

SYSTEMATIC STUDIES ON THE NON-MARINE MOLLUSCA OF THE INDO-AUSTRALIAN ARCHIPELAGO

published by

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II. Critical Revision of the Javanese Pulmonate Land-shells of the Families *Helicarionidae*, *Pleurodontidae*, *Fruticicolidae* and *Streptaxidae*

by

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The four families treated below²⁾ contain shells of various sizes (smallest species: *Kaliella fimbriosa* with maximum diameter 2.2 mm, largest: *Amphidromus javanicus* with maximum height 67 mm, or *Hemiplecta humphreysiana* with maximum breadth 55 mm) and various forms (turreted as *Amphidromus*, globular like *Bradybaena*, flat as *Landouria*, or even fingernail-shaped as in *Parmarion*). Most of the species are dextral, except those in the genera *Dyakia* and *Pseudopartula* which are always sinistral, and in *Amphidromus*, in which there is a more or less constant proportion of lefthanded and righthanded individuals in each species.

These families form part of the subclass *Pulmonata*, a large group of snails mainly terrestrial in habit. Their chief characteristic is that they do not breathe by means of a gill, like the *Prosobranchia*, but through a vacuolarised part of the mantle cavity which acts as a "lung".

Another peculiarity of the Pulmonates is the absence of an operculum, i.e. the lid with which the Prosobranch snails, when retracting, can close their shell. Instead of an operculum the Pulmonates occasionally produce a temporary cover, the epiphragma, behind which the animal can retract during unfavourable climatic conditions (drought, heat). This epiphragma is a calcareous secretion of the mantle edge. It is shed entirely when the bad spell is over. Hence the epiphragma does not form a permanent part of the snail's body like the operculum of the Prosobranchs.

The four families treated in the present report belong to the Order

¹⁾ The author of the paper and the editors of "Treubia" are very much indebted to the "Zoologisch Insulinde Fonds" for a grant by which the illustration of this article is made possible.

²⁾ The first part of these "Systematic Studies" appeared in *Treubia*, 19, 1948, p. 539-604.

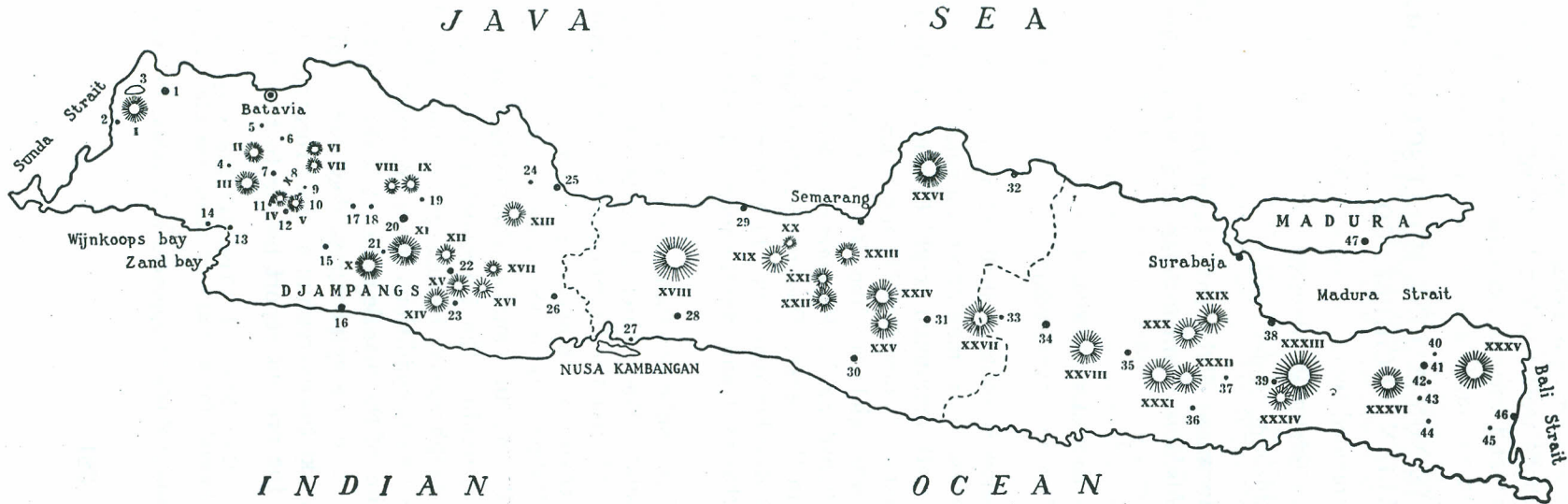


Fig. 1. Sketch map of the Island of Java, indicating the localities mentioned in the text. Roman figures denote mountains, arabic figures all other locations.

- | | | | | | |
|--------------------|-----------------|-----------------|------------------------|-----------------|----------------|
| I. Karang | XV. Tjikorai | XXIX. Welirang | 7. Buitenzorg | 21. Tjiwidej | 35. Kediri |
| II. Mount Tjibodas | XVI. Galunggung | XXX. Ardjuno | 8. Puntjak Pass | 22. Garut | 36. Wlingi |
| III. Salak | XVII. Sawal | XXXI. Kelut | 9. Sindanglaya | 23. Tjikadjang | 37. Malang |
| IV. Pangerango | XVIII. Slamet | XXXII. Kawi | 10. Tjibodas | 24. Palimanan | 38. Pasuruan |
| V. Gedeh | XIX. Dieng | XXXIII. Tengger | 11. Tjibadak | 25. Cheribon | 39. Nongkodjar |
| VI. Pantjar | XX. Prah | XXXIV. Smeru | 12. Sukabumi | 26. Bandjar | 40. Wonosobo |
| VII. Paniisan | XXI. Sindoro | XXXV. Jang | 13. Palabuan | 27. Tjilatjap | 41. Bondowoso |
| VIII. Burangrang | XXII. Sumbing | XXXVI. Idjen | 14. Tjisolak | 28. Banjumas | 42. Klakah |
| IX. Tangkuban Prah | XXIII. Ungaran | 1. Serang | 15. Sukanegara | 29. Pekalongan | 43. Kalisat |
| X. Patuha | XXIV. Merbabu | 2. Pasauran | 16. Sindangbarang laut | 30. Djokjakarta | 44. Mrawan |
| XI. Malabar | XXV. Merapi | 3. Lake Danau | 17. Radjamandala | 31. Surakarta | 45. Rogodjampi |
| XII. Guntur | XXVI. Muriah | 4. Leuwiliang | 18. Padalarang | 32. Rembang | 46. Banjuwangi |
| XIII. Tjiremei | XXVII. Lawu | 5. Kuripan | 19. Tjisarua | 33. Sarangan | 47. Pamekasan |
| XIV. Papandajan | XXVIII. Wilis | 6. Depok | 20. Bandung | | |

of *Stylommatophora*, i.e. they possess two pairs of tentacles (rhinophores), the upper pair being the largest. At the tips of these upper tentacles (ommato-phores) the eyes are implanted.

