.2 mm.

DISTRIBUTION: Java, Madura and Nusa Barung.

Type-locality: Java.

The original set was collected by JUNGHUHN "on mountains in Java" (PHILIPPI in KÜSTER, 1847). I know hardly any further, more exact data in literature. MOUSSON (1849) mentioned Nusa Barung, a small island south of East Java. VAN BENTHEM JUTTING (1929) especially mentioned West Java, later on (1941) she added Pamekasan, Madura Island (leg. P. A. OUWENS).

Habitat: The labels on the material in the museum collections, usually gave little information on the biotope in which the species was found. Only the altitude (1100—1700 m) is regularly mentioned. Once only a specimen was found under fallen bark. Messrs. A. C. V. VAN BEMMEL and L. J. M. BUTOT provided me with exact data on two localities. In both cases the animals were found in a dead tree, the wood of which had become a moist spongy mass. The snails had penetrated very deeply into the wood, in one of the two cases accompanied by specimens of *A. schepmani* and by termites (rajaps). In spite of intensive searches no *Clausiliidae* were found in the neighbourhood of the trees.

Localities. The data of the sets studied by me, as far as the localities were in any way exact, are:

Madura.

Pamekasan, leg. P. A. OUWENS (Z.M.A., 4)[1])

dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
20.9	4.4	5.0	3.4	11
21.9	4.3	5.1	3.5	11
21.9	4.4	5.2	3.7	11½
20.8	4.4	5.3	4.0	11

These are long specimens.

[1]) vide note on p. 21.

Nusa Barung, island south of East Java, leg. H. ZOLLINGER (Zoölogisches Museum der Universität, Zürich, 1). This is the holotype of *moritzi* MOUSSON. MOUSSON (1849) gave the following dimensions:

17.5 4.5

I found

17.2 4.3 4.9 3.3 9

For a *cornea* it is a rather ventricose specimen (l/d = 4.0).

West Java.

Mount Tjikorai, 1700 m, leg. H. FRUHSTORFER, 1891 (N.M.R., 3; S.M.F. no. 61133, 6 and Z.M.A., 4)

	14.5—21.5	3.5—4.3	3.5—4.9	2.3—3.4	9—11
averages:	17.1	3.9	4.1	2.8	

This proves that the shells from this locality are usually small, but fairly ventricose specimens also occur.

Mount Papandajan, Tjibulu near Tjikadjang, 1500 m, leg. W. C. VAN HEURN, 1929 and 1930 (R.M.L., 2)

15.8	3.8	3.6	2.4	10
16.4	3.6	3.8	2.2	10½

These specimens show the same character as those from the last-mentioned locality.

Sukabumi, leg. E. F. JOCHIM (R.M.L. no. 103c, 5 and no. 107a, 4)

	20.0—22.1	4.1—4.5	4.7—5.2	3.3—3.9	10½—11
averages:	20.9	4.3	5.0	3.5	

In size these shells resemble those from Madura, they are long.

District Sukapura, Mount Djampang, south of Sukabumi, 1200 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61136, 2 and no. 61137, 4)

	14.9—17.9	3.1—3.9	3.3—4.2	2.4—2.9	10—11
averages:	16.3	3.4	3.6	2.6	

This shows that only small specimens are known from this locality.

Mount Mandalawangi, north of Mount Guntur, 1100 m, under fallen bark, leg. E. JACOBSON, 1934 (Z.M.A., 1)

21.2 4.0 4.8 3.6 11½

Mount Gedeh, leg. LEDRU, 1898 (K.B.I.N., 25); 1300 m altitude, leg. H. FRUHSTORFER (S.M.F. no. 61110, 1) and without further indication (M.H.P., 2 and K. L. PFEIFFER collection, 2)

	16.6—20.8	3.8—4.4	4.0—5.1	2.7—3.7	10—11½
averages:	19.5	4.2	4.6	3.3	

The following two localities are known in detail, so we are sure that the specimens studied formed two populations. I give the extreme dimensions and the averages for each of the localities apart.

Mount Gedeh, Tjibodas, 1400 m, cleared tropical rain-wood, very moist area, under the bark one of the fallen trees had decayed into a wet pulpy mass, in the outer layers of which the burrows of termites (rajaps) were found; the wood could be squeezed dry like wet cottonwool; under the bark the snails and their eggs were found to a great depth in the pulpy mass. In spite of intensive search no *Clausiliidae* were found in the neighbourhood of the tree. Leg. A. C. V. VAN BEMMEL, H. A. VAN BEMMEL and L. J. M. BUTOT, 1950 (F. E. LOOSJES collection, 13)

	17.7—20.7	4.0—4.4	4.3—5.0	3.1—3.5	9½—11
averages:	19.1	4.2	4.6	3.3	

In size these specimens occupy an intermediate position between the small and the large form. Moreover the shells are not very solid, possibly as a consequence of the way of life. In addition to *A. cornea* some specimens of *A. schepmani* MLLDFF. were found in the tree.

Mount Gedeh, Tjibodas, wood behind the Pasangrahan (resthouse), in a fallen tree-trunk, the wood of which formed a wet pulpy mass, this time without termite-burrows. In the immediate neighbourhood of the tree no *Clausiliidae* were found. Leg. L. J. M.

BUTOT en J. BUTOT-OKKERSEN, 1951 (M.Z.B., 15 + 11 juv. and F. E. LOOSJES collection, 9)

	16.7—20.9	3.9—4.4	4.1—4.9	2.6—3.5	10—11
averages:	19.2	4.1	4.5	3.1	

The dimensions of these specimens show only very little difference with those of the preceding set. Again the shells were very fragile. This time only one species was found in the tree.

These two latter localities show an identical biotope. It seems likely that this is not the normal environment of the species. Probably such a rotting tree offers so many advantages to the animals that those that happen to find it, remain there for the greater part. Particularly eggs and young snails find extremely favourable conditions for their development there, because of the moistness and protection against predators. The fact that the shell remains very fragile, possibly owing to shortage of lime in the food provided by the tree (probably fungi) can apparently not prevent development in this environment. That an intensive search in the immediate surroundings of the two biotopes did not yield more specimens, is no proof that there were no more. If only 2 specimens live in a tree for a year, they may, under favourable conditions, produce a population of more than 20 animals. Therefore the species needs not at all be common in the neighbourhood.

The fact that only small numbers of specimens from each of the localities of most of these tropical species, are found in the collections, supports my idea of their distribution over a wide range, in populations consisting of a few specimens only.

Although the above-mentioned sets, show some differences in size, the structure of the small and the large forms do not differ, while shells of intermediate dimensions occur (Mount Gedeh). BOETTGER regarded the small specimens as a separate variety and named them in manuscript. As, however, it seems likely to me that we have only to do with a non-hereditary variety, caused by local conditions, I prefer not to publish the name given by him.

Acrophaedusa thrausta n.sp.
(fig. 44)

DIAGNOSIS: This species of *Acrophaedusa* differs from the other species of the genus by its fragile, light horn-coloured, very transparent shell, the whorls of which are clearly provided with small papillae along the suture.

DESCRIPTION. Shell small, fusiform, fairly ventricose, fragile, cream- to white-horn-coloured, shining, transparent. Spire rather short, conical, with slightly concave or straight lateral outlines. Whorls 8½ to 9, rather convex, especially the older whorls, sculptured with faint, rather irregular, transverse striae (about 10 to the mm on the whorl above the aperture), which are slightly coarser on the neck. There is a distinct thread below the deep suture. The upper edge of the thread is crenulated or is broken

up into papillae of the colour of the shell. The nuclear whorls are smooth. Above the aperture the last whorl is almost as broad as the preceding whorls and only slightly higher. The neck is rather flat.

Aperture rather large, pear-shaped, the sinulus is wide and high. The base of the peristome and the top of the sinulus recede only very little from the plane in which the peristome lies. The peristome is continuous, whitish, slightly reflexed and thickened, the upper edge is not or only just clear of the preceding whorl and forms a fairly distinct angle in the place where it touches the lamella superior. The outer margin descends from the sinulus in a very faint curve. The parieto-columellar margin first runs to the right, forms a more or less distinct angle there and then descends fairly straight and slightly towards the right. The two vertical edges run practically parallel. The lower edge is semicircular.

Lamella superior low, reaching the margin, continuous with the spiral lamella, which ends at the ventral side above the aperture. Lamella inferior is low and only just visible in a front view of the aperture; it does not reach the margin and ascends steeply into the shell. The inferior lamella ends beyond the end of the spiral lamella on the ventrolateral-left side. When looking obliquely from below into the aperture, the inner side of the base of the lamella inferior is invisible. Lamella subcolumellaris runs as far as the margin; its inner end lies on the left side beyond the ends of the two other lamellae.

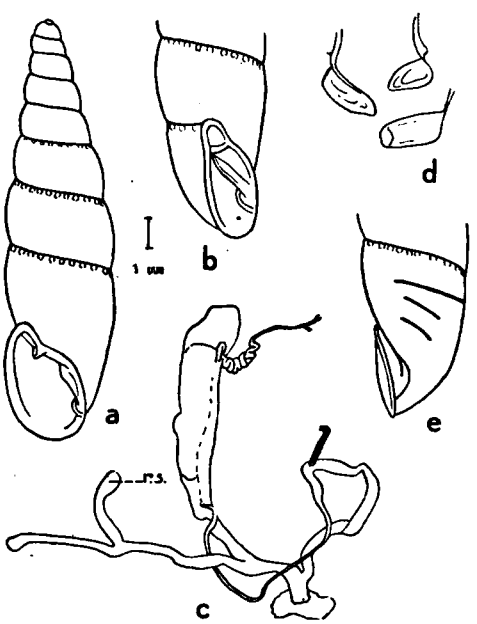

Fig. 44. **Acrophaedusa thrausta** n.sp.
Loc. (**a.**, **b.** and **e.**) Sumatra, Mount Kerintji; holotype.
(**c—d**) Sumatra, Mount Kerintji; paratype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** reproductive organs (r.s. = receptaculum seminis); **d.** 3 views of the clausilium; **e.** right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies at the right side. The principal plica runs from ventrolateral-right to dorsal and so traverses more than ¼ of a whorl. Below it we find two plicae palatales, both about equally long (ca 1 mm) and diverging outwards. Below them follows at quite a distance the subcolumellar lamella, which, like the plicae, is very clearly visible through the shell. The plate of the clausilium is fairly long, tongue-shaped, with parallel sides, and as usually curved in the form of a saddle; its length is 2.2, its width 1.0 mm.
Length of the shells: 12.4 to 15.0 mm, diam. 3.2 to 3.8 mm; aperture: height 3.4 to 4.0 mm, width 2.4 to 3.0 mm. I studied 49 specimens. The ventrosity l/d is 3.4 to 4.2, the average is 3.9.

The holotype is in the authors collection; the dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
14.0	3.6	3.6	2.6	9

The dimensions of the paratypes (J. DRIJVER collection, 10 and F. E. LOOSJES collection, 33):

12.4—15.0	3.3—3.8	3.4—4.0	2.4—3.0	8½—9
averages: 13.7	3.6	3.7	2.7	

ANATOMY. The soft parts of the animal are dirty white, only the eye-spot on the big tentacles is dark-coloured. The formula of the radula is about $85 \times \frac{1}{3} + \frac{7}{2} + \frac{13}{3-\omega}$, viz. about 85 rows, each consisting of one central tooth with 3 cusps, on either side 7 lateral teeth, each with 2 cusps, and 13 marginals with 3 to many cusps.
Genital organs. There is an appendix to the duct of the receptaculum seminis, which is slightly longer than the distal part of the duct itself. There are no further particular appendices. The retractor muscle and the nerve of the left upper tentacle pass between the penis and the vagina.

The dimensions of some ducts and organs, measured in a snail with a shell of almost 15 mm length and 4 mm diam., are: penis 5 mm, epiphallus as far as the retractor muscle 2 mm, vas deferens measured from the attachment of the retractor 10 mm, prostate and uterus 6 mm, vagina as far as the orifice of the duct of the receptaculum seminis 3 mm, from there to the uterus 2 mm, duct of the receptaculum seminis as far as the attachment of the appendix 4 mm, from there to the end of the receptaculum 3 mm, length of the appendix 4 mm. The appendix and the duct of the receptaculum lie close to the prostate and the uterus.

DISTRIBUTION: Sumatra, Padang Highlands, Mount Kerintji.
Type-locality: Mount Kerintji.

The original set was found at the base of Mount Kerintji, Kaju Aru plantation, on a decaying tree-trunk, 1500 m altitude, by Messrs. F. J. J. LOEFF and J. DRIJVER in 1952.
Localities. Besides the original set I saw specimens from Kaju Aru plantation which were found at some km from the type-locality, leg. J. DRIJVER, 1952 (J. DRIJVER collection, 5)

12.8.—14.5	3.2—3.6	3.4—3.7	2.4—2.8	8½—9
averages: 13.6	3.4	3.6	2.6	

Acrophaedusa orientalis (L. PFEIFFER, 1842)
(fig. 45, 46)

1842 PFEIFFER, p. 60 (*Clausilia orientalis*)
1847 KÜSTER, p. 25, pl. 2, f. 17—19 (*Clausilia orientalis*)
1848 PFEIFFER, p. 414 (*Clausilia orientalis*)
1855 ADAMS, p. 184 (*Clausilia orientalis*, subgenus *Phaedusa*)
1867 VON MARTENS, p. 383 (*Clausilia orientalis*, group *Phaedusa*)
1892 COOKE, p. 468 (*Clausilia orientalis*)
1914 LESCHKE, p. 239 (*Phaedusa orientalis*)
1915 COOKE, p. 265 (*Pseudonenia orientalis*)
1934 RENSCH, p. 757 (*Phaedusa* (*Acrophaedusa*) *cornea*)

DESCRIPTION of the material. Shell of medium size, fusiform, moderately solid, yellowish- or greyish-horn-coloured, glossy, rather transpar-

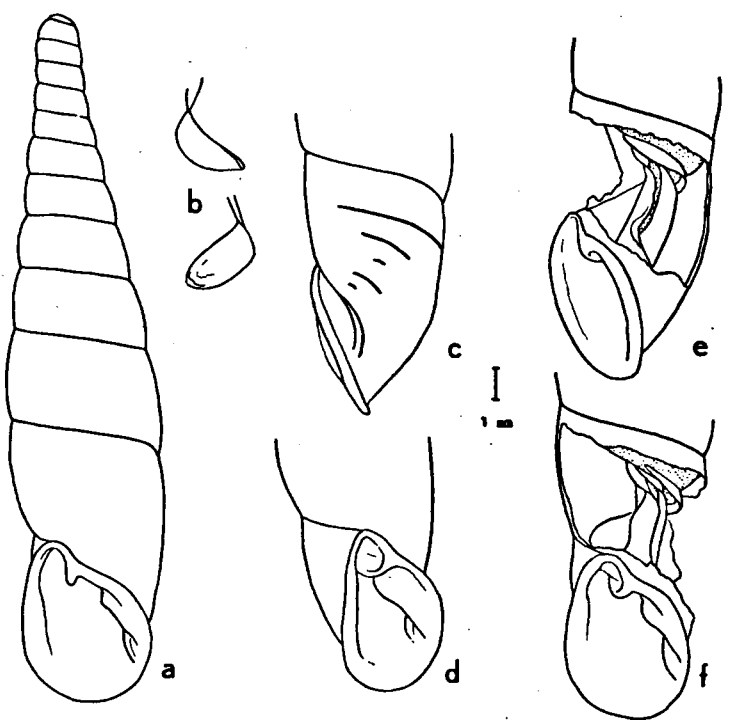

Fig. 45. **Acrophaedusa orientalis** (L. PFEIFFER)
Loc. Java, Mount Gedeh.
a. ventral side of the shell; **b.** 2 views of the clausilium; **c.** right side of the last whorl with the plicae seen through the shell; **d.** ventrolateral-left side of the last whorl; **e.** ventrolateral-right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium has been removed; **f.** ventral side of the last whorl, the palatal wall has been broken away, the clausilium has been removed.

ent. Spire rather slender, with concave lateral outlines. Whorls 11 to 14, rather flat, sculptured with fine, regular, straight, closely-planted, transverse striae (about 25 to 30 to the mm on the whorl above the aperture), which are not any stronger on the neck. There may be a thread along the shallow suture. The nuclear whorls (ca $2\frac{1}{2}$) are smooth. With the 2—3 following whorls they form a cylindric top. The neck is distinctly swollen. The last whorl is strikingly short and almost as broad as the penultimate one.

The aperture is wide pear-shaped, whitish, horn-coloured within and has a broad, high sinulus. The base of the peristome and the sinulus are receding. The peristome is continuous, white, shining, thickened and reflexed. The upper margin is clear of the preceding whorl and usually forms a distinct angle in the place where it is touched by the lamella superior. Usually the vertical sides run parallel, the outer one running down in a regular faint curve, while the parieto-columellar margin runs down towards the right, then forms a more or less distinct angle and finally descends rather steeply. The base of the peristome is semicircular. Lamella superior is rather high, reaching the margin, continuous with the spiral lamella, which ends at the ventral side. Lamella inferior is low and runs upward and inward more or less straight. The columellar edge may be clearly visible in the aperture, in which case it looks as if the inferior lamella is bifurcated towards the inside. There is often a faint concavity close to the end of the inferior lamella near the peristome. Towards the dorsal side the inferior lamella regularly increases in height, then it slowly decreases. Within the shell the end lies on the ventrolateral-left side, just beyond the end of the spiral lamella. When looking obliquely from below into the aperture, the inner curve of the base of the lamella inferior is hardly visible. Lamella subcolumellaris runs as far as the margin and ends in the shell on the left side beyond the two other lamellae.

The closing apparatus lies at the right side. The principal plica runs from the right side to beyond the dorsal side and so traverses more than $\frac{1}{4}$ of a whorl. Below the principal plica we find 3 to 4 palatal plicae. When there are 3, they are from top to bottom: long, long, short. Often a fourth plica occurs between the two long ones, which may vary in size from point-shaped to the length of the two others, viz.: long, short, long, short, or even: long, long, long, short. Below the plicae the lamella subcolumellaris is often visible through the shell. The clausilium has a fairly long, regular plate, curved in the shape of a saddle, with two parallel sides. The top is slightly thickened. On both sides the plate merges regularly into the pedicle and is about 2.4 mm long and 1.1 mm wide.

Length of the shells: 19.2 to 25.3 mm, diam. 4.1 to 5.0 mm; aperture: height 4.5 to 5.9 mm, width 3.0 to 4.3 mm. I studied more than 100 shells. The ventrosity l/d is 4.4 to 5.5, the average is 4.8.

I do not know where the original set is preserved.

PFEIFFER gave the following dimensions: "long 25, diam. 4 mill". In 1848 he mentioned: "longa 25, diam. infra medium $4\frac{1}{3}$ mill. Ap. 5 mill. longa, medio $3\frac{2}{3}$ lata". PFEIFFER (1842) described *"Clausilia orientalis* V. D. BUSCH" without indicating whether only the name was VON

DEM BUSCH 's or the description too. He did record that the specimen came from the collection VON DEM BUSCH. In 1848 he mentioned *Clausilia orientalis* V. D. BUSCH mss., so not V. D. BUSCH in PFEIFFER, besides which he mentioned his own publication separately. Although later on VON DEM BUSCH was always regarded as the author, there is no proof that the description is really from him which is absolutely necessary in order to regard him as the author.

The original publication indicates clearly what species is meant, although PFEIFFER recorded that there were no plicae palatales. In 1848 he recorded: "lunella haud conspicua, neque plica palatalis". KÜSTER (1847) recorded two hardly visible plicae palatales, but for the rest his description is the same as PFEIFFER 's original one. VON MARTENS (1867) observed 3 plicae, of which the central one was the shortest. RENSCH (1934), finally, described a specimen of this species as *A. cornea* PHIL. with 5 plicae palatales. He gives the following dimensions:

22.8 5.4 5.3 — 13¼

The relationship with *A. cornea* is indeed very close. BOETTGER in manuscript considered the species a variety of *A. cornea*. I am, however, not in the least convinced that these two forms belong to the same species and are only due to differences in the environment of the localities. If

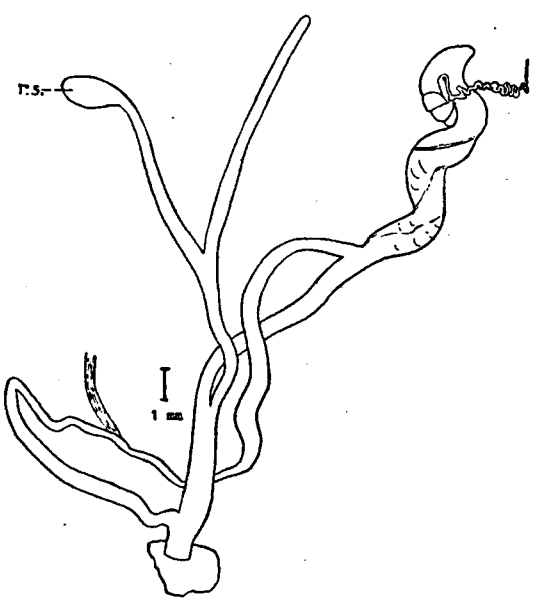

Fig. 46. **Acrophaedusa orientalis** (L. PFEIFFER)
Loc. Java, Mount Gedeh.
Reproductive organs (r.s. = receptaculum seminis).

this should prove to be the case, by the study of a large amount of material from different biotopes, then *orientalis* has priority over *cornea*.

ANATOMY unknown up to now. Messrs. A. C. V. VAN BEMMEL and T.

NEERVOORT provided me with living specimens from which I give those data that are of importance. The soft parts of the living animal are very light-coloured, white to yellowish-grey, the big tentacles with a black eye-spot. The formula of the radula is :

about $94 \times \frac{1}{3} + \frac{8}{2} + \frac{13}{3-5}$. Neither the basal plates, nor the teeth deviate from the normal situation in *Clausiliidae*.

Genital organs: there is an appendix to the duct of the receptaculum seminis. It is as long as, or slightly longer than the distal part of the duct itself. There are no further special appendices. The retractor and the nerve of the left upper tentacle pass between the penis and the vagina. The dimensions of some ducts and organs, measured in a snail of more than 21 mm length and almost 5 mm diameter, are approximately: penis 9 mm, epiphallus as far as the retractor muscle 4 mm, vas deferens measured from the retractor upwards 17 mm, prostate and uterus 9 mm, vagina as far as the orifice of the duct of the receptaculum seminis 5 mm, from there to the uterus 9 mm, duct of the receptaculum seminis as far as the attachment of the appendix 5 mm, from there to the end of the receptaculum 10 mm, length of the appendix 10 mm. The duct of the receptaculum seminis and the appendix lie close to the prostate-gland and the uterus. If we compare *A. orientalis* with *A. cornea* it is a striking fact that in *orientalis* the duct of the receptaculum seminis between the attachment of the appendix and the vagina, is relatively much longer than in *cornea*. Of either species I saw 2 specimens; so this is an argument in favour of the opinion that we actually have to do with two different species.

Acrophaedusa orientalis is oviparous. I found several times eggs in my cultivating-dishes. The diameter of the eggs, which vary in shape from spherical to oviform, is more than 2 mm. I measured e.g. 1.9 by 2.4 and 2.1 by 2.9 mm. The shell of the egg contains numerous isolated particles of calcium.