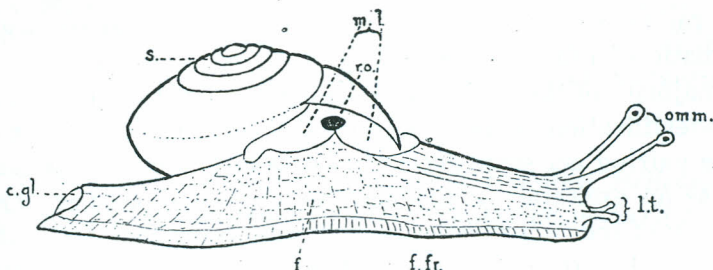


Fig. 2. Outline sketch of living Pulmonate: c. gl. caudal gland; f. foot; f. fr. foot fringe; lt. lower tentacles; m.l. mantle lobes; omm. ommatophores; r.o. respiratory orifice; s. shell. Author del.

All species possess a radula. The general features of this organ and its importance for the snail's subsistence, and — in another sense — for the scientific classification of the Gastropods, have been discussed in the first part of these "Systematic Studies".

In the Pulmonates the radula generally consists of numerous transverse rows of teeth. In each row there is one median tooth (the central or rhachis). On either side of this central tooth numerous laterals and marginals are symmetrically disposed. The radula formula is denoted as x.y.l.y.x. In various species, however, there is no sharp differentiation between laterals and marginals. Therefore they are sometimes named together latero-marginals. The radula formula is then most adequately

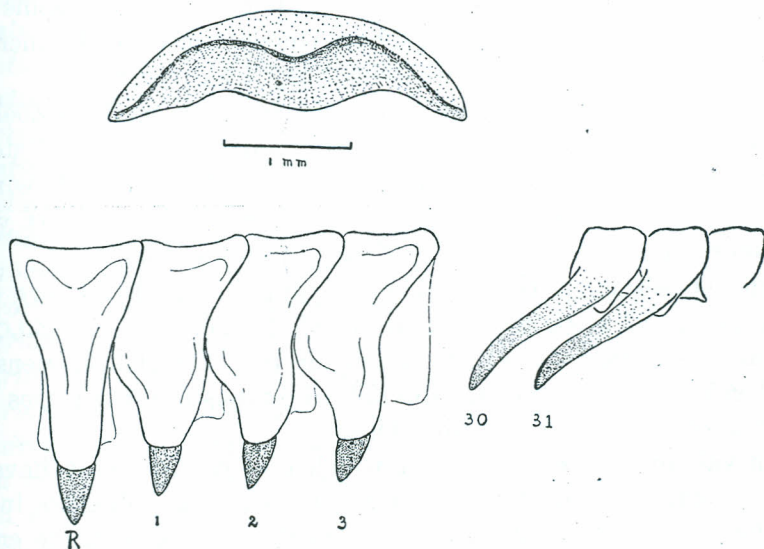


Fig. 3. *Elaphroconcha bataviana* (VON DEM BUSCH). Mandibula and radula elements. R. central or rhachis tooth. Author del.

designated as $\infty.1.\infty$. The cutting margin of each tooth can be provided with one or more denticles, of various form and position.

Over the tongue with the radula ribbon a curved chitinous jaw, or mandibula, is situated just behind the snail's lips.

Both radula and mandibula afford important clues for ascertaining the systematic affinities of the species.

The majority of the Pulmonates are hermaphroditic, but it is probable that cross-fertilisation is the usual mode of propagation. As an introduction of the pairing act some species shoot a calcareous "love dart" (gypsobelum) as an excitatory instrument, in the other partner's skin. After the launching of the dart this organ cannot be retracted, but is abandoned. A new dart is then formed in the dart sac, an elongate pouch close to the genital opening.

Reproduction takes place by oviposition or by ovovivipary. Unfortunately our knowledge of this part of the life history of the Javanese species is very deficient.

Most of the species live on the ground, in earth, under stones, among grass, moss and other low vegetation, or on moss- and algae-covered rocks. Only *Amphidromus* and *Pseudopartula* generally live on trees. The other genera are found crawling on leaves of shrubs and stems of trees only during damp weather.

Their diet consists of living plants, decaying vegetable matter, mould, or the algae covering the tree bark and the rocks. Of the two *Parmarion* species it is recorded that they take delight in swallowing latex of *Hevea brasiliensis* when it is tapped in the rubber plantations.

For the classification the well-known "Handbuch der systematischen Weichtierkunde" by J. THIELE (1929-1935) is followed, with some emendations based on modern research. These emendations will be mentioned in the discussion of the genera with which they are concerned.

The author is very much indebted to the authorities of the Zoologisch Museum of Buitenzorg, of the Rijksmuseum van Natuurlijke Historie at Leiden and of the Naturhistorisches Museum at Basle for allowing her free access to their collections and for the permission to insert various details concerning their Javanese mollusks in this report.

To the Direction of the Senckenberg Museum at Frankfurt on the Main, in the first place to the curator of Mollusca Dr A. ZILCH, my grateful acknowledgements are tendered for the loan of specimens from their malacological department, especially the types and paratypes of the MOELLENDORFF and BOETTGER collections.

Much valuable material without which this report would have been far more incomplete than it is now was received from collectors in Java.

Of the pre-war generation mention must be made of three eminent collectors: Jonkheer W. C. VAN HEURN, Zoologist of the Institute of Plant

Diseases and Pests, Rev. C. TH. CRIBB, British parson in Java and the late Dr E. R. JACOBSON, private naturalist.

Among the younger generation a special compliment is due to sergeant L. J. M. BUTOT and private F. WILLEMSSEN, both ardent naturalists, who — during their military service in Java — succeeded in collecting valuable material under most inconvenient and often dangerous circumstances.

**Systematic Account of the Pulmonate Families *Helicarionidae*,
Pleurodontidae, *Fruticicolidae* and *Streptaxidae*, occurring in Java**

Phylum Mollusca
Classis Gastropoda
Subclassis Pulmonata
Ordo Stylommatophora

Familia HELICARIONIDAE

- Coneuplecta bandongensis* (BOETTGER).
- Coneuplecta macrostoma* (MOELLENDORFF).
- Coneuplecta sitaliformis* (MOELLENDORFF).
- Liardetia acutiuscula* (MOELLENDORFF).
- Liardetia convexoconica* (MOELLENDORFF).
- Liardetia angigyra angigyra* (MOELLENDORFF).
- Liardetia viridula* (MOELLENDORFF).
- Liardetia densetorta* (MOELLENDORFF).
- Liardetia javana* (BOETTGER).
- Liardetia pisum* (MOELLENDORFF).
- Liardetia reticulata* n. sp.
- Liardetia platyconus* (MOELLENDORFF).
- Liardetia dendrophila* n. sp.
- Liardetia indifferens* (BOETTGER).
- Liardetia ambliia* (MOELLENDORFF).
- Liardetia doliolum* (PFEIFFER).
- Liardetia fimbriosa* (QUADRAS & MOELLENDORFF).
- Lamprocystis infans* (PFEIFFER).
- Lamprocystis gedeana* MOELLENDORFF.
- Helicarion albellus* MARTENS.
- Helicarion perfragilis* MOELLENDORFF.
- Helicarion lineolatus* MARTENS.
- Inozonites imitator* MOELLENDORFF.
- Dyakia rumphii* (VON DEM BUSCH).
- Dyakia clypeus* (MOUSSON).
- Elaphroconcha bataviana* (VON DEM BUSCH).
- Elaphroconcha javacensis* (FÉRUSAC).

- Elaphroconcha patens* (MARTENS).
Parmarion pupillaris HUMBERT.
Parmarion martensi SIMROTH.
Microparmarion austeni SIMROTH.
Microparmarion strubelli SIMROTH.
Hemiplecta humphreysiana (LEA).
Microcystina exigua (MOELLENDORFF).
Microcystina nana (MOELLENDORFF).
Microcystina gratilla n. sp.
Microcystina vitreiformis (MOELLENDORFF).
Microcystina fruhstorferi (MOELLENDORFF).
Microcystina subglobosa (MOELLENDORFF).
Microcystina circumlineata (MOELLENDORFF).
Durgella pusilla (MARTENS).
Durgella sundana RENSCH.

Familia PLEURODONTIDAE

- Ganesella bantamensis* (SMITH).
Landouria rotatoria (VON DEM BUSCH).
Landouria winteriana (PFEIFFER).
Landouria epiplatia (MOELLENDORFF).
Landouria ciliocincta (MOELLENDORFF).
Landouria smironensis (MOUSSON).
Landouria monticola n. sp.
Chloritis crassula (PHILIPPI).
Chloritis fruhstorferi MOELLENDORFF.
Chloritis helicinoides (MOUSSON).
Chloritis transversalis (MOUSSON).
Amphidromus palaceus (MOUSSON).
Amphidromus heerianus (PFEIFFER).
Amphidromus winteri (PFEIFFER).
Amphidromus javanicus (SOWERBY).
Amphidromus perversus (LINNÉ).
Amphidromus alticola FULTON.
Amphidromus porcellanus (MOUSSON).
Amphidromus furcillatus (MOUSSON).
Amphidromus filozonatus (MARTENS).
Pseudopartula galericulum (MOUSSON).

Familia FRUTICICOLIDAE

- Bradybaena similaris* (FÉRUSSAC).

Familia STREPTAXIDAE

- Gulella bicolor* (HUTTON).

Familia HELICARIONIDAE¹⁾

Shell large or small, turreted, globular or flat, unicolorous, glassy, or banded, polished, striated, or ribbed, perforate or with closed umbilicus.

Peristome not continuous, generally not, or only slightly, thickened.

Animal with a tripartite or undivided foot sole. The posterior end of the foot in many species with a large caudal gland, overhung by a fingerlike process. In some species flap-like projections of the mantle enclose the shell exteriorly. Marginal teeth of the radula usually multicuspid; in some species uni- or bicuspid. Hermaphrodite. In many species with dart sac and dart.

Most of the Javanese species are living on the ground, between vegetable debris and earth. Only species of *Helicarion*, *Liardetia*, *Parmarion* and *Microparmarion* are often encountered on tree trunks or on the foliage of shrubs and herbs.

Distribution: Tropical and temperate zones of the Old and New World.

Key to the genera living in Java

- 1. Animal slug-like, with rudimentary shell in which it cannot retract 2
- Animal with normal shell in which it can entirely retract 3
- 2. Shell flat, fingernail-shaped **Parmarion**
- Shell with one flat whorl **Microparmarion**
- 3. Shell sinistral **Dyakia**
- Shell dextral 4
- 4. Shell large, maximal diameter more than 30 mm 5
- Shell smaller, under 25 mm maximal diameter 6
- 5. Dart sac large, dart gland continuous with dart sac. Marginal teeth of radula bicuspid **Hemiplecta**
- Dart sac smaller, dart glands opening into dart sac by a narrow duct. Marginal radular teeth unicuspid **Elaphroconcha**
- 6. Umbilicus rather wide **Inozonites**
- Umbilicus closed or narrow 7
- 7. Shell flat, or very low conical; highly polished 8
- Shell decidedly conical; polished or dull 9
- 8. Shell moderately large, up to 10 mm max. diam. Spiral lines weak. Reflected part of peristome near umbilicus without special sinuosity **Lamprocystis**
- Shell small, not more than 7 mm max. diam. Sculpture well visible. Reflected part of peristome near umbilicus with a sinuosity **Microcystina**

¹⁾ For the classification of the members of this family I have followed H. B. BAKER (Bull. Bernice P. Bishop Mus. no. 158, 1938, no. 165, 1940 and no. 166, 1941) as his investigations of the soft parts of the *Helicarionidae* have led to a modern and reasonable taxonomy of this large and varied family.

9. Shell highly polished; umbilicus closed **Helicarion**
 — Shell dull, or little shining; umbilicus open, although narrow 10
 10. Radula with tricuspid laterals and multicuspid marginals ... **Liardetia**
 — Laterals and marginals uniformly multicuspid 11
 11. Central tooth 5-cuspid. Shell small; max. diam. under 6 mm
 **Coneuplecta**
 — Central tooth 3-cuspid. Shell larger, max. diam. more than 6 mm
 **Durgella**

Genus **Coneuplecta** MOELLENDORFF, 1893

Shell small, moderately conical, corneous to greenish-brown or reddish-brown, finely striated or costulate. Umbilicus almost closed. Peristome not continuous, thin.

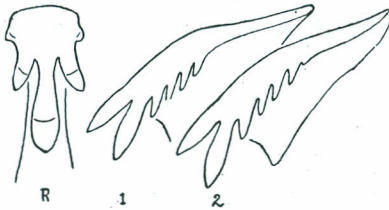


Fig. 4. *Coneuplecta bandongensis* (BTTG.). Radula elements. Author del.

Animal hermaphrodite. Spermatheca present. Penis without diverticulum. The radula has a narrow central tooth, provided with 5 denticles, and numerous latero-marginals, each with 5-6, almost uniform cusps (fig. 4).

• Distribution: Java, New Guinea, Bismarck Archipelago, Philippines, Australia. Perhaps in still more islands

of the Indo-Pacific region, but these small snails have been little investigated.

In Java there are three species:

1. Shell rather large, fragile, last whorl large and inflated **macrostoma**
 — Shell smaller, fragile, last whorl moderately large, but not inflated
 **sitaliformis**
 — Shell is an almost ideal cone, with flat sides and base; whorls with
 distinct spiral lirae above and below the periphery ... **bandongensis**

Coneuplecta bandongensis (BOETTGER, 1890) (fig. 5).

1890 BOETTGER, Ber. Senckenb. p. 141, pl. 5, fig. 3, 3a-b (*Sitala*).

1892 MARTENS, Erg. Weber, 2, p. 233 (? *Geotrochus pellucidus* v. HASS. ms).

1894 SMITH, Journ. Linn. Soc. London, 24, p. 343, pl. 25, fig. 3 (*Sitala baritensis*).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 58 (*Sitala javana*).

1914 LESCHKE, Mitt. naturh. Mus. Hamburg, 31, p. 229 (*Sitala bandongensis* and *S. javana*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 68 (*Durgellina baritensis*).

Shell high-conical, with rather flat sides and base. Periphery with acute keel. Brownish-yellow, little transparent, somewhat shining. Delicately striated according to the growth-lines. This structure is crossed by raised spiral lirae, about 9-12 above, and 6-8 below the periphery of the last whorl. On the base these lirae become more and more obsolete towards the umbilicus.