DISTRIBUTION : West Java.

Type-locality: Java.

The locality given by PFEIFFER (1842) was Java. After him only RENSCH (1934) gave a more exact indication, viz. West Java, Tjibeureum Falls near Tjibodas (1700 m).

Habitat. The animals from Tjibeureum Falls were collected at 1700 m altitude, under stones or fallen leaves, sometimes even in the water. Messrs. A. C. V. VAN BEMMEL and T. NEERVOORT found the snails under projecting stones wetted by the spray of the falls. Mr. L. J. M. BUTOT found a specimen on the ground under leaves of *Zingiberaceae* and grasses on marshy ground. So all this stresses the very great moistness of the biotope.

Localities: Below follow a few data on the material studied by me. Sets for which only "Java" was indicated are not mentioned.

West Java.

Puntjak-pass, near Bogor, wood near Lake Telaga Warna, 1450 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 1) and on decaying bark on the ground, 1500 m, leg. L. J. M. BUTOT, 1947 (F. E. LOOSJES collection, 1)[1])

[1]) vide note on p. 21.

dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
23.0	5.1	5.4	4.2	13
21.4	4.9	5.1	3.1	12

Mount Pangrango near Bogor, in jungle, 1000 m, leg. AURIVILLIUS, 1899 (Naturhistoriska Riksmuseet, Stockholm, 1)

23.4	4.4	5.3	3.7	13

Mount Gedeh, 1300 m, leg. H. FRUHSTORFER, 1892 (Z.M.A., 1); 1000 m, leg. H. FRUHSTORFER 1892 and 1893 (S.M.F. no. 61134, 5; no. 61138, 3 and no. 61139, 6) and in jungle, 1800 m, leg. W. M. DOCTERS VAN LEEUWEN, 1927 (Z.M.A., 1)

	19.9—24.8	4.0—4.7	4.5—5.2	3.1—3.7	11—14
averages:	21.4	4.3	4.8	3.4	

Mount Gedeh, on the verge of the path to the Tjibeureum Falls, on the ground of an area covered with vegetation, under leaves of *Zingiberaceae* and grasses, marshy, leg. L. J. M. BUTOT, 1950 (M.Z.B., 1)

21.7	4.8	5.3	4.0	12½

Mount Gedeh, Tjibeureum Falls, 1700 m, under stone, leg. W. S. S. VAN BENTHEM JUTTING, 1930 (Z.M.A., 1) and id. but without further indication on the biotope, 1931 (Z.M.A., 9); under fallen leaves, more or less in the water, leg. K. L. PFEIFFER, 1939 (Z.M.A., 1 and K. L. PFEIFFER collection, 10); under projecting stones wetted by the spray of the falls, leg. A. C. V. VAN BEMMEL and T. NEERVOORT, 1948 (M.Z.B., 2 and F. E. LOOSJES collection, 32)

	19.8—25.3	4.3—5.0	4.7—5.9	3.0—4.3	11½—14
averages:	22.4	4.7	5.2	3.7	

Acrophaedusa junghuhni (PHILIPPI, 1847)
(fig. 47, 48)

1846 PFEIFFER, p. 63 (*Clausilia Junghuhni*, nom. nud.)
1847 PHILIPPI in KÜSTER, p. 23, pl. 2, f. 5—7 (*Clausilia Junghuhnii*)
1848 PFEIFFER, p. 405 (*Clausilia Junghuhni*)
1855 ADAMS, p. 184 (*Clausilia junghuhnii, Phaedusa*)
1867 VON MARTENS, p. 383 (*Clausilia Junghuhni*, group *Phaedusa*)
1877 BOETTGER, p. 64 (*Clausilia Junghuhni*, sectio *Phaedusa*, group *Acrophaedusa*)
1890 BOETTGER, p. 148, pl. 6, f. 1a—b (*Clausilia* (*Pseudonenia*) *junghuhni*)
1892 COOKE, p. 468 (*Clausilia junghuhni*)
1914 LESCHKE, p. 238 (*Phaedusa junghuhni*)
1915 COOKE, p. 265 (*Acrophaedusa junghuhni*)
1929 VAN BENTHEM JUTTING, p. 81 (*Phaedusa junghuhni*)
1935 PARAVICINI, p. 174 (*Clausilia junghuhni*)

DESCRIPTION of the material. Shell of medium size, ventricose-fusiform, moderately solid, yellowish- or brownish-horn-coloured, almost white shells also occur, glossy, hardly to fairly transparent. Spire rather short and broad, with slightly concave lateral outlines. Whorls 8½—11½, moderately convex, especially the lower whorls are sometimes very flat; sculptured with very fine, regular, closely-planted, transverse striae (about 20 to the mm on the whorl above the aperture), which are hardly any coarser on the neck. Usually there is no distinct thread along the moderately deep suture. The ca 2½ nuclear whorls are smooth and they form a short cylindric, rather blunt top. The neck is swollen. The last whorl is not very high above the aperture and almost as broad as the penultimate one.

The aperture is wide, pear-shaped, with a broad and rather high sinulus. The base of the peristome and the top of the sinulus are receding. The peristome is continuous, white, often shining, thickened and reflexed. The upper margin is only just clear of the preceding whorl and usually forms a distinct angle in the place where it is touched by the lamella superior. Usually the vertical edges run practically parallel, the outer one running down from the sinulus in a very faint curve, while the parieto-columellar margin first runs to the right while slowly descending, then there is a more or less distinct angle near the closed umbilical slit, after which it descends steeply. The base of the peristome is semicircular.

Lamella superior is rather high and distinct, reaching the margin, continuous with the spiral lamella, which ends a little beyond the ventral side. Lamella inferior low, only just visible in a front view

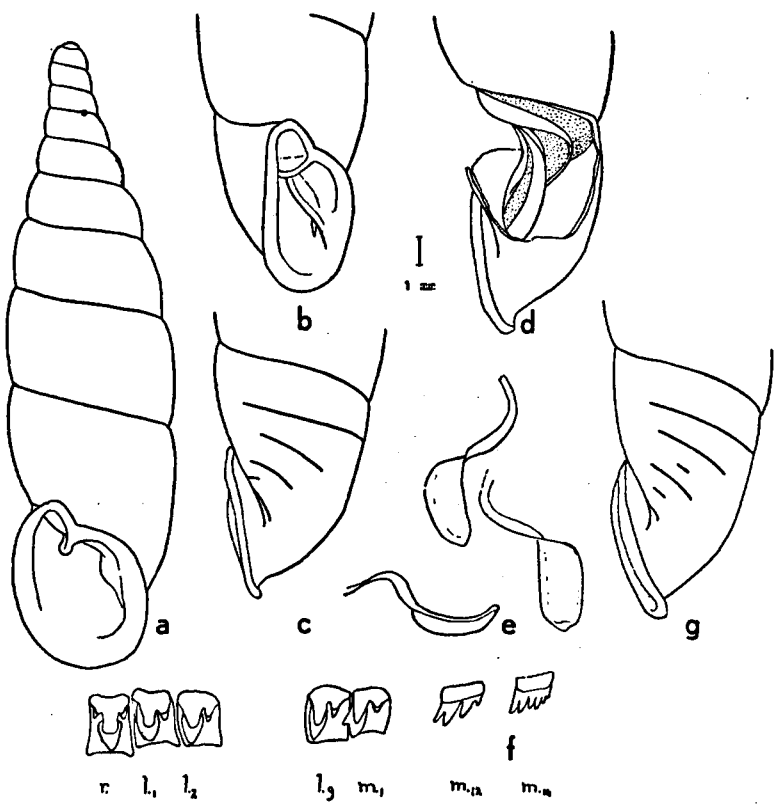

Fig. 47. **Acrophaedusa junghuhni** (PHILIPPI)
Loc. Java, Tjibitung near Bandung.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** right side of the last whorl, the palatal wall with the plicae has been broken away to show the inner structure of the shell, the clausilium has been removed; **e.** 3 views of the clausilium; **f.** some elements of the radula (× 390); **g.** right side of the last whorl of a specimen with 4 palatal plicae below the principalis.

of the aperture. The thickened edge ascends inwards pretty steeply. This fold sometimes looks bifurcate, because there is a distinct columellar edge occasionally. After increasing in height at first, the inferior lamella decreases again from laterodorsal-right upward and ends at the left side, beyond the end of the spiral lamella and together with the subcolumellar lamella. When looking obliquely from below into the aperture the inner side of the base of the lamella inferior is not or hardly visible. Lamella subcolumellaris lies concealed behind the inferior lamella. Only occasionally the lower end becomes visible. It never reaches the margin, however. The inner end lies at the left side.

The closing apparatus lies at the right side. The principal plica runs from ventrolateral-right to dorsolateral-left, and so traverses about ½ whorl. Under the plica principalis lie usually 3 plicae palatales, regularly distributed over the height of the whorl; the two upper ones are usually of equal length (1—2 mm), the bottom one is very short and lies close to the umbilical slit. Sometimes there is a short fourth plica between the two long ones (in about 4% of the total number). Exceptionally we may also find a duplication of the third (short) plica, or a small fold between the principalis and the upper palatal plica. Specimens with more than one additional fold occur. The lamella subcolumellaris, last of all, is sometimes visible through the shell under the short lowest plica. The plicae are usually clearly visible through the shell. The clausilium has a rather long, tongue-shaped plate, regularly curved in the shape of a saddle, with practically parallel sides; the top is slightly thickened. The plate merges regularly into the pedicle on both sides. The plate is about 3.0 mm long and about 1.3 mm wide.

Length of the shells: 15.4 to 24.4 mm, diam. 4.3 to 6.0 mm; aperture: height 4.1 to 6.3 mm, width 2.8 to 4.8 mm. I studied more than 1200 shells. The ventrosity l/d is 3.3 to 5.0, the average is 4.0.

I do not know, where the original set is preserved. The dimensions given by PHILIPPI (in KÜSTER, 1847) are: "Höhe 10¼‴, Breite 2¾‴". In PHILIPPI's very incomplete description a subcolumellar lamella is mentioned. It is visible in the aperture (columellari "emersa"), as in *cornea*. In most cases this is certainly not so and still PHILIPPI cannot have meant any other species. PFEIFFER (1848) mentioned for *junghuhni* as well as for *cornea*: "Subcolumellaris immersa", and he gave the following dimensions: "Long. 22, diam. fere 6 mill. Ap. 6 mill. longa, 4 lata". Ever since the original description the number of plicae was given correctly. As points of difference with *A. cornea* VON MARTENS (1867) recorded the ventrosity of *junghuhni* and the stronger thickening of the peristome; he did not mention the (not clearly visible) subcolumellar lamella. BOETTGER (1877) joined *junghuhni* with *cornea* in a new group *Acrophaedusa*. Later on (1890) he completed the diagnosis according to PFEIFFER's publication (1848) and described a smaller variety, without giving it a name. According to my opinion the characters which he mentioned all fall within the range of variation of typical *junghuhni* specimens. The original set from which he described the deviations was reexamined by me. In the material examined by O. BOETTGER one also finds some four varieties indicated by names on the labels. Descriptions of these varieties are not known. As I regard all four of them only as individual variations

(they occur in the series, of normal specimens usually connected by intermediate forms), I do not give the names here. BOETTGER distinguished brown-coloured specimens, relatively slender specimens, specimens with 4 instead of 3 palatal plicae below the principalis and specimens with a violet peristome. I saw the "type"-material from his collection. The violet of the specimen with violet peristome (S.M.F. no. 61129), seems artificial to me.

ANATOMY. No anatomical data were known up to now. The indefatigable diligence of Mr. L. J. M. BUTOT provided me with living specimens which enable me to give the following details.

The animal is white to yellowish grey; the eye-spot on the upper tentacles (vide photo 4) is black. The formula of the radula is: about $85 \times \frac{1}{3} + \frac{9}{2} + \frac{14}{3-\omega}$, so about 85 rows, each consisting of one central tooth with 3 cusps, on either side 9 lateral teeth with 2 cusps each and 14 marginals with 3 to many cusps.

Genital organs. There is an appendix to the duct of the receptaculum seminis, which is only little longer than the distal part of the duct itself.

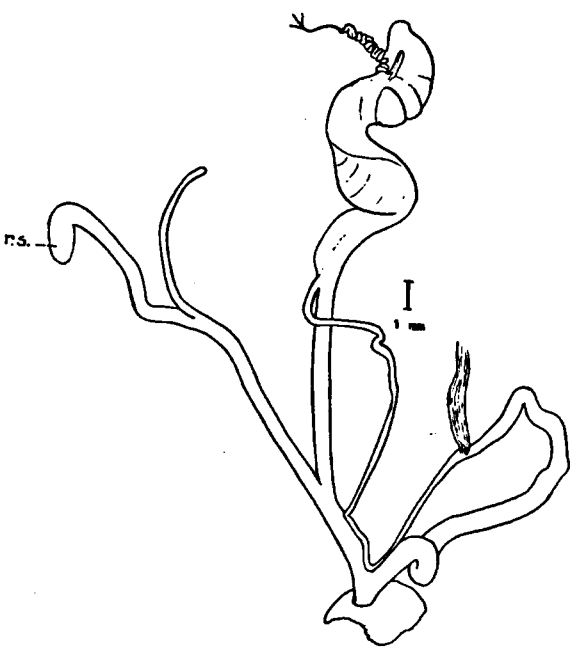

Fig. 48. **Acrophaedusa junghuhni** (PHILIPPI)
Loc. Java, Tjibitung near Bandung.
Reproductive organs (r.s. = receptaculum seminis).

There are no further special appendices. The retractor and the nerve of the left upper tentacle pass between the penis and the vagina. The dimensions of some ducts and organs, measured in a snail with a shell of 22 mm length and 5.5 mm diam., are approximately: penis 14 mm,

epiphallus as far as the retractor muscle 3 mm, vas deferens from the retractor 19 mm, prostate and uterus 11 mm, vagina as far as the orifice of the duct of the receptaculum seminis 4 mm, from there to the uterus 8 mm, duct of the receptaculum seminis as far as the attachment of the appendix 8 mm, from there to the end of the receptaculum 8 mm, length of the appendix 6 mm. The duct of the receptaculum and the appendix lie close against the prostate gland and the uterus.

Acrophaedusa junghuhni is oviparous. Many times I found eggs in my cultivating dishes, often up to 8 eggs together. The shell of the egg is provided with isolated particles of calcium. Immediately after the laying the contents of the eggs are as clear as crystal. The eggs vary from spherical to oval, the diameter is e.g. 2.3 by 2.0 mm, 2.5 by 2.0 mm and 2.0 by 1.8 mm.

Little is known about the age *Clausiliidae* may reach. I cultivated specimens of a number of European species and found that some of the animals reached an age of at least 9 years (cf. LOOSJES, 1946). I have been cultivating *A. junghuhni* specimens for four years now, and certainly not in optimal conditions. I got them when they were already full-grown. According to me, *Clausiliidae* reach an age of at least five years.

DISTRIBUTION : Java, Sumatra.

Type-locality: Java.

In his original description PHILIPPI (in KÜSTER, 1847) only recorded that the specimens came from the Java mountains. BOETTGER (1890) mentioned Arga Sarie plantation, Mount Malabar, at 1700 m altitude, as the locality. VAN BENTHEM JUTTING (1929) mentioned especially West Java and PARAVICINI (1935b) found specimens near Tjinjiroean, Mount Malabar.

Habitat. This species is terrestrial. Several times specimens were found on the ground among grasses or leaves. Usually, however, the biotope is not mentioned on the labels. The altitude above sealevel, at which *A. junghuhni* was found, varies from 700 to 2800 m.

Localities. The following is a survey of the material with more exact localities, studied by me.

West Java.

Mount Tjikorai, ca 1700 m, leg. H. FRUHSTORFER, 1891 (S.M.F. no. 61125, 5 and no. 61126, 2); ca 2800 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61127, 1 and no. 61128, 3); leg. H. FRUHSTORFER, without further indications (N.M.R., 2 and Z.M.A., 4)[1])

dimensions (in mm):

	shell		aperture		number of whorls
	length	diam.	height	width	
	18.0—23.5	4.4—5.4	4.1—5.4	2.8—4.0	9½—11
averages:	20.1	4.8	4.8	3.5	

Mount Papandajan, leg. W. C. VAN HEURN, 1929 (R.M.L., 1 and R.M.L. no. 104c, 1); leg. W. C. VAN HEURN, 1930 (J. TH. HENRARD collection, 3); 700—1000 m, leg. W. C. VAN HEURN, 1931 (J. TH. HENRARD collection, 4); ca 1200 m, leg. H. FRUHSTORFER, 1891 (S.M.F. no. 61132, 1)

	18.5—23.3	4.9—5.5	4.6—5.6	3.4—4.1	8½—11
averages:	20.6	5.2	5.1	3.6	

Mount Papandajan, Tjibulu near Tjikadjang, in the grass of the verge of a road, leg. W. C. VAN HEURN, 1930 (R.M.L., 744; R.M.L. no. 104e, 100 and F. E. LOOSJES collection, 6)

[1]) vide note on p. 21.

	18.1—24.1	4.5—5.8	4.4—5.9	3.1—4.1	9—11½
averages :	20.7	5.1	5.0	3.6	

Mount Papandajan, Tjibulu near Tjisurupan, leg. W. C. VAN HEURN, 1929 and 1930 (R.M.L., 66 ; R.M.L. no. 104d, 19)

	18.1—23.4	4.6—5.6	4.0—5.6	3.2—4.2	9½—11½
averages :	20.7	5.1	5.1	3.6	

Mount Papandajan, Tjisurupan, ca 1300 m, leg. H. FRUHSTORFER, (Z.M.A., 2); ca 1200 m, leg. H. FRUHSTORFER, 1891 (S.M.F. no. 61120, 13)

	17.3—22.2	4.4—5.5	4.5—5.4	2.8—4.0	9½—10½
averages :	20.1	5.0	5.0	3.7	

Mount Papandajan, strip of jungle along the road to Bandung, between Santosa and Patjeh, 1600 m, leg. K. L. PFEIFFER, 1939 (K. L. PFEIFFER collection, no. 2035c, 2)

21.2	5.4	5.4	4.2	10
21.3	5.2	5.1	4.0	10½

Mount Guntur, Kawa Kamodjang, leg. W. C. VAN HEURN, 1929 (R.M.L., 4); 2000 m, leg. K. L. PFEIFFER, 1939 (K. L. PFEIFFER collection, no. 2035d, 2)

15.4—19.3	4.1—4.9	4.3—4.9	3.0—3.4	8½—10½
averages : 17.3	4.5	4.6	3.3	

Mount Guntur, 1500 m, leg. E. JACOBSON, 1937 (Z.M.A., 3)

18.9	5.0	5.2	3.6	10
18.5	4.8	4.8	3.4	10
19.0	4.7	4.7	3.3	9½

Mount Malabar, 1600 m, leg. W. C. VAN HEURN, 1921 (R.M.L., 46); 2300 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61121, 2)

	18.9—23.8	4.8—5.9	4.7—6.0	3.2—4.3	9—11
averages :	21.0	5.3	5.4	3.9	

Mount Malabar, in the garden of the wire-less station, on wet dead wood on the ground, leg. L. J. M. BUTOT, 1948 (F. E. LOOSJES collection, 2)

19.1	4.9	4.9	3.7	10
20.6	4.7	5.1	3.7	10½

Mount Malabar, Tjinjiruan Estate, leg. H. W. VAN DER WEELE, 1903 (R.M.L., 60) and 1909 (R.M.L., 1); 1800 m, leg. E. PARAVICINI, 1924 (E. PARAVICINI collection, no. 687a, 4 and S.M.F. no. 61124, 4)

	18.5—23.5	4.7—6.0	4.9—6.3	3.4—4.5	9—11
averages :	20.5	5.2	5.5	4.0	

Mount Malabar, Arga Sarie plantation, leg. A. STRUBELL (B.M.L. 95.10.24.3—5, 3 ; Z.M.A., 1); without recording a collector (Museum Bremen no. 347, 2 and no. 655, 1); ca 1700 m, leg. A. STRUBELL (S.M.F. no. 61116, 19 ; no. 61118, 2 ; no. 61119, 4) and the same collection, 1889 (S.M.F. no. 61117, 3)

	17.8—24.0	4.8—5.5	5.0—6.0	3.6—4.5	9—11
averages :	20.5	5.2	5.5	4.0	

Mount Tangkuban Prahu, 1500 m, leg. E. JACOBSON, 1937 (Z.M.A., 3); 700—1000 m, leg. E. JACOBSON, 1938 (Z.M.A., 11)

	16.9—21.7	4.1—4.7	4.4—4.9	2.9—3.5	9—10½
averages :	19.2	4.4	4.7	3.2	

Pengalengan, near Bandung, ca 1300 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61123, 1); ca 1500 m, leg. H. FRUHSTORFER, 1895 (S.M.F. no. 61122, 7 and no. 61129, 1) and without indication of altitude and date (Z.M.A., 1)

	18.2—21.3	4.7—5.4	4.9—5.4	3.4—3.9	9½—10½
averages :	19.5	5.0	5.1	3.7	

Negla Estate near Pengalengan, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 7)

	20.3—23.5	5.1—5.5	4.9—5.6	3.1—4.0	10—10½
averages :	21.1	5.3	5.3	3.6	

Subdistrict Pengalengan, near Bandung, Tjibitung, in cleared jungle on the ground

under decaying leaves and twigs, 1800—2000 m, leg. L. J. M. Butot and R. Troelstra, 1948 (M.Z.B., 21 and F. E. Loosjes collection, 12)

	19.5—24.4	5.0—5.9	5.1—6.2	3.8—4.8	9—11
averages:	21.0	5.4	5.7	4.2	

District Sukapura, Mount Djampang, south of Sukabumi, 1200 m, leg. H. Fruhstorfer, 1892 (S.M.F. no. 61130, 1 and no. 61131, 4)

18.0	4.0	4.5	3.3	10
22.0	5.4	5.4	4.0	10½
20.1	4.8	4.8	3.6	10
19.9	4.6	4.5	3.5	9½
19.9	4.7	4.5	3.2	11

On these specimens Boettger based the slender variety. He chose the first-mentioned specimen as its holotype. According to me the second is a completely normal *A. junghuhni*, the other specimens form a series between these two extremes. So I see no reason yet to split the species.