Whorls $5\frac{3}{4}$ - $6\frac{1}{4}$, forming an almost ideal cone with nearly straight sides and a flat base. The whorls are little convex, suture well marked, but shallow. Spire raised, but apex not sharp. Last whorl not descending, base minutely perforate or almost closed.

Aperture more or less quadrangular to rhombiform. Peristome not continuous, sharp, not thickened or reflected, except for a small part in the umbilical region.

Dimensions: height 2.2-2.9, breadth 2.2-2.7, height of aperture 0.5-0.6 mm. The type specimen from Mount Malabar (Mus. Senckenberg no. 62073) is high 2.2 and broad 2.2 mm, with an aperture of 0.5 mm. The type of *Sitala javana* from the Tengger Mountains (Mus. Senckenberg no. 62071) is high 2.3 and broad 2.4 mm, with an aperture of 0.6 mm high. In the original diagnosis the measurements are *bandongensis*: high 2.25, broad 2.33 mm, *javana*: high 2.5, broad 2.5 mm.

Distribution: Java, North Borneo, Bali, Sumbawa, Celebes, Amboina, Haruku, Banda.

Habitat in Java: among dead leaves and other vegetable debris, moss, low vegetation, from almost sea-level to mountainous regions, 1650 m. alt.

West Java: Leuwiliang, near waterfall of the Tjianten, 300 m; Mt. Tjibodas, estate of Tjampea, 300 m; Kuripan, near Buitenzorg, 200 m; Buitenzorg, Botanical Garden, 250 m, on leaves of *Phoenix spinosa*; estate of Tjikopo, near Buitenzorg, 700 m; estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 700 m; Tjibodas, Mt. Gedeh, wood near pasanggrahan, 1400 m and wood near little waterfall, on leaf of *Elatostemma*, 1500 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; limestone hill near Sukanegara, Djampang, 1000 m; Mt. Masigit and Mt. Pawon, near Padalarang, 700 m on mossy rocks; between Bandung and Lembang, under dead wood in autocar dump, 1000 m; Maribaja, S. E. of hot springs, 1100 m; Mt. Dogdog, 1500 m; Mt. Malabar (BOETTGER, 1890); Mt. Tjikorai, 1650 m.

Central Java: Sulang, near Kali Besèk, 100 m.

East Java: Sutji, near Grisse, 100 m; Tengger Mts.

RENSCH (1932) was quite right when he united *Coneuplecta baritensis* and *C. bandongensis*. By some curious error, however, he gave *C. baritensis* the priority, although this name is 4 years younger than *C. bandongensis*.

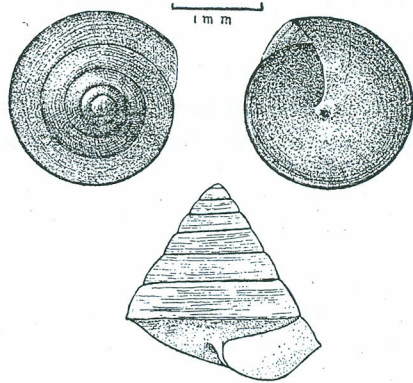


Fig. 5. *Coneuplecta bandongensis* (BTTG.). Shell from top, base and side. ABDULKADIR del.

Besides, he suggested that *Sitala javana* MOELLENDORFF (1897) might also be included in the synonymy of *C. bandongensis* and *C. baritensis*, but he did not take a final decision for want of material and figures. Judging from the type and paratypes of *Sitala javana*, collected by FRUHSTORFER in the Tengger Mountains, and which I had on loan from the Senckenberg Museum, this opinion can now fully be confirmed.

A variety mentioned *Sitala javana* BTGG. var. *celebesiana* MLLDFF. was described by MOELLENDORFF (Nachr. Blatt, 28, p. 135, 1896) from Bua Kraeng, Celebes, differing from the main form in having a larger shell, with more lustre and less convex whorls. If the identification is right, this form has now to be called *Coneuplecta bandongensis* (BTGG.) var. *celebesiana* (MLLDFF). In the Amsterdam Zoological Museum there are shells of *Coneuplecta bandongensis* collected along the road from Makalé to Kalossi, in the southern peninsula of Celebes, 700-800 m alt., Sept. 1948, by Mrs. G. A. TAMMES-BOLT. It is a new record for Celebes.

***Coneuplecta macrostoma* (MOELLENDORFF, 1897) (fig. 6).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 61 (*Kaliella*).

1914 LESCHKE, Mitt. naturh. Mus. Hamburg, 31, p. 230 (*Kaliella*).

Shell globose, very fragile, with a conical spire and a large, inflated, last whorl. Base rounded. In young animals the periphery of the shell is

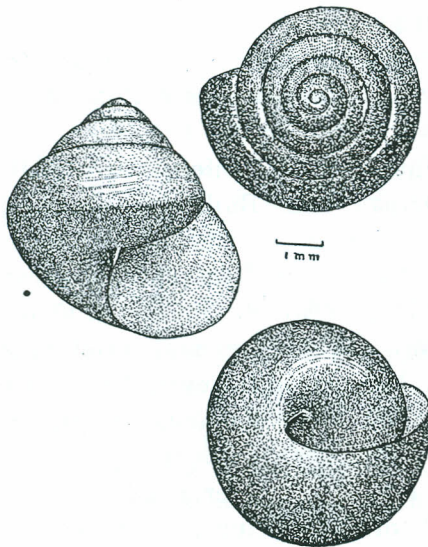


Fig. 6. *Coneuplecta macrostoma* (MLLDFF). Shell from side, top and base. LENSVELT del.

weakly angular; in adult animals this carination becomes obsolete towards the periphery. Dark greenish-brown, somewhat shining and transparent. Finely striated in radial and in spiral direction.

Whorls $4\frac{1}{2}$ -5, rapidly increasing in size. The sides of the spire are little convex and the suture is shallow. Last whorl disproportionately large. Spire elevated, top not sharp. Umbilicus very narrow or almost closed.

Aperture somewhat oblique, wide, circular, only interrupted by the base of the penultimate whorl. Peristome not continuous, sharp, fragile. The columellar side more or less vertical, reflected, hiding the greater part of the umbilicus.

Dimensions: height 3.8-5.4, breadth 3.9-5.5, height of aperture 2.2-2.6 mm. The type specimen from Mount Gedeh (Mus. Senckenberg no. 4094) is high 5.4, broad 5.3 mm and has an aperture of 2.6 mm height.

In the original description 5 mm is mentioned for the height as well for the breadth of the shell.

Distribution: Java.

Habitat in Java: living in the mountain forest, on leaves and branches of low vegetation.

West Java: Lebak Saät, Mount Gedeh, 2400 m; Kandang Badak, Mount Gedeh, 2400 m; between Tjibeureum and Kandang Badak, Mount Gedeh, 2000 m, hanging from a slime thread; Mount Tilu, 2100 m.

East Java: Tengger Mts, 2000 m; road to Jang Plateau, near the lake, 2000 m.

According to THIELE [Zool. Jahrb. (Syst.) 55, 1928, p. 135] the radula of "*Kaliella*" *macrostoma* proves that the species is a *Durgellina*. The latter genus is a synonym of *Coneuplecta*.

***Coneuplecta sitaliformis* (MOELLENDORFF, 1897) (fig. 7, 8).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 59 (*Kaliella*).

1914 LESCHKE, Mitt. naturh. Mus. Hamburg, 31, p. 208, fig. 1 (*Kaliella platyconus*). p. 230 (*Kaliella sitaliformis*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 69 (*Durgellina acutiuscula*, *Kaliella platyconus*, *K. platyc.* var. *intermedia*).

1934 RENSCH, Trop. Binnengew. 4, p. 750 (*Durgellina convexoconica*), p. 758 (*Kaliella sitaliformis*).

Shell high conical, with a large, but not inflated, last whorl and a rounded base. In immature shells the periphery of the last whorl is delicately keeled by a thread-like keel. In adult animals this keel becomes obsolete towards the aperture, leaving a certain angularity only.

Greenish-yellow, sometimes more straw coloured, sometimes brownish. Fragile, somewhat transparent and with a soft lustre. Finely striated according to the very oblique growth lines. This sculpture is crossed by equally fine spiral lines.

Whorls $5\frac{3}{4}$ - $6\frac{1}{4}$ rapidly increasing in size. The whorls of the spire are rather flat or moderately rounded, hence the suture is shallow. Last whorl broad and rounded. Spire elevated, top obtuse. Umbilicus very narrow to almost closed.

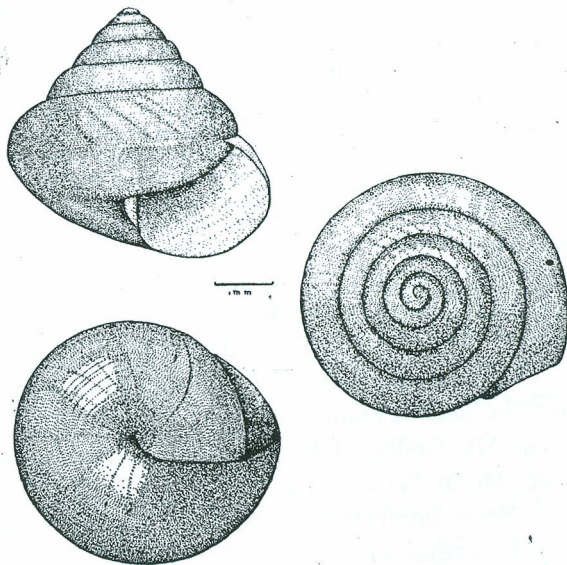


Fig. 7. *Coneuplecta sitaliformis* (MLDFF). Type. Shell from side, top and base. LENSVELT del.

Aperture broad-rhombiform, very oblique. Peristome not continuous, sharp. The columellar side which is nearly vertical and a little reflected, is hiding the greater part of the umbilicus.

Dimensions: height 3.6-4.8, breadth 3.5-4.6, height of the aperture 1.4-2 mm. The type specimen from the Tengger Mts (Mus. Senckenberg no. 62091) is high 4.4, broad 4.6 mm and has an aperture of 1.9 mm height. In the original diagnosis the height is given as 2.33, the breadth as 2.5 mm.

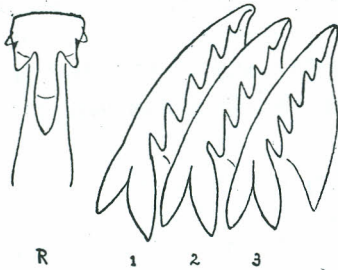


Fig. 8. *Coneplecta sitaliformis* (MLLDF). Radula elements. Author del.

Distribution: Java, Celebes.

Habitat in Java: the species prefers hilly and mountainous regions. Occasionally it occurs at lower altitudes. Living on leaves and branches of low vegetation in primary and secondary forests.

West Java: Kuripan, near Buitenzorg, 200 m; Buitenzorg, Botanical Garden, 250 m; Warangloa, near Buitenzorg, 650 m; estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; Megamendung, near Buitenzorg, jungle, 800 m, jungle near Puntjak pass, 1000 m; Tjibodas, Mt. Gedeh, wood near pasanggrahan, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Djampang, 3600 feet; Mt. Papandajan, 5000 feet; jungle near Tegal Primula, Mt. Papandajan, on Ilex leaves, 2200 m; Mt. Tjikorai, 5000 feet; jungle of Mt. Wajang, 1600 m; Mt. Dogdog, 1500 m; along river near Maribaja, 800 m; Mt. Tangkuban Prahū, 1000 m.

Central Java: Mt. Prahū, 2500 m; near origin of the Seraju river, Dieng Highland, 2100 m; Mt. Telemojo, 1400 m.

East Java: Sarangan, near Madiun, secondary wood, 1200 m; Tengger Mts, 4000-5000 feet.

The typical form is sharply keeled at the periphery. In the var. *subangulata* (MOELLENDORFF, 1897) the keel is more or less obsolete. This variety is recorded from Mt. Gedeh, West Java, 9000 feet.

In the var. *elator* (BOETTGER ms) nov. var. the spire is more conical, but the keel is shaped as in the type form. This variety has been recorded from Mt. Gedeh, 4000 feet, Djampang, 2000 feet and Mt. Wajang, 6500 feet, all in West Java.

Both varieties are not very important; in a large material there can be found all intermediate stages.

As I will work out more elaborately under *Liardetia acutiuscula* (MOELLENDORFF) the shells which RENSCH (l. c., p. 69) quoted as *Durgellina acutiuscula* and *Kaliella platyconus* (with the exception of *Kaliella acutiuscula* LESCHKE which is a *Liardetia convexoconica*) are to be considered as *Coneplecta sitaliformis*.

Kaliella platyconus BOETTGER ms is a synonym of *Coneuplecta sitaliformis*. For detailed information the reader is referred to *Liardetia platyconus* MOELLENDORFF in this paper.

Genus *Liardetia* GUDE, 1913

Shell small, low, moderately or high conical. Thin, corneous, greenish-brown or reddish-brown. Finely striated or costulate.

Umbilicus open, or almost closed. Peristome not continuous, thin.

Of the anatomy very little is known. The animals are so small that dissection is difficult. Not even the classic organ for taxonomic purposes, the radula, has been investigated in all species. Therefore the status of several species remains unknown.

In the species from which the radula could be prepared the rhachis has a large median cone and two small ectocones. In the lateral teeth the median ectocone becomes smaller in the more laterally placed teeth. The marginals are multicuspid (fig. 9).

Various species are ovoviviparous. Of the Javanese species this mode of reproduction is known only in *Liardetia doliolum* (PFR). Of the other Javanese species the breeding habits are unknown.

Distribution: Tropical Asia and islands of Indian and Pacific Oceans, including the Malay Archipelago and the Philippines.