Mount Gedeh, ca 1300 m (N.M.B. no. 254a, 4); leg. H. Fruhstorfer (K. L. Pfeiffer collection no. 2035a, 2) and without any information on altitude or collector (K. L. Pfeiffer collection no. 2035b, 2)

	19.0—21.4	4.0—5.3	4.4—5.3	3.1—4.0	10—11
averages:	19.8	4.7	5.0	3.7	

Bogor (R.M.L., 10)

	19.3—23.2	4.9—5.7	5.1—6.1	3.7—4.4	8½—10½
averages:	21.2	5.3	5.5	4.1	

Mount Burangrang, north of Bandung, basin of River Tjimeta, on the ground, ca 1400 m, leg. L. J. M. Butot, 1949 (M.Z.B., 3)

19.4	4.6	4.9	3.4	10
18.3	4.9	—	—	10
18.6	4.7	4.9	3.8	10

Mount Tilu, south of Bandung, 1450 m, leg. E. Jacobson, 1937 (Z.M.A., 1)

20.8	5.0	5.0	3.5	10

Mount Gedogan (eastern slope), peak of Mount Misigit, near Padalarang, some hundred meters to the south-west of Lake Situ Lembang, on the ground under leaf and underneath an old mouldered trunk, leg. L. J. M. Butot, 1949 (M.Z.B., 11)

	17.6—19.8	4.5—5.0	4.6—5.4	3.3—3.9	9—10
averages:	18.5	4.8	5.0	3.7	

Sumatra.
Padang Highlands, northern slope of Mount Kerintji, Muara Labu (L. A. J. de Wilde collection, 5 and Z.M.A., 2)

	18.3—22.4	4.4—5.0	4.1—5.4	2.5—3.5	9½—10
averages:	19.9	4.6	4.8	3.0	

Mount Piso Piso, north-west of Lake Toba, in jungle, 1950 m (Naturhistoriska Riksmuseet, Stockholm no. 1642, 2)

21.8	5.5	5.5	3.8	8½
23.4	5.3	5.5	3.9	10

These two sets prove for the first time that *A. junghuhni* also occurs in Sumatra. The specimens from that island studied by me were less strikingly ventricose and therefore showed more straight lateral outlines than is usual in *A. junghuhni*, but I know similar specimens from Java.

Acrophaedusa schepmani (Von Moellendorff, 1897) (fig. 49)

1897 Von Moellendorff, p. 71 (*Clausilia* (*Acrophaedusa*) *schepmani*)
1915 Cooke, p. 265 (*Pseudonenia schepmani*)
1929 Van Benthem Jutting, p. 81 (*Phaedusa schepmani*)

DESCRIPTION of the material (the holotype included). Shell small, fusiform, slender, moderately solid, yellowish- or sometimes brownish-horn-coloured, almost white shells also occur, glossy, rather transparent. Spire rather slender, with slightly concave lateral outlines. Whorls 9—11, rather convex. The lower whorls are sometimes flat; sculptured with very fine, regular, closely-planted transverse striae (about 15 to the mm on the whorl above the aperture), which are hardly any coarser on the neck. The suture is rather deep, there is no thread. The nuclear whorls are smooth and sometimes form a cylindric top with some of the following whorls (e.g. the holotype). The neck is usually rather flat. The last whorl (above the aperture) is clearly narrower and higher than the penultimate one.

The aperture is relatively small, narrow pear-shaped, with a rather high sinulus. The base of the peristome and the top of the sinulus are receding. The peristome is continuous, whitish, slightly reflexed and thickened. The upper margin is clear of the preceding whorl and forms

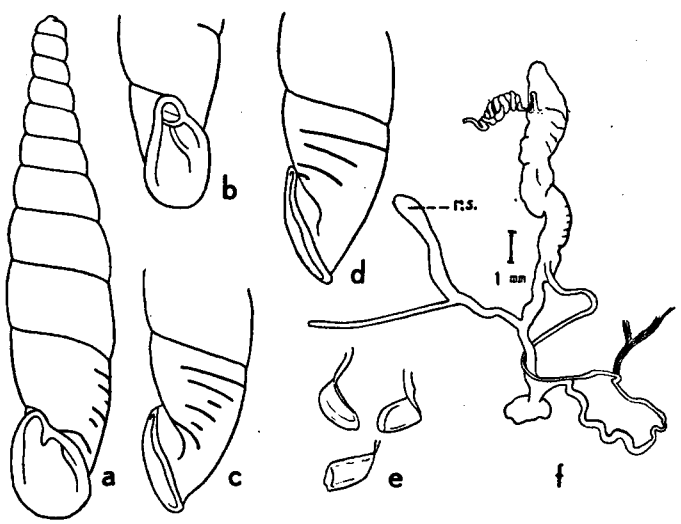

Fig. 49. **Acrophaedusa schepmani** (VON MOELLENDORFF)
Loc. (a—c) Java; holotype.
(d) Java; paratype.
(e—f) Java; Mount Gedeh.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** the same side of another shell with 3 plicae below the principalis; **e.** 3 views of the clausilium; **f.** reproductive organs (r.s. = receptaculum seminis).

a more or less distinct angle where it touches the lamella superior. From the sinulus the outer margin runs downwards and slightly outwards in a fairly straight line. The parieto-columellar margin first runs to the right and then descends in a regular curve. The two margins diverge downwards so that the aperture is strikingly wide at the bottom. The base of the peristome is semicircular.

Lamella superior low, reaching the margin, continuous with the spiral lamella, which ends ventrally above the aperture. Lamella inferior is low but clearly visible in the aperture. It does not reach the margin and ascends fairly steeply towards the interior of the shell. The inferior lamella ends a little before the subcolumellar lamella, ventrolateral-left, just beyond the end of the spiral lamella. When looking obliquely from below into the aperture, the inner side of the base of the lamella inferior is invisible. Lamella subcolumellaris is not visible in a front view of the aperture, as the outer end lies concealed behind the end of the inferior lamella, the inner end lies on the left side.

The closing apparatus lies on the right side. The principal plica runs from ventrolateral-right to just beyond the dorsal side, so it is about ½ whorl long. Below it we find, usually clearly visible through the shell, three or four plicae palatales (the holotype has 4), distributed fairly regularly over the height of the whorl. From top to bottom they are: long, long, short or: long, short, long, short, in such a way that a fourth small plica appears between the two long ones, which exceptionally may be almost as long as the two adjacent plicae. The specimens with four plicae are most common. Both forms occur together. Very exceptionally there may be an extra plica below the lower one. The plicae diverge slightly outwards or run practically parallel. At the bottom the lamella subcolumellaris is often visible through the shell. The plate of the clausilium is fairly long, tongue-shaped with parallel sides. Its length is 1.8 mm, its width 0.9 mm.

Length of the shells: 12.2 to 17.8 mm, diam. 3.0 to 4.0 mm; aperture: height 2.5 to 4.1 mm, width 1.8 to 3.0 mm. I studied 70 specimens. The ventrosity l/d is 4.0 to 5.1, the average is 4.6.

The original set is in the Senckenberg Museum (S.M.F. no. 61110) where VON MOELLENDORFF's collection is preserved. VON MOELLENDORFF (1897) gave the following dimensions for the holotype (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
16.3	3.5	—	—	11
I measured for the holotype:				
16.6	3.5	3.6	2.4	11
and for 7 paratypes:				
15.3—16.7	3.2—3.8	3.4—3.9	2.2—2.6	10—11
averages: 16.1	3.4	3.6	2.4	

The original description is short but clear. There is no doubt what species was meant.

There is a danger of confounding this species with small, slender specimens of *cornea*, but the position of the lamella subcolumellaris behind the lamella inferior is always a good diagnostic character.

ANATOMY. Up to now no anatomical data were known on *A. schepmani*. Messrs. A. C. V. VAN BEMMEL and L. J. M. BUTOT sent me living material of this species, which enabled me to publish the following data. The soft parts of the animal are white, or greyish-white; only the eye-spot on the upper tentacles is black. The formula of the radula is about

$90 \times \frac{1}{3} + \frac{7}{2} + \frac{10}{3-\omega}$. viz. about 90 rows, each consisting of one central tooth with 3 cusps, on either side 7 lateral teeth, each with 2 cusps, and 10 marginals with 3 to many cusps.

Genital organs. There is an appendix to the duct of the receptaculum seminis, which is only slightly longer than the distal part of the duct itself. There are no further special appendices. The retractor muscle and the nerve of the left upper tentacle pass between the penis and the vagina.

The dimensions of some ducts and organs, measured in a snail with a shell of 14 mm length and more than 3 mm diameter, are approximately: penis 4 mm, epiphallus as far as the retractor muscle 2 mm, vas deferens measured from the attachment of the retractor upward 6 mm, prostate and uterus 6 mm, vagina as far as the orifice of the duct of the receptaculum seminis 2 mm, from there to the uterus 1 mm, duct of the receptaculum seminis as far as the attachment of the appendix 2 mm, from there to the end of the receptaculum 3 mm, length of the appendix 3 mm. The duct of the receptaculum and the appendix lie close against the prostate and the uterus.

Acrophaedusa schepmani is oviparous; as in other *Clausiliidae* the egg-shell is provided with many isolated particles of calcium.

DISTRIBUTION: Java.

Type-locality: Java.

The original description (VON MOELLENDORFF, 1897) recorded that H. FRUHSTORFER collected the material described in Java during the period from 1891 till 1893. The label belonging to the type mentions Mount Gedeh, 4,000 feet. VAN BENTHEM JUTTING (1929) gave particularly West Java as the area of the species.

Habitat. Also in the case of this species exact data only became available recently. Messrs. A. C. V. VAN BEMMEL and L. J. M. BUTOT found some six specimens at 1400 m altitude in the spongy wet wood of a dead tree, in which they also found *A. cornea* PHIL. The area consisted of cleared tropical jungle and was very wet. In the outer layers of the trunk there were burrows of termites (rajaps). The snails and their eggs were found in the pulpy wood. An intensive search was made within a radius of ca 30 m from the trunk, but not one single snail was found. Another locality mentioned by Mr. BUTOT was on the ground of a marshy area, covered with vegetation, under the decaying leaves of grasses and *Zingiberaceae*. The altitude above sea-level at which this species was found, is 1200 to 1700 m.

Localities. I studied the following sets of this species. Samples labelled only "Java" are not mentioned here further.

West Java.

District Sukapura, Mount Djampang, south of Sukabumi, 1200 m, leg. H. FRUHSTORFER (S.M.F. no. 61136, 2)[1])

14.3	3.2	3.1	2.2	10
13.8	3.1	3.2	2.2	9½

[1]) vide note on p. 21.

Pantjoran Mas near Rarahan, Mount Gedeh, leg. W. S. S. VAN BENTHEM JUTTING, 1930 and 1931 (Z.M.A., 6)

	15.0—15.7	3.2—3.7	3.0—3.4	2.0—2.3	9—10
averages:	15.3	3.5	3.3	2.2	

Mount Gedeh, ca 1300 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61111, 4), without recording the date (S.M.F. no. 61110, 8 and Z.M.A., 5) only information: 1300 m altitude (N.M.B. no. 256a, 3); leg. LEDRU, 1898 (K.B.I.N., 1) leg. J. PAAR, 1900 (K. L. PFEIFFER collection no. 8606c, 4)

	15.3—17.8	3.2—3.8	3.2—3.9	2.0—2.7	9½—11
averages:	16.3	3.5	3.6	2.4	

Mount Gedeh, Tjibeureum Falls, 1700 m, leg. W. S. S. VAN BENTHEM JUTTING, 1931 (Z.M.A., 5); 1600 m, leg. K. L. PFEIFFER, 1939 (K. L. PFEIFFER collection no. 8606a, 1)

	12.2—14.5	3.0—3.4	2.5—3.4	1.8—2.5	9—10
averages:	13.8	3.2	3.1	2.1	

The species was found here together with *A. orientalis* PFR.

Mount Gedeh, Tjibodas, 1400 m, cleared tropical jungle, very wet area. Under its bark one of the fallen trees had decayed to a wet pulpy mass, in the outer layers of which burrows of termites (rajaps) were found. The wood could be squeezed dry like cotton-wool; the snails and their eggs were found very deep in the pulpy mass of wood. In spite of intensive search no *Clausiliidae* were found in the neighbourhood of the tree. Leg. A. C. V. VAN BEMMEL and L. J. M. BUTOT, 1950 (M.Z.B., 1; F. E. LOOSJES collection, 4)

	14.2—17.4	3.2—4.0	3.1—3.7	2.2—2.6	9½—11
averages:	16.2	3.6	3.4	2.4	

In addition to this species many specimens of *A. cornea* PHIL. were found in the tree.

Mount Gedeh, along the path to Tjibeureum Falls, on the ground in an area covered with vegetation, under decaying leaves of grasses and *Zingiberaceae* leg. L. J. M. BUTOT, 1950 (M.Z.B., 1 and F. E. LOOSJES collection, 1) and idem, under and among decaying leaves and twigs, leg. L. J. M. BUTOT, 1951 (F. E. LOOSJES collection, 3)

	13.0—14.9	3.1—3.4	2.8—3.4	2.3—2.5	9—10
averages:	14.1	3.3	3.2	2.4	

Specimens of *A. orientalis* PFR., *Hydrocena javana*, *Prosopeas acutissimum*, a *Pupina* and a *Diplommatina* species were also found here.

In general the number of specimens found in one locality is very small. For this reason the differences in the averages of the several localities cannot be regarded as very important.

Acrophaedusa alticola (VON MARTENS, 1892) (fig. 50)

1892 VON MARTENS, p. 245 (*Clausilia alticola*)
1892 COOKE, p. 468 (*Clausilia alticola*)
1893 SYKES, p. 30 (*Clausilia alticola*)
1915 COOKE, p. 265 (*Pseudonenia alticola*)

DESCRIPTION of the material. Shell small, fusiform, slightly ventricose, moderately solid, yellowish-horn-coloured, glossy, fairly transparent. Spire rather slender, with slightly concave lateral outlines. Whorls 9 to 10, moderately convex, sculptured with very fine, regular, closely-planted, transverse striae (about 15 to the mm on the whorl above the aperture), which are hardly any coarser on the neck. The suture is shallow and there is no thread along it. The nuclear whorls are smooth, sometimes they form together with the following whorls a more or less distinct,

cylindric top. The neck is moderately flat. The last whorl (above the aperture) is a little narrower than the penultimate one.

The aperture is relatively small, narrow pear-shaped, the sinulus is fairly high and wide. The base of the peristome and the top of the sinulus are receding. The peristome is continuous, whitish, slightly reflexed and thickened. The upper margin is just clear of the preceding whorl and forms a distinct angle, where it touches the lamella superior. The outer margin descends in a faint curve. From the sinulus the parieto-columellar margin runs to the right almost horizontally, curves slowly and then descends steeply. The two sides of the peristome run more or less parallel. The base is semicircular.

Lamella superior is fairly low, reaching the margin, continuous with the spiral lamella. Lamella inferior is also fairly low and ascends steeply inwards. The columellar margin may be clearly visible. When looking obliquely from below into the aperture, the inner side of the base of the lamella inferior is invisible. Lamella subcolumellaris is not visible in a front view of the aperture ; it lies concealed behind the lower end of the inferior lamella. The ends of the lamellae in the shell could not be studied, as I did not want to open the specimens that were at my disposal.

The closing apparatus lies at the right side of the last whorl. The plica palatalis principalis runs from ventrolateral-right to dorsal and so traverses more than ¼ whorl. Below it we find, clearly visible through the shell, 3 plicae palatales fairly regularly distributed over the height of the whorl. From top to bottom they are : long, long, short. The plicae run practically parallel. Below the last the end of the lamella subcolumellaris is visible. The clausilium is not known.

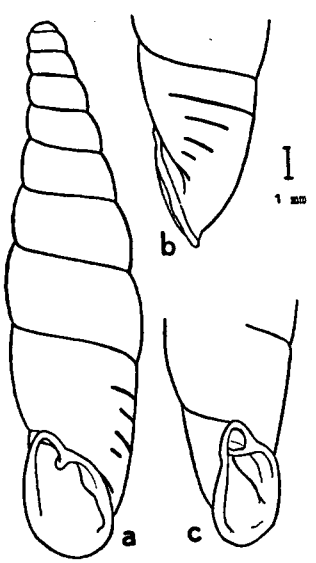

Fig. 50. **Acrophaedusa alticola** (VON MARTENS)
Loc. Sumatra, Mount Singgalang.
a. ventral side of the shell ; **b.** right side of the last whorl with the plicae seen through the shell ; **c.** ventrolateral-left side of the last whorl.

Length of the shells: 17.4 to 17.8 mm, diam. 4.3 mm; aperture: height 4.0 to 4.4 mm, width 2.5 to 2.7 mm. I saw only 2 specimens. The ventrosity l/d is 4.0 to 4.2. The average is 4.1.

I do not know, where the holotype is preserved. According to Dr. S. JAECKEL (in litteris) it is not in the Berlin Museum.

VON MARTENS (1892) recorded the following dimensions (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
18	4	4	3	9

The original description (VON MARTENS, 1892) is very clear and leaves no doubt about the species.

This species is very closely related to *A. junghuhni* and *A. schepmani*. The resemblance is so striking that it seems likely that, on studying a sufficient number of specimens it will prove necessary to incorporate it as a subspecies in one of these two species.

VON MARTENS recorded relationship with *A. cornea* and, undoubtedly, we have to do with an *Acrophaedusa*.

ANATOMY unknown.

DISTRIBUTION: Sumatra.
Type-locality: Mount Singalang near Fort de Kock.
Habitat. Nothing is known on the biotope in which the snail lives. The altitude above sea-level at which the localities are situated is 1800 m.
Localities. I saw only two specimens of this species.

Sumatra.
Padang Highlands, Mount Singgalang (Z.M.A., 1); id. 1800 m, leg. E. JACOBSON, 1925 (Z.M.A., 1)

17.4	4.3	4.0	2.5	9½
17.8	4.3	4.4	2.7	9

Acrophaedusa fruhstorferi (VON MOELLENDORFF, 1897)
(fig. 51)

1897 VON MOELLENDORFF, p. 72 (*Clausilia* (*Acrophaedusa*) *fruhstorferi*)
1915 COOKE, p. 265 (*Pseudonenia fruhstorferi*)
1929 VAN BENTHEM JUTTING, p. 81 (*Phaedusa fruhstorferi*)

DESCRIPTION of the material (the holotype included). Shell of medium size, elongated fusiform, delicate, brownish-horn-coloured, glossy, slightly transparent. Spire slender, with a long, fragile cylindric top, consisting of about 8 whorls. The lateral outlines are concave. Whorls 16 to 17, flat, sculptured with fine closely planted transverse striae (about 20 to the mm on the whorl above the aperture), which are hardly any coarser on the neck. The nuclear are smooth and rather narrow. The following whorls hardly increase in size at first, later on, at about the eighth whorl, they increase slowly in height and diameter. The neck is flat, not swollen. The suture is shallow.
The aperture is rather small, pear-shaped. The sinulus is fairly

broad. The base of the peristome and the top of the sinulus are receding. The peristome is continuous, horn-coloured, slightly reflexed, a little expanded, somewhat thickened. Its upper margin forms a more or less (the holotype) distinct angle where it is touched by the lamella superior. At the top of the sinulus the margin is only just clear of the preceding whorl. From the sinulus the outer margin descends in a regular curve, just like the parieto-columellar margin, which is, however, a little more bent. The base of the aperture is regularly rounded.

Lamella superior high, reaching the margin, continuous with the lamella spiralis. Lamella inferior is low as far as it is visible in the aperture, it does not reach the margin and turns inward and upward very steeply. The subcolumellar lamella is deeply immersed, not visible in a front view of the aperture. The inner structure of the shell of this species is unknown, as I did not want to open one of the specimens.

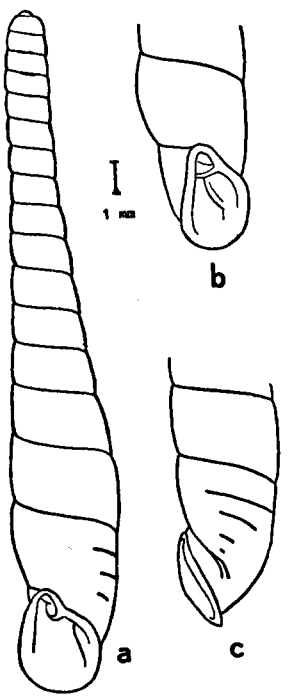

Fig. 51. **Acrophaedusa fruhstorferi** (VON MOELLENDORFF)
Loc. Java, holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell.

The closing apparatus lies at the right side. The plica palatalis principalis runs from dorsolateral-left to lateroventral-right. So it is about ½ whorl long. Below it are usually 3 short almost parallel plicae, distributed fairly regularly over the whorl. The top one is the longest, the lowest one the shortest. Below the last one the subcolumellar lamella is visible through the shell. The clausilium is not known.

Length of the shells: 20.0 to 22.2 mm, diam. 2.9 to 3.4 mm;

aperture : height 3.0 to 3.5 mm, width 2.1 to 2.7 mm. I studied 11 shells. The ventrosity l/d is 6.1 to 6.6, the average is 6.4.

I studied the holotype and a paratype, which are preserved in the Senckenberg Museum (S.M.F. no. 61107, 2). The dimensions are (in mm):

shell		aperture		number of whorls	
length	diam.	height	width		
22.0	3.4	3.3	2.5	17	holotype
22.2	3.4	3.5	2.7	16½	paratype
VON MOELLENDORFF (1897) recorded :					
22	3.5	—	—	17½	

His description does not leave any doubt as to what species he meant.

ANATOMY unknown.

DISTRIBUTION : Java.

Type-locality: Java.

In the original description only "Java" is indicated as the type-locality, in which the shells were collected by H. FRUHSTORFER. The type-specimens, however, are labelled ; "Java, Gg. Malabar, 7000' Bandong, leg. H. FRUHSTORFER". VAN BENTHEM JUTTING mentioned West Java as the area in which *A. fruhstorferi* occurs (1929).

Habitat. Nothing is known on the habitat or the biology. The species has been recorded from mountain localities from 1900 to 2300 m altitude.

Localities: In addition to the original set I studied specimens from the following localities. Those only labelled "Java" are not included, although most of them were collected by FRUHSTORFER and are therefore probably of the same origin as the other specimens.

West Java.

Mount Malabar, 2300 m, leg. H. FRUHSTORFER, 1892, the type-locality (S.M.F. no. 30404, 1 ; no. 61108, 1 ; Z.M.A., 1)[1])

21.2	3.3	3.4	2.5	16
21.5	3.3	3.0	2.4	16
21.3	3.4	3.2	2.1	16

Mount Tjikorai, 1900 m, leg. H. FRUHSTORFER, 1892 (S.M.F. no. 61109, 1), top whorls damaged.

—	2.9	3.0	2.3	—

Acrophaedusa nubigena (VON MOELLENDORFF, 1897) (fig. 52)

1897 VON MOELLENDORFF, p. 71 (*Clausilia* (*Acrophaedusa*) *nubigena*)
1915 COOKE, p. 265 (*Pseudonenia nubigena*)
1929 VAN BENTHEM JUTTING, p. 81 (*Phaedusa nubigena*)

DESCRIPTION of the material (the holotype included). Shell small, ventricose, fusiform, clavate, solid, purplish-brown, often corroded whitish, slightly glossy, not transparent. Spire rather plump and short, with

[1]) vide note on p. 21.

slightly concave lateral outlines. Whorls 8 to 9½, flat sometimes slightly convex, sculptured with numerous, closely planted, regularly distributed, fine, parallel, transverse striae (about 25 to the mm on the whorl above the aperture), which are hardly any stronger on the neck. The nuclear whorls are smooth, usually fairly wide, mamillated, but they may be corroded to a sharply pointed, whitish apex. From the top down the whorls rapidly grow in size. The suture is rather shallow, there is no marginal thread. The neck bends down regularly and slowly towards the base of the aperture.

The aperture is relatively small, wide pear-shaped, brownish within. The sinulus is wide and high. The base of the peristome and the top of the sinulus are receding. The peristome is continuous whitish, somewhat reflexed, slightly thickened. At the top of the sinulus the upper margin is just clear of the preceding whorl; it has a distinct angle, where it is touched by the superior lamella. From the sinulus the outer margin runs downwards fairly straight, but sometimes it shows a faint curve. The parieto-columellar margin is strongly and regularly bent towards the right side and downwards, forming a more or less distinct angle near the umbilicus. The base of the aperture is semicircular.