In Java there are 14 species:

- 1. Umbilicus narrow 2
- Umbilicus wide for the genus **viridula**
- 2. Shell turreted, suture so deep that the whorls are descending step-like **fimbriosa**
- Shell conical, or low conical, whorls never descending step-like ... 3
- 3. Shell an almost ideal cone with flat sides and base, and a superficial suture 4
- Sides of the shell more curved, suture well impressed 5
- 4. Shell high 3.6-3.9, broad 2.9-3.4 mm, top angle rather narrow **acutiuscula**
- Shell high 4.2-4.4, broad 3.8-4.2 mm, top angle rather broad **angigyra**
- 5. Periphery of the last whorl round 6
- Periphery of the last whorl angular, or sharply keeled 8
- 6. Whorls ornated with radial ribs, separated by narrow interstices, and crossed by fine spiral lines 7

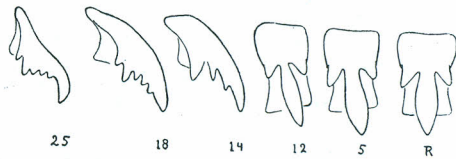


Fig. 9. *Liardetia doliolum* (PFR). Radula elements. Author del.

- Whorls without radial ribs, only the growth striae and the still more delicate spiral lines occurring **javana**
- 7. Spire somewhat elevated, spiral sculpture weak, shell greenish-yellow **pisum**
- Spire low, spiral sculpture more pronounced, shell brownish-yellow **reticulata**
- 8. Spire rather elevated, shell higher than broad **convexoconica**
- Spire low conical, shell broader than high 9
- 9. Periphery of last whorl acutely keeled 10
- Periphery of last whorl angular, but not acute 11
- 10. Whorls 4-4½, increasing in size rapidly **dendrophila**
- Whorls 5-5½, increasing in size more slowly **platyconus**
- 11. Radial striae coarse, rib-like **doliolum**
- Radial striae finer 12
- 12. Initial whorl large, subsequent ones rather flat, suture superficial **amblia**
- Initial whorls smaller, whorls somewhat convex, suture more impressed 13
- 13. Whorls 5½-6½, greatest width of last whorl above the periphery, causing the shell to look „shouldered” **densetorta**
- Whorls 5-5½, whorls not „shouldered” **indifferens**

Of the 17 minute, globular Pulmonates inhabiting Java which have generally been recorded in literature as members of the genus *Kaliella* BLANFORD three ought to be removed to *Coneuplecta*, viz. *C. bandongensis*, *C. sitaliformis* and *C. macrostoma*, as has been discussed in the previous paragraph.

The remaining 14 species are allocated here tentatively to the genus *Liardetia* GUDE, although in four of them (*javana*, *fimbriosa*, *reticulata* and *dendrophila*) we only know the shells, but nothing of their internal organization.

Therefore it is highly desirable that attempts be made to obtain living specimens, so that a definite opinion can be formed.

One of the chief differences between *Kaliella* and *Liardetia* consists in the shape of the marginal teeth which are tricuspid in *Kaliella*, but multicuspid in *Liardetia* (BURRINGTON BAKER, Bull. B. P. Bishop Mus. no. 166, 1941, p. 214).

***Liardetia acutiuscula* (MOELLENDORFF, 1897) (fig. 10, 11).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 59 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Kaliella*) — not p. 208, fig. 2 which is *L. convexoconica*, see there.

1935 PARAVICINI, Arch. Moll. K. 67, p. 172 (*Kaliella*).

Shell high-conical to pyramidal, with flat sides and base. Periphery of last whorl acutely keeled with a thread-like keel. The shell is very

similar to that of *L. angigyra* (MLLDFF), but the latter species is larger and has a wider top angle.

Greenish-yellow to yellowish-white. Shining and transparent. Delicately striated according to the growth lines. This structure is crossed by a still finer spiral pattern, only visible under strong magnification.

Whorls 7-7½, regularly increasing in size, with almost flat sides. Hence the profile of the shell approaches the ideal cone. Suture superficial. Spire elevated, but apex not sharp. Umbilicus narrow.

Aperture trapezoidal, somewhat oblique. Peristome sharp, not continuous, the columellar side vertical, a little reflected, hiding part of the umbilicus.

Dimensions: height 3.6-3.9, breadth 2.9-3.4, height of aperture 0.8-0.9 mm. The type specimen from Java (without precise locality) (Mus. Senckenberg no. 62083) is high 3.9, broad 3.2 mm and has an aperture of 0.9 mm height. In the original description the height is given as 3.33, the breadth as 3.- mm.

Distribution: Java. The distribution Bali and Sumba [RENSCH, Zool. Jahrb. (Syst.) 63, 1932, p. 69] is dubious, because it has been stated that RENSCH confounded other species with this name (see under *Coneuplecta sitaliformis*).

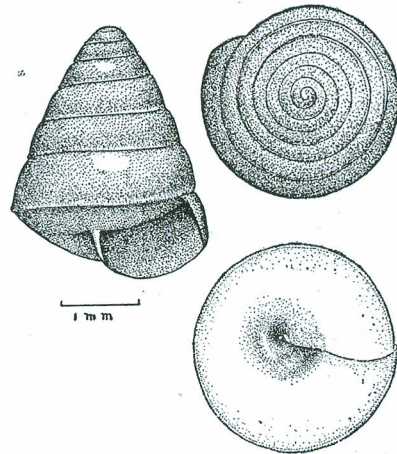


Fig. 10. *Liardetia acutiuscula* (MLLDFF). Shell from side, top and base. LENSVELT del.

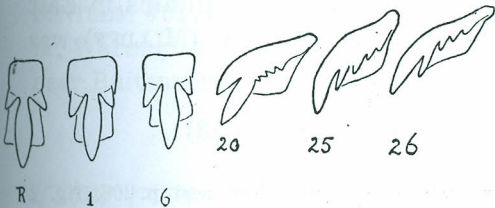


Fig. 11. *Liardetia acutiuscula* (MLLDFF). Radula elements. Author del.

Habitat in Java: low vegetation and vegetable debris on the soil of mountain forests, at 1000 m and more altitude.

West Java: Mt. Gedeh; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, soil fauna, 2400 m; Sukabumi, 600 m; Mt. Malabar, 1600 m;

Mt. Papandajan, 5000 feet; Mt. Tjikorai.

There is a great deal of confusion concerning this species. It seems that "*Kaliella*" *acutiuscula* in BOETTGER's conception (Mus. Senckenberg nos. 62086 to 62089) is quite another shell as what MOELLENDORFF (l. c.) described under this name.

This would not have been so serious because BOETTGER's name was never published, lying as a museum-label name in the Francfort Museum. BOETTGER's specimens are, as I could check from his samples, what

MOELLENDORFF described as *Kaliella sitaliformis* (now *Coneuplecta sitaliformis*).

But some 25 years later RENSCH (l. c.) who obviously compared Boettgerian *acutiuscula* and who was not aware of the duplicity of the names, assimilated some shells of his Sunda Expedition with *Kaliella acutiuscula*, adding MOELLENDORFF as an author where in fact BOETTGER ms ought to be read.

Thus it is clear that RENSCH's *Durgellina acutiuscula* is now *Coneuplecta sitaliformis* MLLDFF which, as we have seen under this species, is synonym with *platyconus* BOETTGER ms, non *platyconus* MLLDFF, 1897. This explains also why RENSCH described the radula as belonging to *Durgellina* (syn. *Coneuplecta*). The true *Liardetia acutiuscula*, however, has a clear *Liardetia* radula.