Lamella superior of medium height, reaching the margin, con-

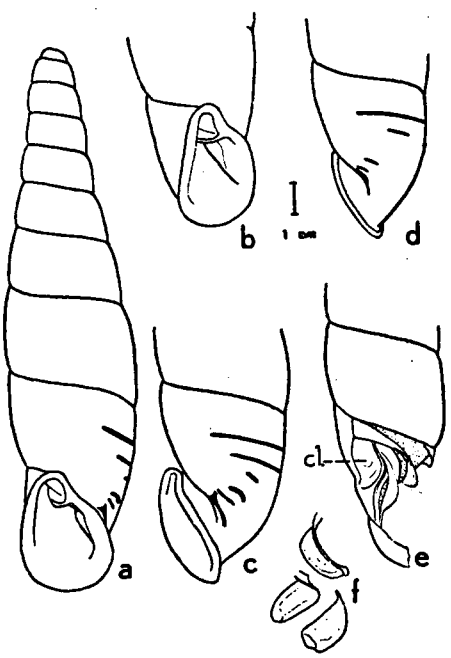

Fig. 52. **Acrophaedusa nubigena** (VON MOELLENDORFF)
Loc. (**a**—**c**) Java; holotype.
(**d**—**f**) Java; paratype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell; **d.** dorsolateral-right side of the last whorl of another specimen with 3 palatal plicae below the principalis; **e.** dorsal side of the last whorl, the palatal wall has been broken away to show the inner structure of the shell, the clausilium (cl.) is present; **f.** 3 views of the clausilium.

tinuous with the spiral lamella, which slowly increases in height. It is highest in a lateral-right position and ends ventrally. Lamella inferior is visible in the aperture as a low fold on the lower half of the columella, its outer end does not reach the margin, it ascends fairly steeply into the interior of the shell, at the same time increasing slowly and regularly in height. Its thickened edge is never horizontal. From the dorsal side the inferior lamella decreases slowly again, being low already at the right side. It ends inward beyond the ventral side and beyond the end of the spiral lamella together with the lamella subcolumellaris. When looking obliquely from below into the aperture, the inner side of the base of the lamella inferior is hardly visible. Lamella subcolumellaris deeply immersed, not visible in a front view of the aperture and ending a little beyond the ventral side.

The closing apparatus lies at the right side. The plica palatalis principalis runs from the dorsal side to just beyond the right side, so it is about ¼ whorl long. Below it are 3 to 4 short, fairly parallel plicae. The first runs near the principalis, below it there is usually a rather wide gap, in which sometimes, however, a very short plica may be visible. Below the gap are two more plicae and the end of the subcolumellar lamella, the latter close to the umbilical slit. The lowest of these two lower plicae may look like a triangle or it may have a side branch running down. It often touches the subcolumellar lamella. The plate of the clausilium is rather slender, with parallel sides, not very sharply bent. The apex is thickened and has an incision in its palatal side. Both sides merge regularly into the pedicle. Length of the plate: 2.0 mm, width 1.1 mm.

Length of the shells: 14.2 to 17.5 mm, diam. 3.5 to 4.1 mm; aperture: height 3.3 to 3.9 mm, width 2.3 to 3.0 mm. I studied 60 shells. The ventrosity l/d is 3.7 to 4.5, the average is 4.0.

The dimensions recorded by Von Moellendorff (1897) were: length 17.5 mm, diam. 4.33 mm; the number of whorls 9½.

I studied the type-specimens, preserved in the collection of the Senckenberg Museum (S.M.F. no. 61112, 5). The holotype measured (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
17.5	4.1	3.9	2.8	9½
and the paratypes:				
15.5	3.9	3.6	2.7	9
15.3	3.6	3.4	2.6	9
14.9	3.8	3.7	2.7	8
—	3.8	—	—	—

Von Moellendorff's description was not quite complete, yet the species is easily recognisable. He mentioned 3 plicae palatales besides the principalis, although just in the holotype the gap between the top plica and the two lower ones shows an extra little fold. So in the holotype the total number is 4 + the principalis.

ANATOMY unknown.

DISTRIBUTION: Java.

Type-locality: Java.

In the original description (1897) "Java" was mentioned as the type-locality. The original set was collected by H. FRUHSTORFER between 1891 and 1893. According to the label of the holotype the exact locality was the summit of Mount Tjikorai at 8600 feet altitude. VAN BENTHEM JUTTING (1929) mentioned especially West Java as the area in which *nubigena* occurs.

Habitat: Like so many *Clausiliidae*, *A. nubigena* is a mountain-dwelling form. The exact habitat is unknown, as are its biological data. The species was found between 1300 m and 2900 m.

Localities. In addition to the original set I studied shells from the following localities. Sets only labelled "Java" are not recorded here. As some of them had the additional information: "at 8,600 feet, collected by H. FRUHSTORFER", they may come from the type-locality but as there is no certainty, I do not include them.

West Java.

Mount Tjikorai, about 2900 m, leg. H. FRUHSTORFER, 1892 (N.M.R., 1; S.M.F. no. 30409, 2 and no. 61113, 4; Z.M.A., 2 and F. E. LOOSJES collection, 1)[1])

14.4—16.7	3.7—4.0	3.3—3.7	2.3—2.8	8—9½
averages: 15.8	3.9	3.5	2.6	

Mount Malabar (K. L. PFEIFFER collection no. 10008a, 2)

15.0	3.7	3.4	2.7	9
15.5	3.9	3.6	2.7	9

Mount Gedeh, 1300 m (N.M.B., 2), the label indicates "paratypoid", either this is incorrect or the locality.

16.0	4.0	3.7	2.6	9
15.3	3.9	3.6	2.4	9

These specimens are very fragile and transparent for *nubigena*; among the specimens from Mount Tjikorai, however, such fragile shells occur also.

One specimen (S.M.F. no. 30408, 1) is labelled "Sumatra". It was supplied by H. ROLLE. I doubt whether this locality is correct. The dimensions are:

14.2	3.6	3.6	2.6	8½

Acrophaedusa wuellerstorfi (ZELEBOR, 1867 (non *wuellerstorffi* VON MOELLENDORFF, 1882))

(fig. 53)

1867 ZELEBOR in PFEIFFER and ZELEBOR, p. 806 (*Clausilia Wüllerstorfi*)
1868 PFEIFFER, p. 411 (*Clausilia wüllerstorfi*)
1882 VON MOELLENDORFF, p. 11 (*Clausilia Nevilliana*)
1895 GODWIN AUSTEN, p. 443 (*Clausilia* (*Phaedusa*) *wüllerstorffi* (sic) and *C.* (*Ph.*) *nevilliana*)
1914 GUDE, p. 325, f. 113 (*Clausilia* (*Phaedusa*) *nevilliana*, section *Pseudonenia*) and p. 327 (*Clausilia* (*Phaedusa*) *wuellerstorfi*, section *Pseudonenia*)
1925 PEILE, p. 255 (*Phaedusa wuellerstorfi* = *Ph. nevilliana*)

[1]) vide note on p. 21.

DESCRIPTION of the material (the holotype included). Shell small or moderately large, cylindric fusiform, rather solid, yellowish- or reddish-brown, glossy or even shining, not very transparent. Spire rather thick, conical, with straight or slightly concave lateral outlines. Whorls 8½ to 11, the lower ones rather flat, sculptured with distinct, fine, closely planted, transverse striae (about 15 to 20 to the mm on the whorl above the aperture), which are hardly any coarser on the neck. There may be a thread along the shallow suture. The nuclear whorls are smooth and often form a short cylindric top. The neck is flat. The last whorl above the aperture is hardly narrower than the penultimate one.

The aperture is oblique, pear-shaped with a rather high sinulus, brownish within. The top of the sinulus is slightly receding. The peristome is continuous, white, slightly reflexed and only a little thickened. The upper margin lies against the preceding whorl or is just clear of it. There is a distinct angle where it touches the lamella superior. The outer margin descends fairly straight and runs a little to the left. From the sinulus the parieto-columellar margin runs almost horizontally to the right and then descends in a regular strong curve. The base of the peristome is semi-circular.

Lamella superior rather high, reaching the margin, continuous with the spiral lamella, which ends inward at the ventral side. Lamella inferior is very low and only just visible in the aperture; it does not reach the peristome and ascends steeply towards the interior; it ends beyond the end of the spiral lamella, lateroventral-left. As the columellar margin is very conspicuous, it looks as if the inferior lamella is forked

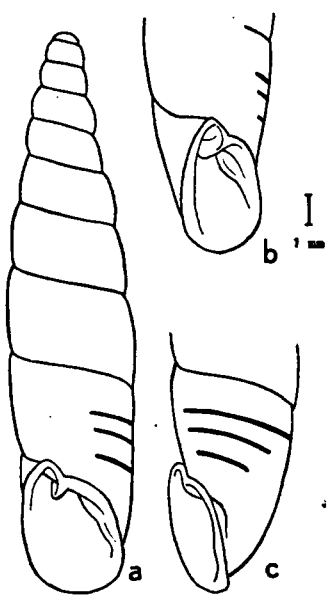

Fig. 53. **Acrophaedusa wuellerstorfi** (ZELEBOR)
Loc. Nicobar Islands; holotype.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** ventrolateral-right side of the last whorl with the plicae seen through the shell.

towards the inside. When looking obliquely from below into the aperture the inner side of the base of the lamella inferior is invisible. Lamella subcolumellaris is deeply immersed, it lies concealed behind the outer end of the inferior lamella, while its inner end lies beyond the ends of the other two lamellae on the left side.
The closing apparatus lies lateroventral-right. The principal plica runs from lateroventral-right to laterodorsal-left and so traverses ½ whorl. Below it are 2 fairly long palatal plicae, diverging towards the aperture, and finally the end of the lamella subcolumellaris. The plicae are distributed regularly over the height of the whorl, in such a way that the distance from the suture to the principalis is roughly as great as that from the lowest palatal plica to the subcolumellar lamella. The plicae are not always visible through the shell. The plate of the clausilium is long, tongue-shaped, with practically parallel sides. As all other clausilia it is saddle-shaped. The top is only slightly thickened; length of the plate 2.3, its width 1.0 mm.
Length of the shells: 16.8 to 21.0 mm, diam. 3.8 to 4.6 mm; aperture: height 3.9 to 4.8 mm, width 2.7 to 3.7 mm. I studied about 70 specimens. The ventrosity l/d is 3.9 to 5.4, the average is 4.5.

The holotype is preserved in the "Naturhistorisches Museum" at Vienna. The dimensions are (in mm):

shell		aperture		number of whorls
length	diam.	height	width	
19.1	4.2	4.4	3.3	10

In his original description ZELEBOR (1867) gave the following dimensons for his new species:

19	4.5	4.5	3.3	10

The description was rather extensive; ZELEBOR already mentioned the relationship with *A. cornea* PHIL. PFEIFFER (1868) did not offer any new aspects. Owing to a mistake in labelling, VON MOELLENDORFF (1882) described this species once more as *C. nevilliana*. His specimens were relatively long and thin. He recorded:

20	4	4	3	10

He also referred to BOETTGER's section *Acrophaedusa*. GUDE (1914) repeated the original description and gave the first drawing. PEILE (1925) finally proved that *wuellerstorfi* ZELEBOR and *nevilliana* MLLDFF are synonym, as could already be suspected from the original descriptions. To my opinion this species occupies an intermediate position between *Acrophaedusa* and *Pseudonenia*.

ANATOMY unknown.

DISTRIBUTION: Nicobar Islands.
Type-locality: Nicobar Islands.
The "Novara" expedition collected the original material in the Nicobars; in which of the islands is not mentioned in the publication (1867). VON MOELLENDORFF (1882) recorded the holotype of *nevilliana* from Camorta Island, where it had been found by DE ROEPSTORFF "under a fallen tree in a damp place". GODWIN AUSTEN (1895) mentioned Ca-

morta and Nancowry Islands, both belonging to the Nicobar group.
Habitat. The data, recorded by VON MOELLENDORFF, of DE ROEPSTORFF, who found a specimen "under a fallen tree in a damp place", is as far as I know the only one on the habitat.
Localities. I studied material from the following localities. Sets only labelled "Nicobar Islands" are not given.

Nicobar Islands.

Camorta (B.M.L. no. 42.12.4.16, 1 and B.M.L., 1; S.M.F. no. 30406, 1; no. 62262, 3 and no. 62263, 2; Z.M.A., 5; F. E. LOOSJES collection, 2); leg. DE ROEPSTORFF (B.M.L. no. 88.8.6.123—128, 6 and B.M.L., 22; S.M.F. no. 62261, 2)[1])

	17.2—20.7	3.8—4.6	3.9—4.8	2.9—3.7	8½—10
averages:	18.7	4.2	4.3	3.2	

Nancowry, leg. DE ROEPSTORFF (B.M.L. no. 88.8.6.37—41, 5 and B.M.L., 12)

	17.1—20.0	3.8—4.3	4.0—4.6	3.0—3.4	8½—10
averages:	18.7	4.1	4.3	3.2	

In addition to the species mentioned, which belong to the genus *Acrophaedusa*, I have seen another specimen, which probably cannot be assigned to one of these species, but which certainly belongs to the genus (fig. 54). Miss VAN BENTHEM JUTTING found this specimen on mount Papandajan, in the wood near Tegal Primula, at an altitude of about 2200 m, in 1931. It reminds one very much of a small solid specimen of *A. junghuhni* PHIL., for it is rather ventricose, with concave lateral outlines, swollen neck and a high and broad sinulus, while the characters of the form of the aperture and the peristome, as well as the lamellae and plicae, are indistinguishable from those of *junghuhni* (the latter as far as I could judge without opening the shell). The shell, however, is not transparent, rather dull, of a bluish colour, so that it

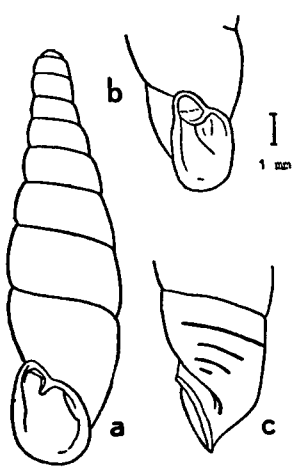

Fig. 54. Shell found bij Miss VAN BENTHEM JUTTING on Mount Papandajan near Tegal Primula.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell.

[1]) vide note on p. 21.

definitely does not fit in one of the *A. junghuhni* or *A. schepmani* series I know. The dimensions are (in mm):

14.0	3.7	3.3	2.3	9½

I think it premature to describe this specimen as a new species or as a subspecies. Possibly new finds may yield transitional forms to one of the known species.

Genus **HEMIPHAEDUSA** O. BOETTGER, 1877

1877 BOETTGER, p. 65
1927 EHRMANN, p. 32

Shell large or moderately large, solid, horn-coloured, lateral outlines straight or concave, aperture often oblique, provided with a reflexed and thickened peristome, which at the top is distinctly clear of the preceding whorl. Lamella superior and lamella spiralis connected, lamella inferior usually low, subcolumellar lamella always visible in the aperture, usually reaching the margin. A lunella is generally present.

Type-species: *Hemiphaedusa pluviatilis* (BENSON), designated by O. BOETTGER, 1877.

Distribution: Eastern and South-Eastern Asia.

From the Indo-Australian area only one species of this genus is known.

Hemiphaedusa excurrens (VON MARTENS, 1864) (fig. 55)

1864b VON MARTENS, p. 527 (*Clausilia excurrens*)
1867 VON MARTENS, p. 384, pl. 22, f. 16 and p. 378, f. 3 (*Clausilia excurrens*, group *Phaedusa*)
1868 PFEIFFER, p. 480 (*Clausilia excurrens*)
1888 WOODS, p. 1055 (*Clausilia excurrens*)
1892 COOKE, p. 468 (*Clausilia excurrens*)
1893 SYKES, p. 28 (*Clausilia excurrens*)
1915 COOKE, p. 265 (*Pseudonenia excurrens*)
1935a PARAVICINI, p. 61 (*Phaedusa excurrens*)

DESCRIPTION of the material. Shell of medium size, fusiform, rather solid, horn-coloured to purplish-brown, usually glossy, some shells are shining, not very transparent. Spire slender, with slightly concave lateral outlines. Whorls 9 to 10½, moderately convex, sculptured with very fine regular, closely planted, transverse striae (about 15 to 20 to the mm on the whorl above the aperture), which are slightly more conspicuous on the neck. The suture is shallow and has no thread. The nuclear whorls are smooth and cream-coloured. The neck is rather flat, not swollen; the last whorl above the aperture is evidently narrower and higher than the penultimate one, which makes the shell typically fusiform and not conical.

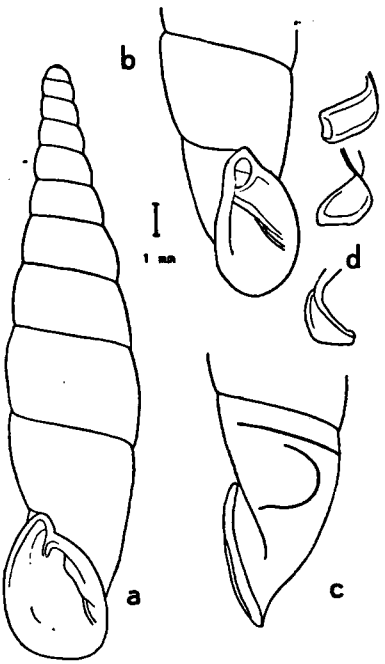

Fig. 55. **Hemiphaedusa excurrens** (VON MARTENS)
Loc. Sumatra, Pager Alam near Lahat.
a. ventral side of the shell; **b.** ventrolateral-left side of the last whorl; **c.** right side of the last whorl with the plicae seen through the shell; **d.** 3 views of the clausilium.

Aperture is triangular, pear-shaped, brownish within and has a high but narrow sinulus. The base of the peristome and the top of the sinulus are slightly receding. The peristome is continuous, white, reflexed and thickened. The upper edge, as also the top of the sinulus, lies quite far before the preceding whorl and shows a distinct angle or incision where it touches the superior lamella. From the sinulus the outer margin descends in a regular faint curve. The parieto-columellar margin runs to the right in a wide curve and then downwards, but may form a more or less distinct angle near the closed umbilical slit. The base of the peristome is semicircular.
Lamella superior fairly strong, reaching the margin, connected with the spiral lamella, which is very low at first and ends ventrally inside, above the aperture. Lamella inferior moderately high, clearly visible in a front view of the aperture and sometimes reaching the peristome; it ascends slightly spirally in the shell, but the thickened edge never runs horizontally. The inferior lamella ends lateroventrally-left, beyond the end of the spiral lamella. When looking obliquely from below into the aperture the inner side of the base of the lamella inferior is just visible. Lamella subcolumellaris is more or less clearly visible in a front view of the aperture, but sometimes reaches the peristome; inside it runs to beyond the end of the inferior lamella on the left side.
The closing apparatus lies at the right side. The principal plica runs from ventral to roughly the left side and so traverses almost

¾ whorl. Below it we find on the right side an almost semicircular lunella, of which the two plicae (the upper and the lower plica palatalis) form the two horns. Only after moistening it with alcohol the lunella is visible through the shell. Even then the subcolumellar lamella, which runs below it, remains hardly visible. The clausilium has a fairly wide plate, strikingly saddle-shaped, with a distinct, slightly thickened top; on both sides the plate merges regularly into the pedicle. From the pedicle the sides diverge slowly until towards the top, they approach each other rather quickly, the palatal side being concave and the columellar side convex. The length of the plate is 2.1 the width 1.1. mm.
Length of the shells: 15.8 to 19.8, diam. 3.8 to 4.4 mm; aperture: height 3.7 to 4.7 mm, width 2.8 to 3.2 mm. I studied 7 specimens. The ventrosity l/d is 3.9 to 4.6, the average is 4.3.

VON MARTENS gave the following dimensions (1864b): "Long. 20, diam. 4, apert. alt. 5, lat. 4 mm" and recorded 11 whorls. One would expect the holotype to be preserved in the Berlin Museum, but Dr. JAECKEL kindly informed me that it is not there.

Some of the characters VON MARTENS recorded in his original description (1864b) are: pale horn-coloured, lamella superior and lamella spiralis not connected and the lamella subcolumellaris not visible in the aperture; the most important characters he mentioned were the lunella and the protruding part of the last whorl (caused by the fact that the upper margin lies far from the preceding whorl). In 1867 he repeated this description, but added that he had seen a similar specimen from Sumatra, which was slightly larger (21 by 5 mm) and had a wider aperture (6 by 4½ mm), while the subcolumellar lamella was visible. He did not pronounce on whether he included it in the same species. No further data on this form are available. The specimens I saw are mostly brownish-violet, their superior lamella and spiral lamella are connected, although the connection is very low, and their subcolumellar lamella is visible in the aperture; they are smaller, however, than VON MARTENS's. For the rest they agree completely with his description. It seems premature to distinguish two species, because I did not see the original set and therefore cannot check the exactitude of the description. I have special doubt on the non-connection of lamellae superior and spiralis. Moreover VON MARTENS said that the species was rare and so he probably had few specimens on which to base his description. Consequently he does not say anything about the variation of the characters. I found one horn-coloured specimen among several other specimens from one locality (in other species also sometimes horn-coloured specimens occur among brown ones).

ANATOMY unknown.

DISTRIBUTION: Sumatra.
Type-locality: near Kepahiang. PARAVICINI (1935a) recorded the species from Pajakombo.
Habitat unknown.
Localities: I studied specimens from:

Pager Alam. Lahat, leg. J. SEMMELINK, 1898 (Z.M.A., 6)[1])
The dimensions are (in mm):

	shell		aperture		number of whorls
	length	diam.	height	width	
	16.0—19.8	4.0—4.4	4.0—4.7	2.9—3.2	9—10½
averages:	17.9	4.1	4.3	3.0	
Source of River Musi (B.M.L. no. 1910.12.30.62, 1)					
	15.8	3.8	3.7	2.8	9

[1]) vide note on p. 21.

V. DISCUSSION AND CONCLUSIONS.

A. TAXONOMY.

The current conceptions of the classification of the *Phaedusinae* are based on O. BOETTGER (1877 and 1878). His system was founded exclusively on the morphology of the shell. I give a survey here, omitting all non-Malaysian sectiones, subsectiones and species.

Genus *Clausilia* DRAPARNAUD
Sect. I-XV (non-Malaysian)
Sect. XVI *Phaedusa* H. & A. ADAMS
a. *Euphaedusa* O. BOETTGER (type *C. shanghaiensis* PFR.) (non-Malaysian)
1—2. (non-Malaysian)
3. "Formenkreis" of *moluccensis* MARTS.
C. cumingiana PFR.
C. moluccensis MARTS.
b. *Pseudonenia* O. BOETTGER (type *C. javana* PFR.)
1. "Formenkreis" of *chinensis* PFR.
C. penangensis STOL.
2. (non-Malaysian)
3. "Formenkreis" of *sumatrana* MARTS.
C. sumatrana MARTS.
4. "Formenkreis" of *heldi* KÜST.
C. heldi KÜST.
var. *moritzi* MOUSS.
5. "Formenkreis" of *javana* PFR.
C. javana PFR.
C. corticina PFR.
c-d. (non-Malaysian)
e. Formosana O. BOETTGER (type *C. swinhoei* PFR.) (non-Malaysian)
1. (non-Malaysian)
2. "Formenkreis" of *cochinchinensis* PFR.
C. borneensis PFR.
f. *Oospira* BLANFORD (type *C. philippiana* PFR.) (non-Malaysian)
g. *Acrophaedusa* O. BOETTGER (type *C. cornea* PHIL.)
C. junghuhni PHIL.
C. cornea PHIL.
h. (non-Malaysian)
follow a number of non-Malaysian subsectiones.

Some species not known to BOETTGER, were not classified by him (viz. *excurrens* MARTS., *filicostata* STOL., *obesa* MARTS., *orientalis* PFR., *schwaneri* MARTS., *wuellerstorfi* ZEL.).

In the course of time this system was completed and changed both by BOETTGER himself and by others.

In 1890 BOETTGER arrived at the conclusion that C. *javana* PFR. and C. *heldi* KÜST. are synonyms. He also described C. *salacana* which according to him holds an intermediate position between *junghuhni* PHIL. and *javana* PFR., but is more closely related to the latter.

In 1899 BOETTGER formed a new group : *Paraphaedusa* (type C. *subpolita* SMITH), in which apart from *subpolita* he also included *usitata* SMITH and *celebensis* SMITH.

The species described by other authors, were either fitted into the existing system or not. BOETTGER's groups came to be regarded as higher systematic units, first as subgenera under the genus *Phaedusa*, afterwards as genera. Thus we find in COOKE (1915) a list of the species found in the different islands of the Indo-Australian Archipelago, which I reproduce in outline :

Pseudonenia javana PFR., *corticina* PFR., *orientalis* PFR., *heldi* KÜST., *h.* var. *moritzi* MOUSS., *salacana* BTTG., *schepmani* MLLDFF., *nubigena* MLLDFF., *fruhstorferi* MLLDFF., *sumatrana* MARTS., *excurrens* MARTS., *alticola* MARTS., *suluana* MLLDFF., *recondita* SYKES.

Euphaedusa obesa MARTS., *aenigmatica* SYKES, *melvilli* SYKES, *robustior* BULLEN, *dohertyi* BTTG., *?filialis* MARTS., *cumingiana* PFR., *c.* var. *simillima* SMITH, *c.* var. *moluccensis* MARTS., *c.* var. *majuscula* TAP.CAN., *c.* var. *kabaenae* HAAS, *alternata* MLLDFF., *pyrrha* SYKES, *makassarensis* SYKES, *balantensis* SYKES, *bonthainensis* SAR., *minahassae* SAR.

Acrophaedusa cornea PHIL. and *junghuhni* PHIL.

Formosana borneensis PFR. and *schwaneri* MARTS.

Paraphaedusa subpolita SMITH, *usitata* SMITH and *celebensis* SMITH.

There are quite a number of errors in this classification. One may wonder e.g. why the species *schepmani, nubigena* and *fruhstorferi,* which VON MOELLENDORFF had brought under *Acrophaedusa,* appear under *Pseudonenia.*

After 1915 there was a revival in the interest in the systematics of the *Clausiliidae* under the influence of the increasing knowledge of the anatomy, particularly as regards the radula and the genital organs. It is A. WAGNER's (1919 and 1920) merit that he drew up a system in which he made use of the results of the anatomical investigations.

The part of his system that is concerned with the Asiatic *Clausiliidae,* the *Phaedusinae,* however, was based on the anatomical knowledge of only 6 species and on the morphology of the shells. Moreover he hardly took account of the existing classification and unsufficiently made use of the existing nomenclature. His efforts did not effect any improvements as regards the *Phaedusinae.* He included most Asiatic species in 3 genera of his subfamily *Clausiliinae* [1]) viz. : *Phaedusa, Aprosphyma* and *Synprosphyma.* I give his classification as far as it is of importance for the Malaysian species :

Subfamilia *Clausiliinae*

1. Genus *Clausilia* (non-Malaysian) [1])

[1]) WAGNER's *Clausilia* (non *Clausilia* DRAP.) is synonymous with *Cochlodina* DE FÉRUSSAC. It is therefore not identical with the usual interpretation of *Clausilia.*

2. Genus *Dilataria* VEST (non-Malaysian)
3. Genus *Phaedusa* autor. (= *Euphaedusa* BOETTGER) (WAGNER mentions *shanghaiensis* PFR. only)
4. Genus *Aprosphyma* WAGNER
   Subgenus *Aprosphyma* s.s.
   Subgenus *Macrenoica* WAGNER
   (including among others: *junghuhni* PHIL., *javana* PFR., *nubigena* MLLDFF. and *cumingiana* PFR.)
   Subgenus Polyptychephora WAGNER
   (incl. e.g. *filicostata* STOL.)
5. Genus *Synprosphyma* WAGNER (non-Malaysian)
6. Genus *Serrulina* MOUSSON (non-Malaysian)

It makes the impression as if WAGNER made a classification based on the scanty anatomical data and then fitted into it a great number of species, actually rather arbitrarily. If he had adapted the existing system to the anatomical data, it would certainly have been more reasonable.

Others have tried to bridge the gap between the two systems, viz. KENNARD and WOODWARD (1923), LINDHOLM (1924) and EHRMANN (1927). As regards the Asiatic species the first two authors applied WAGNER's classification and indicated the types for the different categories, making full use of the priority principles. They classified WAGNER's genus *Phaedusa* in the old way, omitting the species that belonged to WAGNER's other groups. LINDHOLM declared emphatically that "too little is known of the anatomy of the Asiatic species to establish their taxonomic position with certainty". He maintained the subfamily *Phaedusinae* for all Asiatic species, but for the rest his classification supplements KENNARD and WOODWARD's very well.

Apart from these two theoretical publications, grounded on literature only, there is EHRMANN's study, based on investigations of shells as well as on literature.

EHRMANN confined himself to the systematics of the Asiatic species. He drew up a system based on his own investigations at the same time making allowance for the old conceptions. He reduced the influence of the very scanty knowledge of the anatomy to proportions more in accordance with reality.

It is no use giving these three classifications separately.

The system in THIELE's "Handbuch" was based on these three and as far as the Asiatic *Clausiliidae* are concerned, on EHRMANN's views in particular.

An outline of the *Phaedusinae* in THIELE's system is given here.

Subfamilia *Phaedusinae*.
Genus *Hemiphaedusa* O. BOETTGER
Subgenus *Synprosphyma* A. WAGNER (non-Malaysian)
follow a number of other non-Malaysian subgenera.
Subgenus *Hemiphaedusa* O. BOETTGER s.s.
sectio *Hemiphaedusa* (type *H. pluviatilis* BENSON)
follow a number of non-Malaysian sectiones.
Subgenus *Acrophaedusa* O. BOETTGER (type H. *cornea* PHIL.)

Subgenus *Formosana* O. BOETTGER (non-Malaysian)
follow a number of other non-Malaysian subgenera.
Genus *Streptodera* LINDHOLM (non-Malaysian)
Genus *Phaedusa* H. & A. ADAMS
Subgenus *Phaedusa* s.s. (= *Pseudonenia* O. BOETTGER = *Macrenoica* WAGNER part.)
sectio *Phaedusa* (type *P. corticina* PFR.)
sectio *Oospira* BLANFORD (type *P. phillippiana* PFR.)
Subgenus *Euphaedusa* O. BOETTGER (type *P. shanghaiensis* PFR.)
Subgenus *Paraphaedusa* O. BOETTGER (type *P. subpolita* SMITH)
Genus *Reinia* KOBELT (non-Malaysian)

YEN (1939 and 1942) dealt with the Chinese *Phaedusinae* and used this system, raising some subgenera to the status of genera. ZILCH (1949) published the data left by EHRMANN and extensively discussed the genus *Paraphaedusa*. In general I agree with EHRMANN with regard to the species of this genus.

Except for the fact that in a number of cases groups of a lower order have been raised to groups of a higher order and that already existing or new species have been brought under some of the groups, THIELE's system is still in use, at least for the groups, that interest us here.

In general it seems not advisable to modify a system like THIELE's on account of a study of specimens from a limited area, because often only part of the species, belonging to a given genus or sectio may occur there. In the material of the Indo-Australian area, however, sufficient reasons are present, for proposing a correction of THIELE's system, e.g. 2 of the 6 genera are endemic and a relatively large number of generic type-species occur, viz.
Phaedusa corticina (PFR.)
Pseudonenia javana (PFR.)
Paraphaedusa subpolita (SMITH)
Acrophaedusa cornea (PHIL.)

Therefore the following changes are proposed:
1. THIELE's separation between two large groups (genera) *Hemiphaedusa* and *Phaedusa* is based a.o. on the assumption that there is no appendix or diverticulum to the duct of the receptaculum seminis in *Hemiphaedusa* s.l. This was proved, however, by WAGNER for one species of one subgenus only, viz. *Synprosphyma*. The other 16 subgenera were included because of the characters of the shell only.

As to the subgenus *Acrophaedusa* (type *A. cornea* PHIL.), I found that *A. cornea* and its relations do have an appendix to the duct of the receptaculum seminis. The same may prove to hold true for the other groups that have been included into *Hemiphaedusa*. Neither are all the characters of the shell (e.g. the absence of the lunella) arguments in favour of including *Acrophaedusa* into *Hemiphaedusa*.

***Acrophaedusa* therefore certainly does not belong to *Hemiphaedusa*.**

On the contrary, when comparing the characters of *Acrophaedusa* and *Phaedusa* in THIELE one hardly finds any differences.

It seems best to me not to combine the genera to higher units, as, considering our present knowledge, this remains for a large part hypothetical. That is why I place the subgenus *Acrophaedusa* beside the other genera as a genus and I raised THIELE's subgenera *Phaedusa, Euphaedusa* and *Paraphaedusa* to the status of genera.

2. Following EHRMANN, THIELE regarded *Pseudonenia* BOETTGER as a synonym of *Phaedusa* H. & A. ADAMS. EHRMANN (1927) said on this subject: "if it is true that according to BOETTGER *javana* and *corticina* belong to the same "Formenkreis", then *Pseudonenia* must be synonymous with *Phaedusa*. The close relationship of the two species cannot be doubted, however". WAGNER and, following his example, KENNARD and WOODWARD as well as LINDHOLM placed the two species in separate genera.

The reasons which induced WAGNER to set apart *javana* from *Phaedusa*, were not clearly stated,yet I agree with him concerning the separation and I do not understand how EHRMANN could favour the idea of such close relationship. Anatomically nothing was known of either species; so EHRMANN must have based himself completely on the characters of the shell.

If we compare the shells of the two species, we get the following list:

corticina PFR.	*javana* PFR.
striae wavy	striae straight
aperture wide, round	aperture rather small, triangular
lamella superior and lamella spiralis separated	lamella superior and lamella spiralis connected
lamella inferior runs inward spirally	lamella inferior ascends rather steeply inward
lamella subcolumellaris deeply immersed	lamella subcolumellaris usually reaches the peristome
below the principalis 3 to 6 plicae palatales, in the middle of the whorl very small or absent, the top one and the bottom one longest.	below the principalis 3 plicae palatales (of which the 2 upper ones long), regularly distributed over the height of the whorl
plate of the clausilium fairly wide triangular	plate of the clausilium tongue-shaped, with parallel sides

Besides these differences there are only very few similarities as for instance the convex or straight lateral outlines. This shows that the construction of the shells of the two species offers too many differences for assuming close relationship.

As regards the genital organs, the differences are much less obvious, but then the possibilities of variation are much smaller here. Moreover the value of certain characters for systematics is insufficiently known yet, as is the range of variation within any one species. Both species have an appendix to the duct of the receptaculum seminis, as is normal

for *Clausiliidae* ; in *Ph. corticina,* the appendix is distinctly shorter than the distal part of the duct, in *Ps. javana* the appendix is almost twice as long than the distal part of the duct.

Finally I found that *Ph. corticina* is viviparous, while *Ps. javana* is oviparous.

Considering these points of difference it is necessary to separate *Ps. javana* from the genus *Phaedusa*. The genus that will then contain *javana* with its relations, will have to be called *Pseudonenia*, the name proposed by BOETTGER in 1877 (generic type *Ps. javana*).

Thus I arrive at the six genera discussed in this study, viz.
Phaedusa, H. & A. ADAMS 1855
Pseudonenia O. BOETTGER 1877
Euphaedusa O. BOETTGER 1877
Paraphaedusa O. BOETTGER 1899
Acrophaedusa O. BOETTGER 1877
Hemiphaedusa O. BOETTGER 1877

Before I pass on to a short discussion of the genera, of their subdivisions and of the species included in them, I first will deal with a few characters that are or may be of importance for the separation of the genera. I confine myself here to a few points, viz. the ones that have caused misconceptions in the past and the ones for which new data have been obtained by my investigations.

B. MORPHOLOGY.

1. the form of the shell.

Because the top whorls increase little in diameter, they may in some species form a small cylinder. The transition from this cylinder to the following whorls then causes an imaginary tangent drawn along the whorls to form a concave line. In this case I speak of concave lateral outlines. It occurs in the species of the genus *Acrophaedusa* and in the only *Hemiphaedusa* of our area. The species of the genera *Phaedusa* and *Pseudonenia* have convex or at best straight lateral outlines. Practically straight sides we also find in *Paraphaedusa* and *Euphaedusa,* although species of the latter sometimes show a more or less cylindric top.

Most species are fusiform, because the last whorl is narrower than the preceding one. There are however some species that are more conical or pin-shaped, as e.g. *Ps. scalariformis.* There are also transitions from fusiform to almost pin-shaped within the subspecies-group of *Ph. filicostata.* Even within one species both forms may occur (*Ps. jacobsoni*).

2. the sculpture.

The striation of the shells is always transverse to the whorls, in the direction of the growth-lines. Only exceptionally there may be small spiral lines between these transverse striae (*Ph. kelantanensis*). In the species of *Phaedusa* the striation is rather rough, wavy ; in the other genera smooth and straight striae occur (*Pseudonenia, Euphaedusa, Acrophaedusa, Hemiphaedusa*) or the shells may be practically smooth (*Paraphaedusa*).

3. the relations between lamella superior and lamella spiralis.

The connection or disconnection of these two lamellae is a character that is not always easy to use. In some species part of the specimens have connected lamellae without visible transition, while others show a distinct separation between these lamellae (e.g. *Clausilia plicatula* DRAP., *C. pumila* PFR., *Zaptyx annae* LOOSJES). In the Indo-Australian Archipelago this dimorphism occurs in *Ph. dorsoplicata*. Still there are many species, even genera, in which the connection or disconnection of the lamellae is a very good character. In this study all species of *Phaedusa*, except for the above-mentioned *Ph. dorsoplicata*, turned out to have separate lamellae ; all *Pseudoneniae, Acrophaedusae* and the only *Hemiphaedusa* species have connected lamellae. *Euphaedusa* and *Paraphaedusa* include species in which : (1) both lamellae are connected in a line, (2) they are not connected, (3) the lamella spiralis approaches the superior lamella from the side of the suture and may even touch it. In this last case the lamella superior, although the two lamellae are connected, has an end that juts out freely into the shell.

4. the lamella inferior.

This lamella may either wind itself slowly up into the shell (which is best circumscribed as "spirally") or it may ascend rather steeply. In the first case in a lateral view from the left, one sees, the edge of this lamella disappear almost horizontally into the aperture (*Phaedusa, Euphaedusa* and *Paraphaedusa)*. A more or less steeply ascending inferior lamella is found in the species of the three other genera (*Pseudonenia, Acrophaedusa* and *Hemiphaedusa)*. In *Paraphaedusa* the lamella is enlarged wing-shaped on the dorsal side of the shell.

5. the lamella subcolumellaris.

The course of the subcolumellar lamella is very interesting. In contrast to the other lamellae, which only run on the parietal wall, this fold runs from the outside to the inside; either or not on the peristome, on the palatal wall, on the columella and finally on the parietal wall, thus forming a transition to the plicae, which only run on the palatal wall. All folds, both plicae and lamellae, have the same structure, viz. like a fold in a table-cloth, of which the insides lie against each other. This structure is often visible in monstrosities (vide e.g. BULLEN, 1906, text figure of *P. sumatrana*, p. 127). **So there is no essential difference between lamellae and plicae.** This is quite in agreement with EDLAUER's (1941) conception of the origin of the folds in *Clausiliidae*.

One of the characters of the lamella subcolumellaris which is important for the distinction between the higher systematic units is, whether it is visible from outside or whether it lies concealed behind the inferior lamella. Here again species are known that occupy an intermediate position. In the species of *Phaedusa* this lamella is not visible in the aperture as a rule, no more than in *Euphaedusa*. In *Paraphaedusa* and *Hemiphaedusa* this lamella is clearly visible in the aperture; in the species of *Paraphaedusa* it usually reaches the peristome. Both *Pseudonenia* and *Acrophaedusa* include species with immersed subcolumellar lamella and also species with a clearly visible one.

6. the plicae palatales.

Only too often one finds in definitions of certain species or in indications of the differences between a number of species the absence or presence of a plica palatalis mentioned as a character (e.g. SYKES, 1893). I want to oppose this tendency most emphatically. One plica more or less occurs regularly as an individual variation. Such an extra fold needs not even be very short, but may equal the other plicae in size (e.g. in *A. orientalis*). The number is not the thing that counts first, but the pattern which constitutes the basis of the distribution of the plicae palatales. The principal plica, which is present in all species, I leave out of account. In the species studied by me 7 basic patterns occur.

a occurs in *Ph. corticina* PFR. and its relations (*Phaedusa*). There is a plica superior and a plica inferior. The latter can be regarded as the horn of a lunella. From the lower plica a callous thickening ascends a short way. Between the two plicae there are 1—9 short parallel plicae, which are extra small or completely absent in the middle of the whorl concerned.

b occurs in a number of species of *Pseudonenia* and *Acrophaedusa* (*Ps. javana* PFR., *Ps. scalariformis* n.sp., *Ps. brachyptycta* n.sp., *A. cornea* PHIL., *A. thrausta* n.sp., *A. orientalis* PFR., *A. junghuhni* PHIL., *A. alticola* MARTS., *A. schepmani* MLLDFF., *A. fruhstorferi* MLLDFF., *A. wuellerstorfi* ZEL.,). Characteristic features are: at least two long folds below the principalis and below that usually a third, mostly short fold. These plicae are regularly distributed over the height of the whorl. Variations occur because there may be a small fold between the two long ones, which may individually become as long as the other two. The bottom fold may become long and finally there may be an extra short fold between the principalis and the upper plica. All these variations can be found in *A. junghuhni*.

c this type occurs in *Pseudonenia*-species (*obesa* MARTS., *gracilenta n.nom.*, *aenigmatica* SYKES, *suluana* MARTS., *sumatrana* MARTS., *penangensis* STOL., *abbreviata* MARTS., *vicaria* SYKES, *mentaweiensis* EHRMANN and *johorensis* TOMLIN). One may regard it as derived from the preceding one. It consists of a series of 4 to 8 practically parallel, fairly long plicae, regularly distributed over the height of the whorl.

d occurs in *Pseudonenia jacobsoni*, n.sp. It may be regarded as derived from type b, by elision of a number of plicae; only the top one has been left.

e is found in *Acrophaedusa nubigena* MLLDFF. and is quite isolated. Below the plica palatalis superior there is a fairly large space without plicae, followed by 2 to 3 short, often irregular small folds, sometimes with a side-branch, or of triangular shape.

f is found in *Euphaedusa* and *Paraphaedusa*, practically without exception. Below the principalis lie a plica palatalis superior and inferior, separated by a large space in the middle of the whorl; a more or less strong callous thickening may connect the two plicae (especially in *Paraphaedusa*).

g is found in *Hemiphaedusa excurrens* MARTS. It consists of a complete lunella.

Just as this survey could induce to decide on a relationship between *Euphaedusa* and *Paraphaedusa*, it might suggest relationship between *Pseudonenia* and *Acrophaedusa* (vide resp. f and b).

Consequently if one finds two specimens with an equal number of plicae, but with different basic patterns, one certainly has to do with different species. If one has two specimens, the numbers of plicae of which differ distinctly, but the basic patterns of which are the same, then they may very well belong to one and the same species.

7. the clausilium.

Five clearly distinguishable forms of the clausilium were found among the species of the area studied (fig. 56).

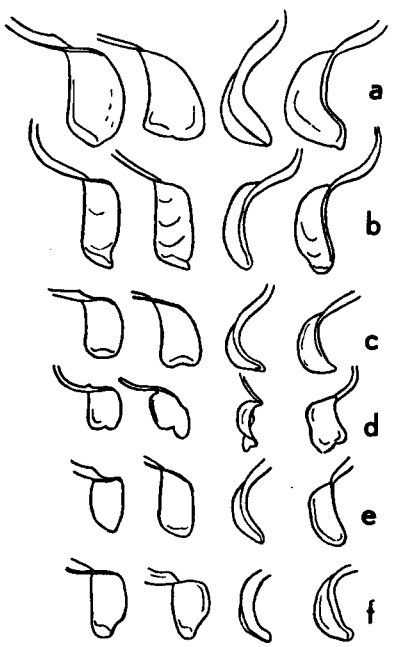

Fig. 56. The clausilia of representatives of each of the six genera ; successively :
seen from the inside in such a way that the top lies within the field of vision ;
seen from the inside so that the transition from the plate to the pedicle lies within the field of vision ;
seen from the columellar side, and
seen from the outside as it lies on a plane.
row **a.** *Ph. c. corticina* (PFR.)
b. *Ps. javana* (PFR.)
c. *Eu. c. cumingiana* (PFR.)
d. *P. subpolita* (SMITH)
e. *Eu. c. cumingiana* (PFR.)
f. *H. excurrens* (MARTS.)

(a) starting from the pedicle the sides of the plate diverge almost to the top, consequently giving the plate a nearly triangular shape. The

transition from the pedicle to the plate is regular. This form occurs in all the specimens investigated of the sectio *Phaedusa* and in *Pseudonenia jacobsoni* n.sp.

(b) the plate is tongue-shaped and relatively long, with parallel sides. The transition from the pedicle to the plate is regular. This type is found in *Pseudonenia* and *Acrophaedusa*.

(c) the plate is short and wide and has a rather blunt top. The transition from the pedicle to the plate is regular (*Euphaedusa*).

(d) the plate is short and wide, as in (c), the top is not always so blunt, sometimes lobed. On the columellar side the transition from the pedicle to the plate is incised (*Paraphaedusa*).

(e) the plate is moderately short and its sides are more or less parallel up to one third from the top, then the palatal side is clearly curved inwards. The transition from the pedicle to the plate is regular (*Hemiphaedusa*).

This shows that here also we find similarities between *Pseudonenia* and *Acrophaedusa*.

8. the colour of the animal.

Up to now no picture of the living animals has ever been published. There are only a few descriptions of the soft parts. Now I found that the *Acrophaedusa*-species: *cornea, thrausta, orientalis, junghuhni* and *schepmani* are very light-coloured (greyish-white), (cf. the photograph). The soft parts of *Ph. corticina* and *Ps. javana* on the other hand are almost black. WIEGMANN described a specimen in alcohol of *Ps. gracilenta* as grey and RENSCH found that the foot of *Eu. cumingiana recondita* is pale reddish-brown, dark brown on the back of the front part with even darker longitudinal stripes in the direction of the upper pair of tentacles. It is too early to generalize yet, but one is inclined to expect a generic character here too.