Of the other references which RENSCH (l. c.) quoted, *Kaliella platyconus* MLLDFF is an error for *platyconus* BTG. ms; *platyconus* LESCHKE, figured on LESCHKE's plate, fig. 1 is *Coneuplecta sitaliformis* and *acutiuscula* LESCHKE, figured plate, fig. 2 is *Liardetia convexoconica*. The last entry, *Kaliella platyconus* var. *intermedia*, refers to a variety of *Coneuplecta sitaliformis* from South Celebes.

There is another discrepancy in RENSCH's reasoning, when he stated that the locus typicus for *Kaliella acutiuscula* is Mt. Papandajan, in West Java. This is certainly erroneous, because the type of the real *Liardetia acutiuscula* in the Senckenberg Museum bears as locality "Java" only. This involves at the same time that RENSCH did not have in hand the type specimen of *Liardetia acutiuscula* (MLLDFF).

Even if we consider the fact that RENSCH had not *Liardetia acutiuscula* (MLLDFF), but *Coneuplecta sitaliformis* (MLLDFF) before him, the terra typica is not Mt. Papandajan, but the Tengger Mountains in East Java where the type specimen of *Coneuplecta sitaliformis* (MLLDFF) was collected.

***Liardetia convexoconica* (MOELLENDORFF, 1897) (fig. 12. 13).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 60 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*) and p. 208, fig. 2 (*Kaliella acutiuscula*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 67 (*Durgellina*).

1940 VAN BENTHEM JUTTING, Treubia, 17, p. 332 (*Kaliella*).

Shell rather high conical, somewhat reminding of *Liardetia acutiuscula* and *Liardetia angigyra*, but in these species the sides and the base of the shells are flatter and the suture is more shallow. Periphery acutely keeled by a thread-like keel. Base moderately rounded.

Greenish-yellow, or brownish-yellow. Shining and transparent. Delicately striated according to the growth lines. This structure is crossed by much finer undulating spiral lines, only visible under strong magnification.

Whorls $5\frac{1}{2}$ -6, regularly descending and increasing in size. Suture not very deep. Spire elevated, but apex not sharp. Umbilicus narrow.

Aperture rhombiform, oblique. Peristome sharp, not continuous. The columellar side is vertical and a little reflected, hiding part of the umbilicus. Dimensions: height 2.7-3.8, breadth 2.5-3.5, height of aperture 0.7-0.9 mm. The type specimen from Java (without further locality) (Mus. Senckenberg no. 62116) is high 3.0 and broad 3.0 mm, with an aperture of 0.8 mm height.

Distribution: Java, Krakatau, Sebesi.

Habitat in Java: among dead leaves and other vegetable debris, moss, low vegetation in hilly and — by preference — in mountainous country.

West Java: Forest between Tjisolak and hot springs, 200 m (VAN BENTHEM JUTTING, l. c.); Leuwiliang, near waterfall of the Tjianten, 300 m; Warangloa, near Buitenzorg, 650 m; Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Depok, north of Buitenzorg, 100 m; Buitenzorg, Botanical Garden, under leaves of *Phoenix spinosa* on the ground, 250 m; Mt. Paniisan, near Buitenzorg, 600 m; estate of Tjisarua-Zuid, near Buitenzorg, on leaf of *Strobilanthes*, 1000 m; estate of Megamendung, near Buitenzorg, 800 m; wood near Telaga Warna, Puntjak pass, 1450 m; Tjibodas, Mt. Gedeh, on treefern, 1450 m; Tjibodas, Mt. Gedeh, jungle near pasanggrahan, 1400 m; Tjibodas, Mt. Gedeh, near little waterfall, on leaf of *Elatostemma*, 1500 m; Tjibodas, Mt. Gedeh, road to Huis ter Bosch, 1800 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m;

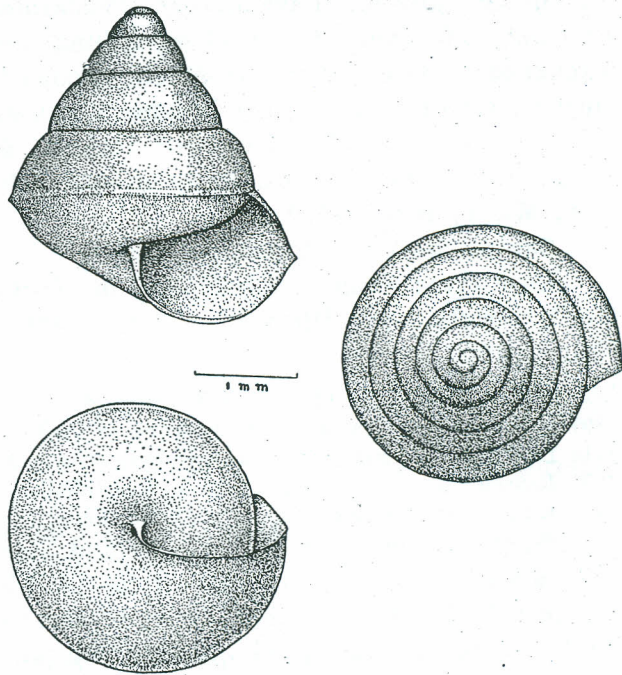


Fig. 12. *Liardetia convexoconica* (MLLDF). Paratype. Shell from front, top and base. LENSVELT del.

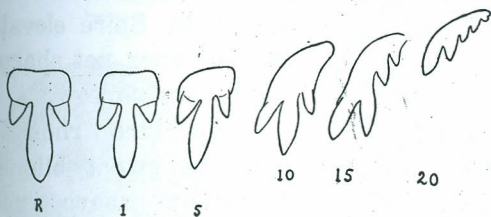


Fig. 13. *Liardetia convexoconica* (MLLDF). Radula elements. Author del.

Mt. Pangerango, 2400 m; limestone hill near Sukanegara, Djampang 1000 m; bank of the Tjitarum, near Radjamandala, soil fauna, 200 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m; Dago, near Bandung, left bank of the Tjikapundung, near waterfall, 800 m; Mt. Tangkuban Prahau, 1000 m; Maribaja, near Bandung, S. E. of the springs, 1100 m; Talun, near Bandung, 500 m; Tjiwidej, near Bandung 1100 m; Mt. Tilu, 6300 feet; Mt. Wajang, 6500 feet; Tjibitung, near Pengalengan, 2000 m; Mt. Papandajan, 5000 feet; Mt. Tjikorai, 5000 feet; Mt. Tjerime, 2500 m.

Central Java: Mt. Telemojo, 1400 m.

East Java: Nongkodjadar, 1200 m; Tengger Mts; Sumber Nongk Durdjo estate, near Djember, 600 m; estate of Sumber Tengah, near Kalisat, 1000 m.

Liardetia angigyra angigyra (MOELLENDORFF, 1897) (fig. 14, 15).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 60 (*Kaliella angigyra*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Kaliella angigyra*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 63 (*Kaliella*).

1934 RENSCH, Trop. Binnengew. 4, p. 749 (*Kaliella*).

Shell high conical, with flat sides and base. Periphery acutely keeled with a thread-like keel. In shape it is an enlarged edition of *Liardetia acutiuscula*, but the top angle is wider and the side profile of the shell flatter. Greenish-yellow, shining and transparent. Delicately striated according to the growth lines. This sculpture is crossed with still finer spiral lines.