C. ANATOMY.

9. the radula.

Unfortunately no anatomical data are available of the species of *Paraphaedusa* and *Hemiphaedusa*.

For the other genera I found the following tooth-formulas (* = investigated by me)

Phaedusa.

* *corticina corticina* $120 \times \frac{1}{3} + \frac{9}{2} + \frac{13}{3-\sim}$

* *corticina nicobarica* $170 \times \frac{1}{3} + \frac{9}{2} + \frac{20}{3-\sim}$

* *filicostata kapayanensis* $143 \times \frac{1}{3} + \frac{9}{2} + \frac{17}{3-\sim}$

* *kelantanensis* $112 \times \frac{1}{3} + \frac{9}{2} + \frac{19}{3-\sim}$

Pseudonenia.

* *javana* $120 \times \frac{1}{3} + \frac{10}{2} + \frac{16}{3-s}$

gracilenta, according to WIEGMANN (1893) $92 \times \frac{1}{3} + \frac{9}{2} + \frac{17}{3-s}$

STOLICZKA (1873) gave a few characters of the radula of *Ps. p. penangensis*, but it is impossible to derive the formula from these data.

Euphaedusa.

* *cumingiana moluccensis* $70 \times \frac{1}{3} + \frac{7}{2} + \frac{15}{3-s}$

cumingiana simillima, according to WIEGMANN (1893) $88\text{-}98 \times \frac{1}{3} + \frac{10}{2} + \frac{13\text{-}18}{3-s}$

cumingiana recondita, according to RENSCH (1932) $96 \times \frac{1}{3} + \frac{7\text{-}8}{2} + \frac{20}{3-s}$

Acrophaedusa.

* *cornea* $95 \times \frac{1}{3} + \frac{8}{2} + \frac{13}{3-s}$

* *thrausta* $85 \times \frac{1}{3} + \frac{7}{2} + \frac{13}{3-s}$

* *orientalis* $94 \times \frac{1}{3} + \frac{8}{2} + \frac{13}{3-s}$

* *junghuhni* $85 \times \frac{1}{3} + \frac{9}{2} + \frac{14}{3-s}$

* *schepmani* $90 \times \frac{1}{3} + \frac{7}{2} + \frac{10}{3-s}$

All these species have a central tooth with 3 cusps; the basal plates and the lateral cusps do not show any peculiarities.

It is rather premature to conclude to differences between the genera from these few data. It is a striking fact that there are always more than a hundred rows in *Phaedusa* and always less than 100 in *Acrophaedusa*. I know yet too little of the individual range of variation to attach much value to small differences. The uniformity of the results found for *Acrophaedusa*, however, is another strong argument in favour of the homogeneity of this genus.

10. the reproductive organs.

Only very sporadically data on the structure of the genital organs have been recorded, as the survey of the literature already proves (p. 11). I mention here the species of which they have been studied now (* = observed by me).

Phaedusa.

* *corticina corticina* (p. 20)

Pseudonenia.

* *javana* (p. 63)

p. penangensis, according to STOLICZKA (1873)
gracilenta, according to WIEGMANN (1893)
* *jacobsoni* (p. 102)
Euphaedusa.
cumingiana recondita, according to RENSCH (1932) (this figure (f. 48) is not clear and incomplete)
Acrophaedusa.
* *cornea* (p. 151)
* *thrausta* (p. 156)
* *orientalis* (p. 160)
* *junghuhni* (p. 164)
* *schepmani* (p. 170)

Of these *Ph. corticina*, *Ps. javana* and *A. cornea* are generic types. I made the drawings shortly after having taken out the organs. So the genital organs are not figured in the natural position but after they had been stretched out, because only in this way one can study and measure them. After the preparation the parts were pinned in the wax-basin with small pins and fixed with 96 per cent alcohol. Slides were made by means of Canada-balsam.

Although the number of specimens studied of each species is very small yet, I found that in various specimens of one species the genital organs are similar in their main aspects. Our knowledge of this subject is still too scanty, however, to enable us to evaluate all structural differences.

All the species studied have an appendix or diverticulum to the duct of the receptaculum seminis. This appendix may be:

1) shorter than the duct of the receptaculum seminis from the bifurcation (the distal part of the duct) (*Ph. corticina*)
2) about equally long (*A. cornea*, *Ps. jacobsoni*, *A. junghuhni*, *A. orientalis*, *A. schepmani*, *A. thrausta*, in order of diminishing length of the duct of the receptaculum seminis, compared with the appendix)
3) distinctly longer (*Ps. javana*, *Ps. penangensis*, *Ps. gracilenta*, *Eu. cumingiana recondita*)

This classification runs almost parallel with the distribution of the species among the genera, based on the morphology of the shells, only *Ps. jacobsoni* is a spoil-sport!

The length of the duct too, from the orifice to the attachment of the appendix (the proximal part) is extremely variable. It is longer than the part behind the attachment of the appendix (the distal part) in *Ps. javana*, *Ps. jacobsoni*, *A. thrausta* and *Eu. cumingiana recondita*; nearly equally long in *Ph. corticina*, *Ps. gracilenta*, *A. orientalis*, *A. junghuhni* and *A. schepmani* and shorter in *Ps. penangensis* and *A. cornea*. I must remark here that rather considerable differences can occur between specimens of *A. junghuhni*. In the one case the part of the duct before the attachment (the proximal part), is slightly longer than the free end (the distal part), in the other case it is slightly shorter. Consequently no great value can be attached to this character; it thwarts the existing system completely.

A distinct transition from the penis to the epiphallus, which WAGNER ascribed to his genus *Aprosphyma*, is not a generic character either.

D. BIOLOGY.

11. reproduction.

Up to now hardly anything was known about the reproduction. I found that the animals are oviparous or viviparous. I was able to observe living specimens of *Ph. corticina, Ps. javana, A. cornea, A. junghuhni* and *A. schepmani*, which I kept in my cultivating dishes for quite a long time. Only the first-mentioned species is viviparous, the other ones lay eggs. After dissecting *Ph. corticina* I found in the uterus young snails with shells of about 2 whorls. There is another possibility, however, to prove that a species is viviparous, even when the dry shells are already many years in a collection. When the animals are collected with young snails in the uterus and afterwards the soft parts decay for the greater part, the young shells are found again in the full-grown shells (LOOSJES & LOOSJES-VAN BEMMEL, 1949). Thus I found that *Ph. lucens* is viviparous, as is *Phaedusa paviei* MORLET from Tonkin. I expect that all the *Phaedusa*-species from the area discussed will prove to be viviparous. *Eu. cumingiana simillima* and *Eu. c. recondita* are also viviparous (resp. according to WIEGMANN (1893) and RENSCH (1932). So it is quite probable that the other *Euphaedusae* from the area discussed are also viviparous. In the species belonging to the genera *Pseudonenia* and *Acrophaedusa* the laying of eggs is probably the rule, at least I found a lot of positive data and never any proof of the opposite.

I see no point in specifically mentioning the day of collection of a specimen, since the *Clausiliidae* grow relatively old (up to 5 years at least; for a European species I established an age of 9 years) and constantly remain in the same locality.

E. BRIEF DISCUSSION OF THE SEPARATE GENERA.

Whenever possible the generic type is dealt with first. It is difficult to give an order of relationship, as the characters contradict each other quite often.

Phaedusa H. & A. ADAMS

Type-species: *Ph. corticina* PFR.

The characters are to be found on p. 15.

In this genus is included a number of Asiatic species, as e.g. the Tonkinese *Phaedusa paviei* MORLET (LOOSJES, 1948 and LOOSJES & LOOSJES-VAN BEMMEL, 1949). Within this large genus the Indo-Australian species form a clearly defined group, which I have taken together and characterized as sectio *Phaedusa* (p. 15).

Of the characters of the sectio *Phaedusa* the pattern of the plicae palatales is very peculiar. The number of plicae between the upper and the lower plica may vary from 1 in some *Ph. corticina* specimens to 9 in some specimens of the *Ph. filicostata* subspecies.

I do not know any non-Malaysian species that could be classed into

this section. The only species in the area that is less typical (e.g. because the lamella superior and the lamella spiralis are connected in part of the specimens and because of the striae) is *Ph. dorsoplicata* from Eastern Borneo.

I include in this sectio *Phaedusa* the following species :

corticina PFR.
borneensis PFR.
dorsoplicata n.sp.
pahangensis LAIDLAW
lucens n.sp.
filicostata STOL.
kelantanensis SYKES

Of the species known the practically always very incomplete descriptions, mostly dating from the last century, could be supplemented. The inner structure of the shells of most of them had not been described before.

To *Ph. corticina* PFR. I join as a subspecies *nicobarica* GUDE, formerly described as an independent species, and the newly-described form from the Batu Islands, *batuensis*. Both resemble typical *Ph. corticina* very closely. *Ph. borneensis*, which several authors brought to the subgenus *Formosana*, certainly does not belong there. The pattern of the plicae palatales is quite different from that of *Formosana* and is completely identical with that of *Ph. corticina*, as is also the spiral course of the inferior lamella, which I could ascertain in the holotype.

The species *Ph. dorsoplicata*, *Ph. pahangensis* and *Ph. lucens* do not give rise to any further remarks.

Under *Ph. filicostata* I class a group of subspecies, occurring mainly in the Malay Peninsula, viz. *Ph. f. filicostata* STOL., *Ph. f. tenuicosta* NEVILL, *Ph. f. compressa* n.subsp., *Ph. f. kapayanensis* DE MORGAN, *Ph. f. musangensis* n.subsp. and *Ph. f. filialis* MARTS. I should like to regard the variable subspecies *tenuicosta* NEVILL (possibly identical with the typical subspecies) as most closely related to the probable original form, of which the subspecies are branches.

These subspecies form a very clear example of the splitting up of a formerly uniform species under the influence of isolation (p. 211). Characteristic differences are mainly to be found in the surface parts of the shell, which are most in contact with the outer world. The inner structure is practically the same in these subspecies. The species *Ph. pahangensis*, *Ph. lucens* and *Ph. kelantanensis* are only the next stage of development of the same process of species-formation.

Of the type-species *Ph. c. corticina* the structure of the radula and the genital organs is known, of *Ph. c. nicobarica*, *Ph. f. filicostata*, *f. kapayanensis* and *Ph. kelantanensis* only the radula. *Ph. c. corticina* is the only form of which we know that the soft parts are very dark-coloured, almost black.

Ph. corticina and *lucens* turned out to be viviparous, like *Ph. paviei* from Tonkin.

Pseudonenia O. BOETTGER

Type-species : *Ps. javana* PFR.

Above I have given a summary of the characters of this genus (p. 56).

I divide the genus into two sectiones, a typical one, *Pseudonenia*, type: *Ps. javana* PFR., and a sectio *Oospira*, (BLANFORD, 1872), type: *Ps. philippiana* PFR.

Under *Oospira*, BLANFORD set apart a number of species of the genus with very blunt, rounded off top-whorls.[1]) It is an open question, whether it is wise to base a subdivision only on such a deviation in the structure of the shell. Mutually quite unrelated species with such ovi-form tops are known from several genera. Also the opposite, a long-drawn, fragile top, consisting of many whorls, occurs in a number of genera, e.g. in the Javanese *Acrophaedusa fruhstorferi*; but this has not resulted in the drawing up of a separate section because of this character.

In the area studied there is only one species (*Ps. johorensis* TOMLIN) that could be brought to *Oospira*. Study of the type-species *Ps. philippiana* from Burma will have to furnish the definite answer, whether *Oospira* is to be maintained as a sectio.

The species of genus *Pseudonenia*, as far as they occur outside the Indo-Australian area, will have to be set apart from the genus *Phaedusa*. At the moment it is impossible to find out if the Indo-Australian species form a clearly defined group within the genus, or agree with the species occurring in more northern parts of Asia.

Therefore I do not now subdivide sectio *Pseudonenia* any further, even though two groups are already distinguishable in the material studied, as can be based on the situation of the subcolumellar lamella, whether it is visible in the aperture or not.

Also in this section a species is found that does not quite fit in, viz. *Ps. jacobsoni* n.sp., of which the clausilium is not tongue-shaped with parallel sides, but triangular, with the greatest width near the top, as in sectio *Phaedusa*. The length of the appendix to the duct of the receptaculum seminis differs from the situation in some other species of *Pseudonenia*. Form and appearance of the shell and the aperture, the course of the lamellae and plicae and the length of the proximal part of the duct to the receptaculum seminis are quite similar, however, to those in *Ps. javana, sumatrana* etc.

In the sectio *Pseudonenia* I include the following species:

lamella subcolumellaris usually clearly visible in the aperture:
javana PFR.
obesa MARTS.
aenigmatica SYKES
gracilenta n.nom.
scalariformis n.sp.
suluana MARTS.

lamella subcolumellaris not visible in the aperture, at least not in a front view:
sumatrana MARTS.
penangensis STOL.
abbreviata MARTS.
vicaria BTTG.

[1]) As the type-species *Ps. philippiana* PFR. is a *Pseudonenia* and not a *Phaedusa*, *Oospira* BLANFORD is a section of *Pseudonenia* now.

brachyptycta n.sp.
mentaweiensis EHRMANN
jacobsoni n.sp.

The descriptions of the species which were already known could practically always be supplemented with new data. Especially little was known on the inner structure of the shells and the clausilia.

On *Ps. javana* I only want to remark that particularly in this species the lamella subcolumellaris is sometimes almost invisible in individual cases.

To *Ps. obesa* I join as a subspecies *salacana* BTTG., because the differences in the characters are very small. *Ps. aenigmatica* SYKES also belongs here according to my opinion, possibly even as a synonym of *obesa*. The number of specimens available of *obesa obesa* and *aenigmatica* was too small to justify a definite conclusion.

Ps. gracilenta (= *Ps. obesa* var. *gracilior* MARTS.) on the other hand is less closely related to o. *obesa* (p. 77) and can therefore certainly be regarded as an independent species. Of *Ps. scalariformis* and *Ps. suluana* only the holotype is known. *Ps. scalariformis* differs slightly from the usual type of *Pseudonenia* by its almost pin-shaped shell, while a fusiform shell is normal. This causes it to resemble closely a *Paraphaedusa*, from which it differs materially by the course of the lamella inferior and the plicae palatales.

The varieties *attenuata* MARTS., *brevior* MARTS. and *vicaria* BTTG., which were brought to *Ps. sumatrana* MARTS. formerly, I have in agreement with BULLEN (1906) raised to separate species because of the differences in the shells. The names have to be changed into resp. *Ps. sumatrana* MARTS., *Ps. abbreviata* MARTS. and *Ps. vicaria* BTTG.

Ps. penangensis is very closely related to these three species especially to the first two as regards the form and the dimensions of the shell. The subspecies *Ps. p. orites* is another example of the formation of subspecies by isolation.

According to my opinion *Ps. mentaweiensis* must be a subspecies of *abbreviata* from the Mentawei Islands as, however, the material (2 specimens) got lost, it remains safer to maintain this form with EHRMANN, as an independent species.

On *Ps. brachyptycta* and *Ps. jacobsoni* not much needs to be said here. Because of its horn-coloured shell and its short principal plica the former occupies a place of its own in the group: it reminds of the genus *Acrophaedusa*, *Ps. jacobsoni* has, as was mentioned, peculiarities that point to *Phaedusa*.

On the anatomical structure data were provided by WIEGMANN (1893) (he described *Ps. gracilenta* n.nom. = *Ps. obesa* var. *gracilior* MARTS.) and STOLICZKA (1873) (on *Ps. p. penangensis* STOL.). I studied the radula and the genital organs of *Ps. javana* and the genital organs of *Ps. jacobsoni*.

The animal of *Ps. javana* is almost black in colour and is oviparous.

Of *Ps. johorensis* TOMLIN, sectio *Oospira*, only the shell is known.

Euphaedusa O. BOETTGER
Type-species: *Eu. shanghaiensis* PFR.
For the characters of the genus vide p. 105.

I do not subdivide the genus any further.

Only 2 species occur in the Indo-Australian Archipelago :

cumingiana PFR.

alternata MLLDFF.

Eu. cumingiana may be divided into a number of geographical races, which are not always easily distinguished by means of the structure of the shell. From the Indo-Australian area we know the typical subspecies, *c. moluccensis* MARTS., *c. simillima* SMITH and *c. recondita* SYKES. In the descriptions of the subspecies I explained, why I do not accept certain races e.g. *kabaenae* HAAS and *laevior* SMITH. All the subspecies are characterized by the possession of papillae along the suture.

RENSCH (1932) was the first to describe the mutual connections in this indeed very uniform subspecies-group. Before him *moluccensis* and *simillima* had been recognized as subspecies, but *recondita* had always been regarded as an independent species. VAN BENTHEM JUTTING (1941) wondered if one could speak of separate subspecies here, or if one could better include them all in a "Rassenkreis" *cumingiana*. Of *Eu. alternata*, the holotype, the only known specimen got lost. EHRMANN brought this species to *Paraphaedusa*, but on account of the original description there is no reason, according to my opinion for not leaving it with *Euphaedusa* as VON MOELLENDORFF did.

Anatomical data are only known from literature. WIEGMANN (1897) described the radula of *Eu. c. simillima* (then usually called *moluccensis*). RENSCH (1932) described the radula and genital organs of *Eu. c. recondita*. RENSCH described the animal of *recondita* as dark-brown on the back with even darker longitudinal stripes, the foot is pale, reddish-brown. The two last-mentioned subspecies are viviparous.

Paraphaedusa O. BOETTGER

Type-species : *P. subpolita* SMITH.

The characters of the genus have been recorded on p. 122.

I do not subdivide this genus any further, even though it is possible to form two groups, based on the place of the closing apparatus. These would be : a typical group with the closing apparatus on the ventral side and another one with the apparatus on the right side.

The species known up to now, come from the Indo-Australian area. They are :

closing apparatus on the ventral side :

subpolita SMITH

celebensis SMITH

closing apparatus on the right side :

usitata SMITH

bonthainensis P. & F. SARASIN

minahassae P. & F. SARASIN

makassarensis SYKES

pyrrha SYKES

schwaneri MARTS.

EHRMANN (published by ZILCH, 1949) gave a complete survey of this genus, with which I agree entirely. For this reason the interested reader

will find little news in the present paper. *P. pyrrha* SYKES could be brought to *Paraphaedusa* with certainty, because I could study the holotype. Further I found that *dohertyi* BTTG, is synonymous with *schwaneri* MARTS. Of the other species there is little to be said.

The anatomical characters of this genus are not known, neither the outer appearance of the snails. It is also unknown whether they are oviparous or viviparous. I did not succeed in getting living material of species of this genus.

Acrophaedusa O. BOETTGER

Type-species : *A. cornea* PHIL.

For the characters of this genus vide p. 147.

As in *Pseudonenia* the species of this genus can be divided into two groups, according to the course of the subcolumellar lamella. In a number of species this lamella is clearly visible in the aperture and even usually reaches the peristome. In other species the lamella subcolumellaris is not visible in a front view of the aperture as it lies concealed behind the lamella inferior.

Up to now the genus is confined to the Indo-Australian area.

I consider the following species to belong to *Acrophaedusa* :

lamella subcolumellaris clearly visible in the aperture :

cornea PHIL.
thrausta n.sp.
orientalis PFR.

lamella subcolumellaris not visible in the aperture, at least not in a front view :

junghuhni PHIL.
schepmani MLLDFF.
alticola MARTS.
fruhstorferi MLLDFF.
nubigena MLLDFF.
wuellerstorfi ZEL.

Of the species already known, practically all the incomplete, existing descriptions could be supplemented with new data. Especially on the inner structure of the shells and the clausilia hardly anything was known.

On *A. cornea* nothing will be said here. *A. thrausta* on the other hand gives rise to several remarks. This species possesses distinct papillae along the suture, a character which, in this area, is only found in *Euphaedusa cumingiana*. For the rest *thrausta* is a genuine *Acrophaedusa*. For a long time *A. orientalis* was not recognised, specimens which really belonged to it were treated as a variety of *cornea*. Besides the shell the genital organs in particular show some characters that may be regarded as arguments in favour of the independence of this species (p. 160). *A. junghuhni* is the species of which I could study the range of variation most extensively, because of the great number of excellently labelled shells available.

A. schepmani and *A. alticola* resemble *A. junghuhni* closely. The number of *A. alticola* specimens which I studied is too small for deciding on the independence of this species. It does not seem unlikely to me that this species is a subspecies of, or even synonymous with *A. schepmani*.

A. fruhstorferi differs by its very long cylindric top, consisting of about 8 whorls. I have already argued that a similar top also occurs in other genera (e.g. *Hemiphaedusa mikado* PILS.) and that the value of such a character is very dubious (p. 200).

A. nubigena is a species of which the pattern of the plicae differs very much from those of all other Indo-Australian species; because of this it occupies a rather peculiar position here. There is no more appropriate genus, however, for *nubigena* so I agree with the author VON MOELLENDORFF and keep it under *Acrophaedusa*.

A. wuellerstorfi is a form which has been placed in this genus although it practically occupies an intermediate position between *Acrophaedusa* and *Pseudonenia*, owing to the characters of its shell. The only slightly reflexed peristome and the non-trumpet-shaped aperture decided me to bring the species to *Acrophaedusa*.

Neither on the radulae, nor on the genital organs anything can be found in literature. I could collect anatomical data on this genus. I studied the radula and the genital organs of *A. cornea, thrausta, orientalis, junghuhni* and *schepmani*. The animals of these species are white or greyish-white. *A. cornea junghuhni* and *schepmani* are oviparous.

Hemiphaedusa O. BOETTGER

Type-species: *H. pluviatilis* BENSON.

The characters of this genus have been described on p. 182.

I do not subdivide the genus.

The only species belonging to this genus and occurring in the Indo-Australian area is *H. excurrens* MARTS. The striking form of the lunella causes this species to be very conspicuous among all other Indonesian species.

F. ECOLOGY

As I have remarked several times before, most collectors show a pitious insufficiency as regards the recording of localities. It is an exception if a label mentions anything more than e.g. Makassar, Celebes. How the snail or the snails were found is hardly ever recorded. Practically the only persons I received material from with extensive data on the nature of the localities, are the ones I mentioned in the introduction. I only want to list those species here, of which data on the biotope in which they live, are known. The data that are new, have been indicated with an asterisk.

Phaedusa H. & A. ADAMS

* *c. corticina* PFR. on an overgrown living tree (*Eugenia malaccensis* L.)

filicostata kapayanensis DE MORGAN
"on tree trunks and on the soil between vegetable detritus" (DE MORGAN, 1885).

kelantanensis SYKES "on bark in damp forest" (VAN BENTHEM JUTTING, 1949).

Pseudonenia O. BOETTGER

* *javana* PFR. on the underside of a dead and fallen overgrown tree (*Erythrina* sp.), under the loose bark.
sumatrana MARTS. on stony soil (VON MARTENS, 1864).
p. penangensis STOL. "on old fallen decaying trees, eventually under the bark, feeding on fungi" (COLLINGE, 1903).
* *abbreviata* MARTS. on stony soil (VON MARTENS, 1864) ; on the soil under tea-plants.
* *jacobsoni* n.sp. in hollow decaying trunks of sago-trees.

Euphaedusa O. BOETTGER

* *c. cumingiana* PFR. on the roots of grasses.
c. moluccensis MARTS. on the soil among roots of trees and pine-apples run wild (VON MARTENS, 1867); in damp woods on decaying tree-trunks (KOBELT, 1897).
c. recondita SYKES "under decaying wood and mosses" (RENSCH, 1935).

Paraphaedusa O. BOETTGER

bonthainensis P. & F. SARASIN "under decaying stems" (SARASIN, 1899).
minahassae P. & F. SARASIN "under mosses, on tree stems" (SARASIN, 1899).

Acrophaedusa O. BOETTGER

* *cornea* PHIL. in dead decaying tree trunks, the wood was a spongy mass.
* *thrausta* n.sp. on a fallen decaying tree trunk.
* *orientalis* PFR. under leaves, more or less in the water ; among and under stones under the spray of a fall ; under leaves of *Zingiberaceae* and grasses on the soil in a marshy area.
* *junghuhni* PHIL. on the soil among grasses and leaves ; on wet dead wood on the ground.
* *schepmani* MLLDFF. in a dead, badly decaying tree trunk, the wood was a spongy mass ; on the soil under and among rotting leaves, among *Zingiberaceae* and grasses in a marshy area.
wuellerstorfi ZEL. "under a fallen tree in a damp place" (VON MOELLENDORFF, 1882).

This shows that of only 19 species and subspecies something is known about the biotope in which the snails live. Almost half of these data were provided by the persons who collected for me, after 1945. Whether the biotope recorded here is the normal one for the species or not, is difficult to decide, because of the scarcity of the data.

It is clear, however, that decaying tree trunks are particularly attractive to many species, the wetter the better. Probably this has a lot to do with the growth of fungi in such places, viz. the remark placed with a set of

Ps. penangensis: "feeding on fungi".

A few species were stated to have been found on the ground, often under rotting leaves, sometimes among grasses and roots of grasses. Very rarely species are recorded from stony soil. Another possibility "found on a living tree", is confined to only one species.

The remark has been made that species of snails which pass their lives almost exclusively on vertical walls, with free hanging shells, generally have a longer and narrower shell, than the species that are typical ground-dwellers. The latter are more inclined to ventrosity. This might be explained, purely mechanically, as follows. The shell can only be built at, if the animal is partly outside the shell, for only then the fold of the mantle is in contact with the margin of the peristome. If a halfgrown shell hangs downwards, its weight and that of the visceral sac within it is borne by the tissues which connect it to the foot. These connecting tissues are in consequence stretched out and become narrower at the same time. The fold of the mantle is connected to this stretched region and thus it will also be narrower than if there is no weight to bear.

There may be something to this hypothesis, if only we think of the ground-dwelling *A. junghuhni* and *Ps. abbreviata*, which are more ventricose than their relations. The North-Western European ventricose ground-dweller *Clausilia rolphi* GRAY too, suggests a similar hypothesis.

It might be interesting to know whether these ventricose shells would become narrower when the animals were bred under other circumstances.

Most of the species of *Clausiliidae* dealt with live in hilly or mountainous country. Table A gives a survey of the distribution of the localities of each species and subspecies over the zones of altitude.

The division into vegetation-zones used here, is discussed more extensively by VAN STEENIS, 1935 (p. 327) and by VAN BENTHEM JUTTING, 1952 (p. 310).

These zones are called:

Zones according to JUNGHUHN	Zones according to VAN STEENIS:
0— 650 m Torrid Zone	0—1000 m Tropical Zone
650—1500 m Temperate Zone	500—1000 m Colline Subzone
1500—2500 m Cool Zone	1000—2400 m Montane Zone
2500— m and upwards Cold Zone	1000—1500 m Submontane Subzone
	2400—4000 m Subalpine Zone
	4000—4500 m Alpine Zone
	4500— and upwards Nival Zone

This table will have to be supplemented with more data before allowing any conclusions. Only the data on some common species, of which much material has been collected and of which careful records have been made on the circumstances under which the animals live are more or less complete. That e.g. *Ph. corticina* has not been recorded from above 2400 m altitude, is no proof that the species does not occur higher. Negative data are of little or no value, only positive ones can be used.

Of the species from the Indo-Australian region only three, *Eu.c. cumingiana, Eu.c. moluccensis* and presumably *Ps. johorensis*, have been recorded from low-land, all the others are hill- or mountain-dwellers.

TABLE A

species	low-land	hilly and moun-tainous country	Distribution according to vegetation-zones of JUNGHUHN				Distribution according to vegetation-zones of VAN STEENIS				
			0-650	650 — 1500	1500 — 2500	2500 →	0-500	500 — 1000	1000 — 1500	1500 — 2400	2400 →
Phaedusa											
c. corticina Pfr.		×	×	×	×			×	×	×	
c. batuensis n.subsp.											
c. nicobarica Gude											
borneensis Pfr.		×									
dorsoplicata n.sp.		×									
pahangensis Laidlaw		×		×	×				×	×	
lucens n.sp.		×									
f. filicostata Stol.		×									
f. tenuicosta Nevill		×									
f. compressa n.subsp.		×									
f. kapayanensis de Morgan		×	×					×			
f. musangensis n.subsp.		×									
f. filialis Marts.		×									
kelantanensis Sykes		×									
Pseudonenia											
iavana Pfr.		×	×	×	×	×		×	×	×	×
o. obesa Marts.		×	×					×			
o. salacana Bttg.		×									
aenigmatica Sykes		×									
gracilenta n.nom.		×			×					×	
scalariformis n.sp.		×		×					×		
suluana Mlldff.											
sumatrana Marts.		×		×				×	×		
p. penangensis Stol.			×				×				
p. orites Laidlaw		×		×	×				×	×	
abbreviata Marts.		×			×					×	
vicaria Bttg.		×									
brachyptycta n.sp.		×									
mentaweiensis Ehrmann											
jacobsoni n.sp.											
johorensis Tomlin	×										
Euphaedusa											
c. cumingiana Pfr.	×										
c. moluccensis Marts.	×										
c. simillima Smith		×		×	×			×	×	×	
c. recondita Sykes		×		×					×		
alternata Mlldff.		×									
Paraphaedusa											
subpolita Smith		×		×	×			×	×	×	
celebensis Smith		×		×	×			×	×	×	
u. usitata Smith		×		×	×			×	×	×	
u. tjambensis Ehrmann		×									
bonthainensis Sar.		×			×					×	
minahassae Sar.		×		×	×				×	×	
makassarensis Sykes		×									
pyrrha Sykes		×									
schwaneri Marts.											
Acrophaedusa											
cornea Phil.		×		×	×				×	×	
thrausta n.sp.		×			×					×	
orientalis Pfr.		×		×	×				×	×	
junghuhni Phil.		×		×	×	×		×	×	×	×
schepmani Mlldff.		×		×	×				×	×	
alticola Marts.		×			×					×	
fruhstorferi Mlldff.		×			×					×	
nubigena Mlldff.		×		×		×			×		×
wuellerstorfi Zel.											
Hemiphaedusa											
excurrens Marts.		×									

TABLE B

	Java and adjacent islands				Sumatra and adjacent islands						Nicobar Islands			Malay Peninsula		Borneo and adjacent islands			Celebes and adjacent islands			Sangihe and Talaud Archipelago				Philippines	Moluccas		Lesser Sunda islands		
	Madura	Nusa Barung	Nusa Kambangan	Java	Sebesi	Sumatra	Mentawei Ids	Batu Ids	Siinalur		Gr. Nicobar	Nancowri	Camorta	Malay Penins.	Penang	Borneo	Laut	Sulu	Celebes	Salayar	Kabaena	Sangihe	Karakelang	Talaud	Palmas	Siquijor	Halmahera	Ternate	Sumbawa	Flores	Timor
Phaedusa																														
c. corticina Pfr.	×			×		×																								
c. batuensis n.subsp.								×																						
c. nicobarica Gude											×		×																	
borneensis Pfr.																×														
dorsoplicata n.sp.																×														
pahangensis Laidlaw														×																
lucens n.sp.														×																
f. filicostata Stol.															×															
f. tenuicosta Nevill														×	×															
f. compressa n.subsp.														×																
f. kapayanensis de Morgan														×																
f. musangensis n.subsp.														×																
f. filialis Marts.																×														
kelantanensis Sykes														×																
Pseudonenia																														
javana Pfr.	×	×	×	×																										
o. obesa Marts.					×	×																								
o. salacana Bttg.				×		×																								
aenigmatica Sykes						×																								
gracilenta n.nom.						×																								
scalariformis n.sp.																×														
suluana Mlldff.																		×												
sumatrana Marts.						×																								
p. penangensis Stol.														×	×															
p. orites Laidlaw														×																
abbreviata Marts.						×																								
vicaria Bttg.						×																								
brachyptycta n.sp.						×																								
mentaweiensis Ehrmann							×																							
jacobsoni n.sp.									×																					
johorensis Tomlin														×																
Euphaedusa																														
c. cumingiana Pfr.																										×				
c. moluccensis Marts.																			×			×	×	×	×		×	×		
c. simillima Smith																			×	×	×								×	×
c. recondita Sykes																														
alternata Mlldff.																			×											
Paraphaedusa																														
subpolita Smith																			×											
celebensis Smith																			×											
u. usitata Smith																			×											
u. tjambensis Ehrmann																			×											
bonthainensis Sar.																			×											
minahassae Sar.																			×											
makassarensis Sykes																			×											
pyrrha Sykes																			×											
schwaneri Marts.																×	×													
Acrophaedusa																														
cornea Phil.	×	×		×																										
thrausta n.sp.						×																								
orientalis Pfr.				×																										
junghuhni Phil.				×		×																								
schepmani Mlldff.				×																										
alticola Marts.						×																								
fruhstorferi Mlldff.				×																										
nubigena Mlldff.				×																										
wuellerstorfi Zel.												×	×																	
Hemiphaedusa																														
excurrens Marts.						×																								

G. Distribution and Zoogeography.

The difficulty that only positive data are of value, also applies to the data on the distribution of the species over the islands.

It is true that serious collectors have been at work in many islands. On the other hand, however, the absence of records on *Phaedusinae* is no proof that these snails do not actually occur. *Clausiliidae* are small and they mostly live concealed, so that they are easily overlooked. Moreover they occur almost exclusively in hilly or mountainous country. Usually important material is only collected by specialized collectors intent on finding these particular snails, who moreover had the opportunity to make long collecting-trips.

West Java is the best-known part, because it is near Bogor (Buitenzorg), the centre for natural science. This may explain, why from West Java 9 species of *Clausiliidae* are known, from Central Java none and from East Java one, which also occurs in West Java. From Madura, north of East Java, 3 species are known, and from Nusa Barung 2; from Nusa Kambangan (south of Central Java) we know 1 species.

Giving a survey of our present knowledge of the distribution of the *Clausiliidae* in the Indo-Australian Archipelago, we should keep in mind that many gaps are still to be bridged in our knowledge of this subject.

Table B gives the distribution of the species and subspecies over the islands.

This table proves that two clearly defined areas can be indicated in the Indo-Australian Archipelago, in which *Clausiliidae* occur, viz.

1. the Malay Peninsula, the Nicobars and the Greater Sunda Islands (Java, Sumatra and Borneo), except Celebes, i.e. the islands of the Sunda shelf.
2. the Philippines, Celebes, the Moluccas and the Lesser Sunda Islands, Sumbawa, Flores and Timor, i.e. the islands between the Sunda and the Sahul shelf.

In the area mentioned under 1. we find the species belonging to the genera *Phaedusa, Pseudonenia, Acrophaedusa* and *Hemiphaedusa*. In the area mentioned under 2. *Euphaedusa* and *Paraphaedusa*. There is only one exception, viz. *Paraphaedusa schwaneri*, which crosses the frontier and is found in Eastern Borneo also.

From New Guinea and the surrounding islands, the islands of the Sahul shelf, no *Clausiliidae* are known up to now. The most eastern record is from Halmahera, where *Eu. cumingiana moluccensis* is found.

The *Clausiliidae* from the Indo-Australian area are certainly all of Asiatic origin, but it seems that they did not all reach the islands by the same way. The genera mentioned above as occurring on the Sunda shelf, also include species occurring in Further India or their closest relations are to be found in Further India. The species of these genera certainly reached the archipelago from the north-west. The species of the two genera occurring in Celebes have their closest relations in China; they must have reached the archipelago via the Philippines, from the north-east.

Sunda Shelf.

Java and adjacent islands. We know a total number of 9 species and subspecies (*Phaedusa* 1, *Pseudonenia* 2 and *Acrophaedusa* 6), which all occur in hilly and mountainous country.[1]) As has been mentioned above these species are mainly found in West Java only. The 3 species of Madura also occur in West Java. Of these species 2 also occur in Sumatra (*Ph. corticina, A. junghuhni*) and a third (*Ps. obesa salacana*) is represented in Sumatra by another subspecies (*Ps. o. obesa*).

All the genera that occur in Java, are also found in Sumatra.

Sumatra and adjacent islands. Sumatra itself has 12 species and subspecies, belonging to 4 genera (*Phaedusa* 1, *Pseudonenia* 7, *Acrophaedusa* 3 and *Hemiphaedusa* 1), all hill- and mountain-dwellers. One genus, *Hemiphaedusa*, is only represented by one species here and does not occur in other parts of the archipelago. With Java it shares 3 genera, with the Nicobars 2 (*Phaedusa* and *Acrophaedusa*), with the Malay Peninsula and Borneo each 2 (*Phaedusa* and *Pseudonenia*). As has been mentioned before, Sumatra has 2 species that also occur in Java and it possesses one closely related subspecies. With the Nicobars it also shares a species, but also in this case we have to do with another subspecies (*Ph. corticina nicobarica*). It does not share species with any of the other islands, but the relationship between some species of *Pseudonenia* from Sumatra and the Malay Peninsula is very close (*Ps. abbreviata* and *Ps. penangensis*).

Nearly all the species are confined to the central mountain-range, the Barisan Mountains.

Sebesi Island, situated between Java and Sumatra as an ideal stepping-stone, has only yielded one species up till now, a Sumatran one (*Ps. o. obesa*).

The chain of islands west of Sumatra only yields two species and one subspecies of a species occurring in Sumatra. From the Mentawei Islands *Ps. mentaweiensis* is probably a subspecies of *Ps. abbreviata*. From the Batu Islands we know the subspecies *Ph. corticina batuensis* and from Simalur *Ps. jacobsoni*, a species with a very peculiar character.

So the three islands or groups of islands each have a form of their own, the two southernmost each a form closely related to Sumatran species; the northernmost its own particular species. This independent position of the fauna of Simalur also expresses itself in other animal groups, like the faunae of the Mentawei and Batu Islands express their closer resemblance with the fauna of Sumatra. So these islands, considered as a whole, agree with Java, Sumatra and the Nicobars in the common possession of a subspecies of *Ph. corticina*.

Nicobar Islands. From these islands we know 2 species belonging to 2 genera (*Phaedusa* and *Acrophaedusa*). With regards to the

[1]) VAN HASSELT (1824) recorded *Clausilia javanica*, but as he did not publish a description or a picture, the name is a nomen nudum. We do not even know what Javanese species he meant.

Clausiliidae, they only form an extension of Sumatra and Java, as *Phaedusa corticina* is represented here by a subspecies and the genus *Acrophaedusa* is confined to these three islands or groups of islands. As the Andamans have not with any certainty yielded *Clausiliidae* up to now [1]), the suggestion is obvious that the Nicobars received these *Phaedusinae* via Sumatra.

Malay Peninsula. 11 species and subspecies are found here, belonging to 2 genera (*Phaedusa* 8 and *Pseudonenia* 3). All but probably one, are hill- or mountain-dwellers. There is a close relationship with Borneo, which possesses a race of the typical Malayan species *Ph. filicostata* and with Sumatra of which the species *Ps. abbreviata* is closely related to *Ps. penangensis* of the Peninsula. In both islands, moreover, species occur, belonging to genera also found in the Malay Peninsula.

The geographical structure of the peninsula gives rise to a few remarks.

In the first place the area which I studied is limited in the north by the Isthmus of Kra, a barrier which plays a part in zoogeography. For a long time a creek or even the sea must have prevented, partly or entirely, any normal exchange of dryland fauna between north and south. The two genera of *Clausiliidae* we know in the Peninsula also occur in Further India. The sectio *Phaedusa*, however, reaches its northern limit on the Isthmus. For species of the genus *Pseudonenia* there is a less distinct boundary. The species *Ps. insignis* from Burma is related to *Ps. penangensis*.

Secondly the peninsula itself, south of the isthmus, has some very interesting features. Centrally, from north-west to far in the south-east, it is divided into a western and an eastern part by a mountain ridge. In both parts, but especially east of this ridge we find a plain, from which scattered isolated hill- or mountain-groups rise (TWEEDIE, 1947 ; LAIDLAW, 1949 ; VAN BENTHEM JUTTING, 1950, 1952). These isolated "knolls" mainly consist of limestone, they resemble lime-islands in a sea of non-calciferous lowland. On these lime-islands we find a rich fauna of snails. The localities of the *Clausiliidae* are outside the central mountain ridge even mostly confined to these "knolls". The isolated situation of the limestone hills is favourable for the development of new races and species. Consequently in some families and genera of Gastropods each "knoll" has its own subspecies or species.

In the *Clausiliidae* the evolutional splitting of species seems to have progressed less far than in other families (e.g. *Vertiginidae*, *Opisthostoma*). In the section *Phaedusa* the structure of the shells suggests the following possible development. In the beginning there was one species of *Phaedusa* in the Malay Peninsula which spread over practically the whole area. This area by erosion fell apart into first large, afterwards smaller limestone-islands. Depending on the duration of isolation and the ability of the isolated populations to develop (mutable periods), subspecies or species could arise. Thus

[1]) There is but one dubious record (p. 88).

possibly *Ph. pahangensis* and *lucens* first split off, while the original form developed into a form related to *Ph. filicostata*. A number of isolated populations of this original species developed independently into *Ph. kelantanensis* and the subspecies of *Ph. filicostata* (*compressa, kapayanensis* and *musangensis*). Most characters of the original species have probably been preserved in the subspecies *Ph. f. tenuicosta*, a variable form which is distributed over the whole range of the central pensinula.

The mountain ridge from north to south seems to have no importance as a barrier for the distribution of mountain-dwellers, as the *Clausiliidae* are ; only *Ph. kelantanensis* occurs mainly in the eastern area, where it is not confined to a few tops.

Where, as on Mount Charas an endemic species like *Ph. lucens* is found side by side with *Ph. filicostata tenuicosta*, we must conclude to a later invasion by the latter. I have not found any transitions between the two forms in the fairly large material.

Borneo. From this island a total number of 5 species and subspecies is known (*Phaedusa* 3, *Pseudonenia* 1, *Paraphaedusa* 1); all are hill- or mountain-dwellers. One of the *Phaedusa*-species is the subspecies *filicostata filialis*, which proves relationship with the Malay Peninsula forms. This subspecies which hardly differs from the Malayan ones, induces me to suppose that these *Clausiliidae* change only very slowly, at least much more slowly than other groups of snails.

The occurrence of a special *Paraphaedusa*-species (*schwaneri*) in Borneo indicates a relationship with the fauna of Celebes, to which *Paraphaedusa* is confined. Apparently it is not very plausible that Borneo received this species directly from Celebes. But yet, according to my opinion, the occurrence in Eastern Borneo and Laut Island is more of an argument in favour of an accidental passive spreading from South Celebes, which is very rich in *Paraphaedusa*-species, than of one in favour of a migration into both islands from the Philippines. Neither from the Philippines, nor from the islands in between, nor from Java, this genus is known, while in Northern Celebes (Minahassa) only one species occurs. Moreover the relationship with some species from South Celebes (e.g. *usitata*) is strikingly close. If the development of *P. schwaneri* in Borneo were an independent one, the ancestors having entered Borneo from the North, this resemblance would be very peculair indeed.

If one supposes the spreading to have been accidental, e.g. on drift-wood, the settlement must date rather far back for the species is spread over the whole eastern part of Borneo and over Laut Island. Apparently it had the opportunity to develop into a separate species.

From South-Western Borneo no *Clausiliidae* are known.

Sulu Islands. From this chain of islands connecting Borneo with the Philippines (Mindanao) I only know 1 species (*Ps. suluana*). Besides this species COOKE (1915) mentioned *Eu. cumingiana* and *Eu. c.* var. *moluccensis*. Where he found these recorded he did not

mention. As his survey contains several incorrect data, I hesitate to adopt his information.

Islands between the Sunda Shelf and the Sahul Shelf.

Celebes. From Celebes which is much better known than Borneo, we know 11 species and subspecies of *Clausiliidae* (*Euphaedusa* 3, *Paraphaedusa* 8), most of them hill- or mountain-dwellers. With the Philippines, the North Moluccas and some of the Lesser Sunda Islands Celebes shares the *Euphaedusae*, but as regards its wealth of *Paraphaedusae*, it is quite unique. As we saw before, only Borneo possesses another species of this genus.

No doubt Celebes received its *Euphaedusae* via the Philippines as they also occur in the interjacent Sangihe and Talaud Archipelago, *Euphaedusae* have not yet been found in Borneo.

Sangihe and Talaud Archipelago. Only one subspecies of *Euphaedusa* (*Eu. cumingiana moluccensis*) is quite common in these islands. The islands form the link between the Philippines and Celebes, thus indicating *Euphaedusa*'s migration to the South.

Philippines. *Euphaedusa* occurs in Siquijor, also in one subspecies, living in the lowland (*Eu. c. cumingiana*). No *Clausiliidae* have been recorded from Mindanao as yet. The northern Philippines I leave out of consideration.

North Moluccas. *Eu. cumingiana moluccensis* is recorded from Halmahera and Ternate, it is a subspecies that sometimes occurs in lowland. This most eastern outpost of the *Clausiliidae* must have come either directly from the Philippines or via Celebes. P. & F. SARASIN considered the direct way unlikely. They assumed that the North Moluccas could only have got these fauna elements from the Philippines via the Sula Islands and Celebes.

They rejected also a direct contact with Celebes (BOETTGER's assumption). An argument against their opinion is the fact that never any *Clausiliidae* have been found in the Sula Islands.

Lesser Sunda Islands. From Sumbawa, Flores and Timor a subspecies of *Euphaedusa* is known, viz. *Eu. cumingiana recondita*, a mountain-dweller. It is fairly sure that this subspecies must have reached these islands from Celebes via Saleyer. That this snail should have come via Java seems not very likely, as no *Euphaedusae* are recorded from Java, Bali and Lombok.

It is a striking fact that of the rich fauna of *Paraphaedusae* found in Celebes, not one species has accompanied the genus *Euphaedusa* on its way towards the south (Saleyer or even Flores) and the east (Halmahera, Ternate).

One might be inclined to wonder, whether the *Paraphaedusae* were not yet present in Celebes at the time of the emigration of Euphaedusoid forms and whether their development perhaps started later. In view of the variation *Paraphaedusa* has already reached, it

seems preferable to date the origin of the different forms of *Paraphaedusa* before that emigration, otherwise the *Euphaedusa* in Flores would have differed in many more respects from the original form (*cumingiana*) during the time that *Paraphaedusa* developed into 8 species. But the close relationship of *Eu. c. recondita* with *c. cumingiana* is beyond dispute. So we shall have to assume that at the time of a possible land-connection between Celebes and the South, the *Paraphaedusae* were already present in Celebes. That *Paraphaedusa* did not use the supposed landconnection, while *Euphaedusa* did, may be explained by the preference of *Paraphaedusa*-species for hilly and mountainous country, while the *Euphaedusa*-subspecies are also found in lowland. Consequently this depended on the nature of the landconnection.
That *Eu. c. recondita* is now found in the mountains of Flores and Sumbawa, does not make this assumption inacceptable.

The foregoing survey proves that the data on the distribution of the Clausiliidae in the Indo-Australian area agree with the facts already known of other animal groups (cf. DE BEAUFORT, 1926, 1943).

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SAMENVATTING.

Toen ik deze studie begon was het mijn bedoeling de verspreiding van de *Clausiliidae* over de Indo-Australische Archipel te toetsen aan de van andere diergroepen bekende zoögeographische gegevens. Al spoedig bleek echter, dat eerst een systematische bewerking noodzakelijk zou zijn om als basis voor verder onderzoek te kunnen dienen. Mijn doelstelling is dus gewijzigd in : het geven van een zo volledig mogelijk overzicht van de in de Indo-Australische Archipel voorkomende *Clausiliidae*, gebaseerd op literatuur-gegevens, museum-materiaal en recente, mede op mijn verzoek gedane vondsten. De thans uit de bewerking ter beschikking gekomen zoögeographische gegevens zijn helaas beneden mijn verwachting gebleven. Daardoor valt de klemtoon van deze studie meer op de systematiek, waarbij vele nieuwe gegevens op het gebied van morphologie, anatomie en biologie aan het licht kwamen. Indien iedere verzamelaar van het bestudeerde materiaal zijn vondsten echter volledig had geëtiketteerd, waren nog veel meer bijzonderheden bekend geworden en waren die vondsten veel waardevoller geweest.

Hieronder volgt een korte uiteenzetting van wat in de opeenvolgende hoofdstukken behandeld wordt.

HOOFDSTUK I bevat een inleiding over de begrenzing van het onderzoek en vermeldt tevens van welke musea en particulieren materiaal voor studie is verkregen. De soorten van de familia *Clausiliidae*, die in de Indo-Australische Archipel voorkomen behoren alle tot de subfamilia *Phaedusinae*, die in hoofdzaak over Oost-Azië is verspreid. Het bestudeerde gebied omvat de Maleise Archipel met inbegrip van het schiereiland Malakka en de Philippijnen.

HOOFDSTUK II geeft een overzicht van de *Phaedusinae* ; men vindt er algemene gegevens over het voorkomen, over het uiterlijk van de slak, over de bouw van de schelp en over de anatomie van de voor de systematiek belangrijke organen. Er blijkt uit, dat de dieren vooral in heuvel- en bergland voorkomen, dat de spoelvormige tot penvormige schelp zeer ingewikkeld van bouw is en steeds kan worden afgesloten door middel van een sluitplaatje, dat in de laatste winding als een deur heen en weer kan bewegen.

Verder worden de radula en de ingewikkeld gebouwde genitaal-organen beschreven. De slakken zijn hermaphrodiet, het is echter niet zeker of wederzijdse bevruchting plaats vindt. Ze leggen eieren of brengen jongen ter wereld, die reeds een schelpje met 2 tot 3 windingen bezitten.

HOOFDSTUK III geeft een overzicht van de geschiedenis van de studie van de Zuidoost-Aziatische *Phaedusinae*. Daaruit blijkt, dat tot nu toe eigenlijk alleen aandacht aan de bouw van de schelpen, aan de systematiek en aan de verspreiding is besteed. Slechts in uitzonderingsgevallen vindt men bij de vroegere auteurs iets over de anatomie van een slak-

kensoort (3 x) of over het biotoop vermeld. De morphologie van de schelpen treft men in hoofdzaak aan in de vorm van onvolledige soortbeschrijvingen. Veelal zijn de inwendige bouw van de schelp en het clausilium niet beschreven.

HOOFDSTUK IV behandelt het systematische gedeelte en begint met een opsomming van de 54 in het gebied aangetroffen soorten en ondersoorten, verdeeld over 6 genera. Negen soorten of ondersoorten zijn door mij voor het eerst beschreven.

Vervolgens vindt men een determinatie-tabel tot de genera en daarna worden de genera met de ertoe behorende soorten behandeld.

De behandeling van een genus begint steeds met de karakteristiek en met een determinatie-tabel tot de soorten. Daarna wordt soort voor soort volledig beschreven. Hierbij heeft in de meeste gevallen het holotype als uitgangspunt voor de beschrijving kunnen dienen. Ik heb tekeningen gemaakt van bijna alle soorten en ondersoorten, zoveel mogelijk naar de holotypen. Na de morphologische beschrijving van de schelp volgt een kort overzicht van de gepubliceerde gegevens op dit gebied.

Daarna wordt zoo mogelijk de anatomie behandeld en vervolgens de verspreiding aan de hand van literatuurgegevens. Tenslotte worden alle door mij bestudeerde monsters, welke van behoorlijke vindplaatsgegevens voorzien waren, genoemd met opgave van minimum en maximum afmetingen en van de gemiddelden.

Dit hoofdstuk geeft dus een volledig overzicht van het bestudeerde materiaal in al zijn facetten.

HOOFDSTUK V vat de in het vorige hoofdstuk verkregen gegevens samen. In de eerste plaats wordt in een systematisch gedeelte de huidige opvatting over de systematiek der Indo-Australische *Phaedusinae* uiteengezet. Daarna geef ik aan welke wijzigingen door mij in het door THIELE gepubliceerde systeem noodzakelijk worden geacht. Dit betreft in hoofdzaak twee punten, nl. 1. *Acrophaedusa* (type *A. cornea* PHIL.), behoort niet als subgenus onder *Hemiphaedusa* en 2. *Phaedusa* (type *Ph. corticina* PFR.) en *Pseudonenia* (type *Ps. javana* PFR.) zijn niet synonym, doch duidelijk te scheiden genera.

In het bestudeerde gebied komen vertegenwoordigers voor van de volgende 6 genera : *Phaedusa, Pseudonenia, Euphaedusa, Paraphaedusa, Acrophaedusa* en *Hemiphaedusa*.

Voor het combineren van deze genera tot groepen van hoger orde acht ik de tijd nog niet gekomen.

Vervolgens worden de voor de systematiek meest belangrijke kenmerken genoemd en hun aanwezigheid in de zes genera wordt besproken. Hierbij is bij de morphologische kenmerken vooral aandacht besteed aan de inwendige bouw van de schelpen, d.w.z. aan de lamellae, plicae en aan het clausilium. Voorts worden enige anatomische en biologische eigenschappen behandeld ; tot nu toe was daarover bijna niets bekend.

Een korte bespreking van de genera en de daartoe behorende soorten sluit hierbij aan.

Vervolgens eist de oecologie van de soorten de aandacht.

De gegevens op dit gebied zijn nog steeds zeer onvolledig, ook al heb ik het aantal bekende feiten bijna kunnen verdubbelen. Men vindt onder

de aanwezige soorten zowel bodembewoners als boombewoners.

Tenslotte wordt de verspreiding behandeld. Tabel I geeft de verspreiding van de soorten en ondersoorten over de eilanden aan. Daaruit blijkt, dat vier genera (*Phaedusa, Pseudonenia, Acrophaedusa* en *Hemiphaedusa*) binnen het bestudeerde gebied gebonden zijn aan het Sunda-plat, terwijl de twee andere genera (*Euphaedusa* en *Paraphaedusa*) in hoofdzaak beperkt zijn tot de eilanden tussen het Sunda- en het Sahul-plat. De soorten, die op het Sunda-plat voorkomen, hebben hun naaste verwanten in Achter-Indië, zodat de immigratie wel van daaruit moet hebben plaats gehad. De soorten van de beide andere genera hebben hun naaste verwanten in China, zij moeten de Archipel wel via de Philippijnen hebben bereikt.

De zoögeographische conclusies, verkregen uit de verspreiding van de Clausiliidae over het Indo-Australische gebied, ondersteunen in het algemeen de bestaande, op andere diergroepen gebaseerde opvattingen.

INDEX

(GENERA, SUBGENERA, SECTIONES, SPECIES, SUBSPECIES AND VARIETIES)[1])

[1]) Non-Malaysian genera, subgenera, etc., are not recorded here. The first pages of the descriptions have been printed in bold type.

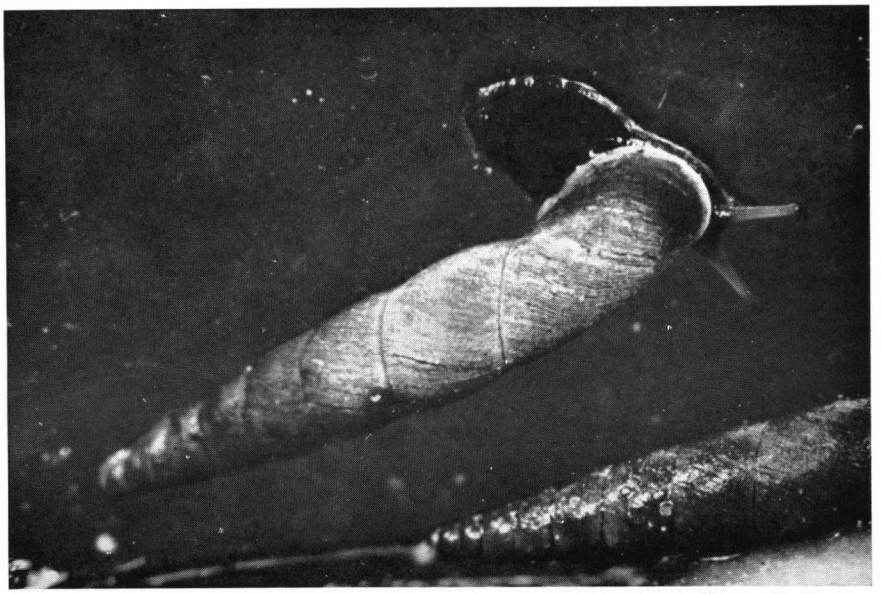


Photo D. LINDNER

Photo 1. *Phaedusa corticina* (PFR.), creeping (enlarged).

Photo Dr. M. A. LIEFTINCK

Photo 2. Habitat of *Ph. corticina* (PFR.); *Eugenia malaccensis* L. (djambu tree) at "Tjisarua-Zuid" Estate, 1000 m alt.; Northern slope of Mount Pangrango.

Photo N. J. A. LEENARTS

Photo 3. *Pseudonenia javana* (PFR.), creeping (enlarged).

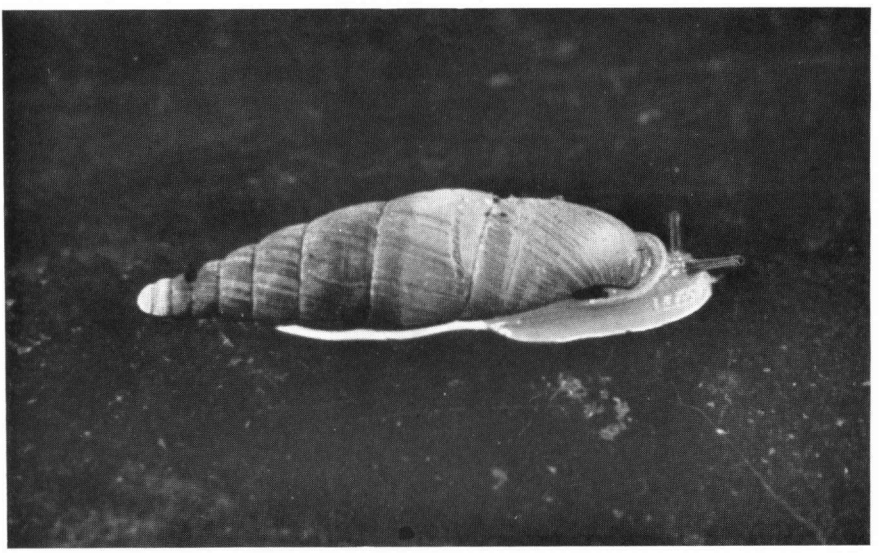
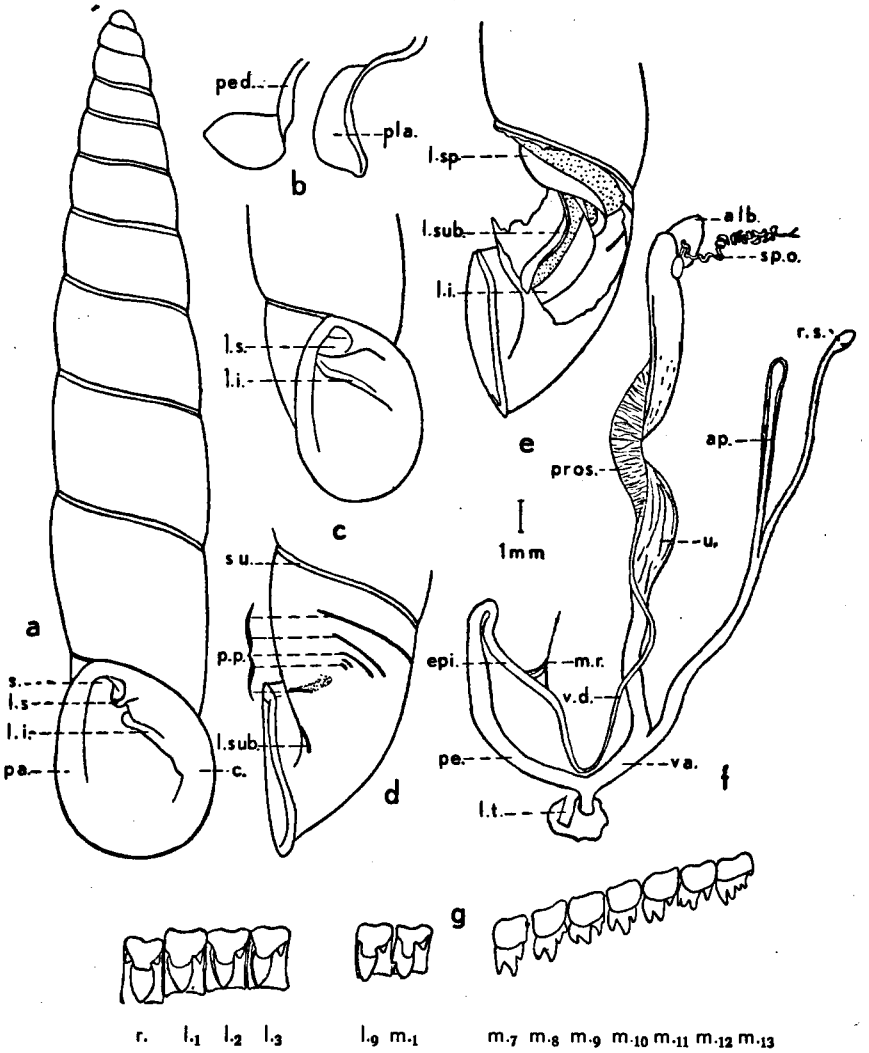


Photo D. LINDNER

Photo 4. *Acrophaedusa junghuhni* (PHIL.), creeping (enlarged).

PLATE I.



a. shell of *Phaedusa corticina* (PFR.), ventral side.
s. = sinulus ; l.s. = lamella superior ; l.i. = lamella inferior ; pa. = palatal or outer margin of the aperture ; c. = columellar margin.

b. two views of the clausilium.
ped. = pedicle ; pla. = plate.

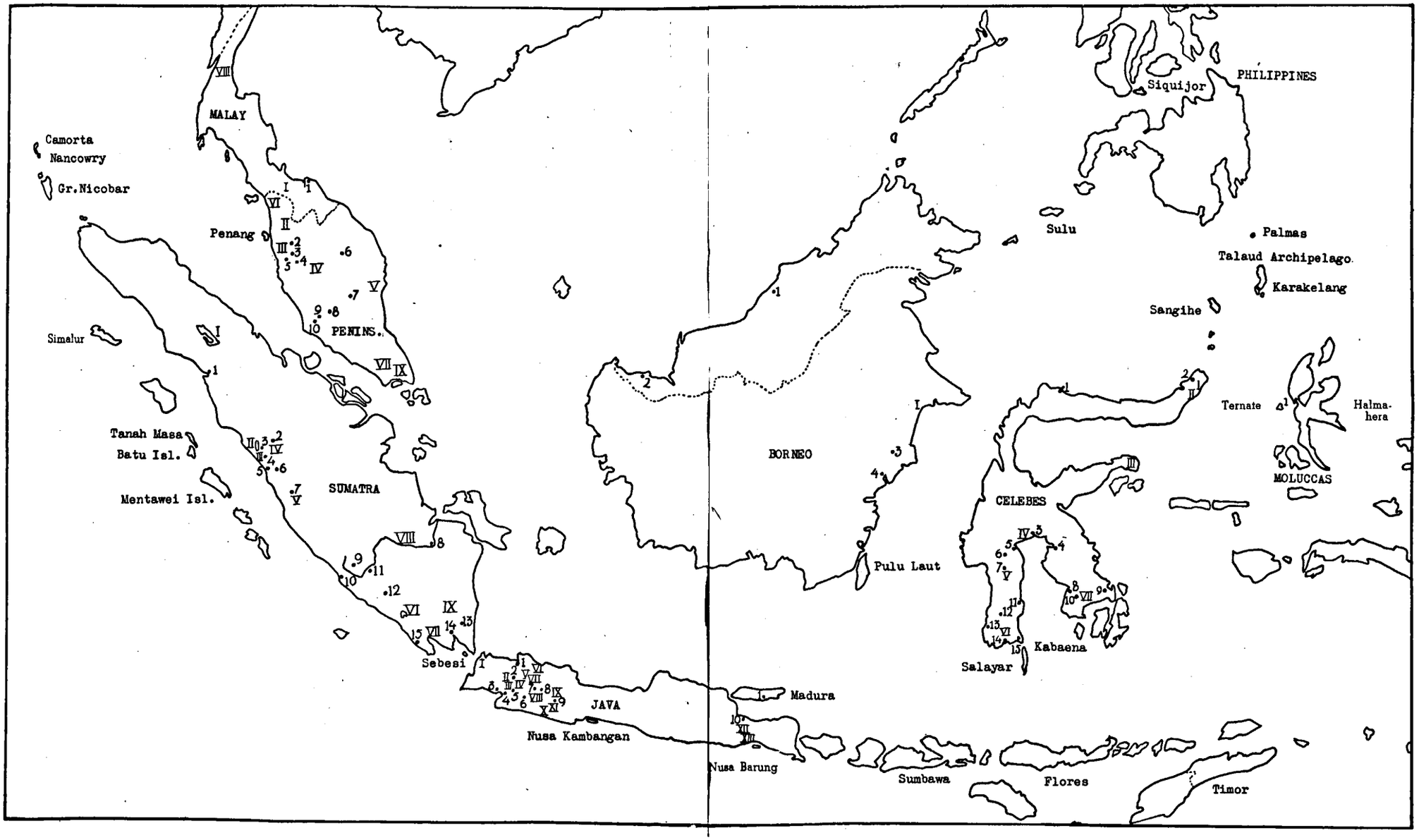
c. last whorl of the shell, lateroventral-left side.
l.s. = lamella superior ; l.i. = lamella inferior.

d. last whorl of the shell, right side.
su. = suture and thread along the suture ; p.p. = plicae palatales, seen through the shell, the upper, long one is the principalis ; l.sub. = lamella subcolumellaris.

e. last whorl of the shell, right side, the palatal wall with the plicae has been broken away ; view of the inner structure, the clausilium has been omitted.
l.sp. = lamella spiralis ; l.sub. = lamella subcolumellaris ; l.i. = lamella inferior.

f. reproductive organs.
pe. = penis ; epi. = epiphallus ; m.r. = musculus retractor penis ; v.d. = vas deferens ; pros. = prostate gland ; alb. = albuminous gland ; sp.o. = spermoviduct ; u. = uterus ; r.s. = receptaculum seminis ; ap. = appendix or diverticulum to the duct of the receptaculum seminis ; va. = vagina ; l.t. = the end of the left upper tentacle.

g. some elements of the radula (390 × enlarged).
r. = rhachidian tooth ; l_1 — l_9 = lateral teeth ; m_1 — m_{13} = marginal teeth.


MALAY
Camorta
Nancowry
Gr.Nicobar
Penang
PENINS.
Simalur
Tanah Masa
Batu Isl.
Mentawei Isl.
SUMATRA
Sebesi
JAVA
Nusa Kambangan
Madura
Nusa Barung
Sumbawa
Flores
Timor
BORNEO
Pulu Laut
Siquijor
PHILIPPINES
Sulu
Palmas
Talaud Archipelago
Karakelang
Sangihe
Ternate
Halma-
hera
MOLUCCAS
CELEBES
Kabaena
Salayar

SKETCHMAP OF THE INDO-AUSTRALIAN ARCHIPELAGO AND THE MALAY PENINSULA, INDICATING THE LOCALITIES MENTIONED IN THE TEXT

Malay Peninsula
1. Patani
2. Lenggong
3. Kuala Kangsar
4. Ipoh
5. Padang Rengas
6. Gua Musang
7. Kota Tongkat & Kota Gelanggi
8. Bentong
9. Genting Sempak
10. Batu Caves
    - I. Mount Besar
    - II. Mount Baling
    - III. Larut Hills
    - IV. Cameron Highlands
    - V. Mount Charas & Mount Panching
    - VI. Perlis
    - VII. Johore
    - VIII. Isthmus of Kra
    - IX. Mount Panti

Sumatra
1. Tapanuli
2. Pajakombo
3. Fort de Kock
4. Padang Pandjang
5. Padang
6. Solok
7. Muara Labu
8. Palembang
9. Kepahiang
10. Benkulen
11. Tebing Tinggi
12. Lahat
13. Sukadana
14. Telokbetong
15. Marang
    - I. Lake Toba
    - II. Lake Manindjau
    - III. Mount Singgalang
    - IV. Mount Sago
    - V. Mount Kerintji
    - VI. Lake Ranau
    - VII. Mount Tanggamus
    - VIII. River Musi
    - IX. Lampong Districts

Java
1. Djakarta (Batavia)
2. Bogor (Buitenzorg)
3. Tjisolok
4. Palabuan
5. Sukabumi
6. Sukanegara
7. Padalarang
8. Bandung
9. Garut
10. Pasuruan
    - I. Mount Karang
    - II. Mount Salak
    - III. Mount Pangrango
    - IV. Mount Gedeh
    - V. Mount Pantjar
    - VI. Mount Tangkuban Prahu
    - VII. Mount Burangrang
    - VIII. Mount Malabar
    - IX. Mount Guntur
    - X. Mount Papandajan
    - XI. Mount Tjikoraj
    - XII. Mount Tengger
    - XIII. Mount Smeru

Madura
1. Pamekasan

Borneo
1. Niah
2. Kuching
3. Tenggarong
4. Balik Papan
    - I. Mount Sekerat

Celebes
1. Kandi
2. Menado
3. Birue
4. Ussu
5. Palopo
6. Makale
7. Kalossi
8. Kolaka
9. Kendari
10. Mendoke
11. Boni
12. Malawa (Bowonglangi)
13. Makassar
14. Bonthain
15. Bira
    - I. Mount Klabat
    - II. Mount Soputan
    - III. Balante
    - IV. Luwu
    - V. Lamontjong Mountains
    - VI. Mount Lompobatang
    - VII. Rumbi

Halmahera
1. Dodinga