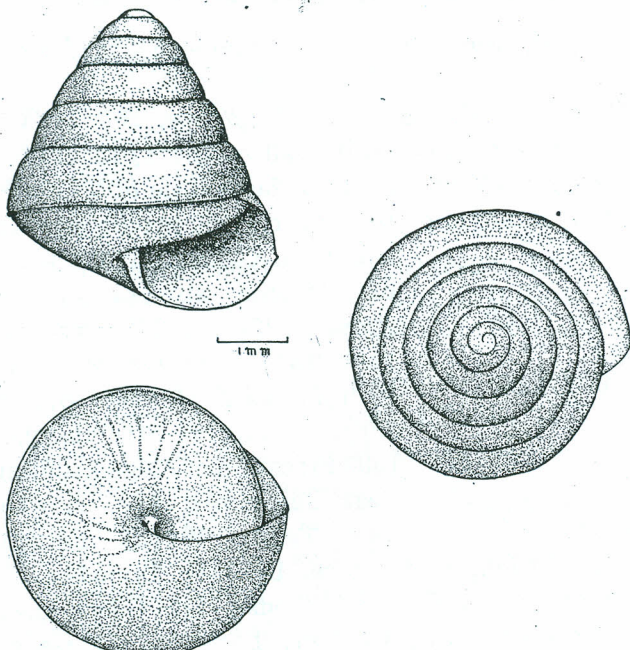


Fig. 14. *Liardetia angigyra angigyra* (MLLDFF). Type. Shell from front, top and base. LENSVELT del.

Whorls 7, regularly increasing in size, little rounded. Height the profile of the shell is an almost ideal cone. Suture superficial. Keel somewhat crenulate. Spire elevated, but apex not sharp. Umbilicus narrow.

Aperture rhombic form, somewhat oblique. Peristome sharp, continuous, the columellar side vertical, somewhat reflected, hiding part of the umbilicus.

Dimensions: height 4.2-4.4, breadth 3.8-4.0, height of aperture

mm. The type specimen from Mt. Gedeh (Mus. Senckenberg no. 4092) is high 4.4, broad 4.2 mm, with an aperture of 1.3, mm height. In the original diagnosis the height is given as 4.5, the breadth as 4.- mm.

Distribution: the main form is an inhabitant of Java. Other subspecies were recorded by RENSCH (l. c.) from Bali (*Kaliella angigyra balica*) and from Sumba, Sumbawa and Flores (*Kaliella angigyra heteromorpha*).

Habitat in Java: forest of the mountain region, between 700 and 3200 m. On mossy rocks, and other soil debris.

West Java: estate of Tjisarua-Zuid, near Buitenzorg, 800 m; Mt. Gedeh, 4000 feet; Mt. Masigit, near Padalarang, 700 m; Mt. Tangkuban Prah, 1000-1600 m.

Central Java: near Lake Pasir (1300 m) and near Tjemorosewu (3260 m) on Mt. Lawu (RENSCH, 1934).

RENSCH (l.c. 1932) dissected a radula from an animal of his *Kaliella angigyra balica*. It is not principally different from that of *Liardetia indifferens* (see there).

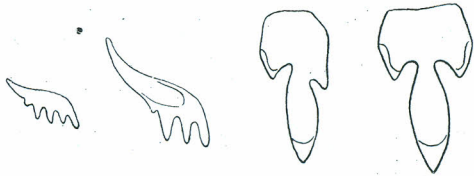


Fig. 15. *Liardetia angigyra balica* (RENSCH). Radula elements. After RENSCH.

***Liardetia viridula* (MOELLENDORFF, 1897) (fig. 16, 17).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 61 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*).

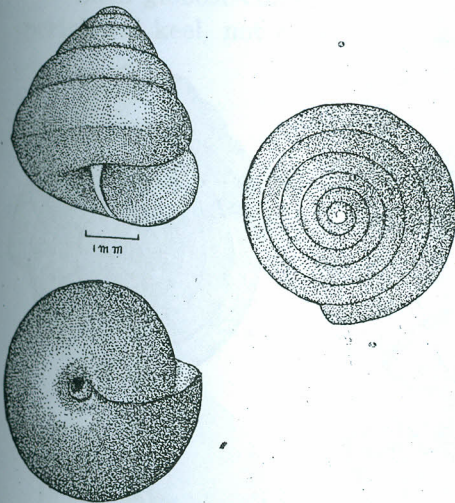


Fig. 16. *Liardetia viridula* (MLLDFF). Shell from front, top and base. LENSVELT del.

Shell rather high conical, with a moderately flat base and a thread-like keel along the periphery of the last whorl. Greenish-yellow, glassy and transparent. Finely striated according to the growth lines. This sculpture is crossed by still more delicate spiral lines, only visible under a powerful lens.

Whorls 6-6½, regularly increasing in size, little curved, hence the suture is shallow. In adult shells the peripheral keel becomes obsolete towards the aperture. Spire elevated, top not sharp. Base little rounded. Umbilicus wide for the genus.

Aperture trapezoidal, little oblique. Peristome not continuous, sharp.

The columellar side is almost vertical, hiding a small section of the umbilicus.

Dimensions: height 2.7-3.9, breadth 2.8-3.4, height of aperture 0.8-1.1 mm. The type specimen from Mt. Gedeh (Mus. Senckenberg no. 62144) is high 3.6 and broad 3.3 mm, with an aperture of 1.0 mm. In the

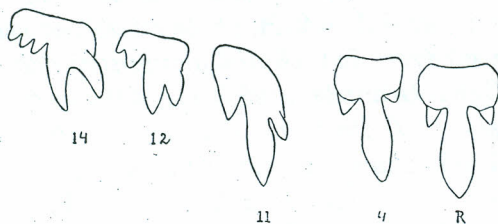


Fig. 17. *Liardetia viridula* (MLLDFF). Radula elements, Author del.

original diagnosis the height is given as 3.75, the breadth as 3.2 and the height of the aperture as 1.25 mm.

Distribution: Java.

Habitat in Java: living on the ground, in earth, dead leaves, low vegetation in the mountain forests of 2400 m altitude and higher.

West Java: near Lebak Saä Mt. Gedeh, on leaf of *Viburnum coriaceum*, 2400 m; Kandang Badak saddle between Mt. Gedeh and Mt. Pangerango, soil fauna, 2400 m; Mt. Gedeh, crater-field, under moss, 2700 m; Mt. Pangerango, 2400 m and 2900 m; Mt. Papandajan, 2600 m; Mt. Tjikorai, 8000 feet.

West Java: near Lebak Saä

Liardetia densetorta (MOELLENDORFF, 1897) (fig. 18, 19).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 60 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 66 (*Kaliella*).

Shell low conical, globose. Base rounded, top elevated, but not sharp. Greyish-yellow, little transparent, with soft lustre. Young shells have an angular periphery; in adult animals this angulation becomes obsolete. Delicately striated according to the lines of growth. This sculpture is crossed by much finer, undulating spiral lines, only visible with a powerful lens.

Whorls $5\frac{1}{2}$ - $6\frac{1}{4}$, narrowly coiled. The last whorl is somewhat expanded laterally, giving the impression that the spire is implanted on a broad base. The greatest width of the last whorl is lying somewhat above the middle, hence this whorl has a slightly

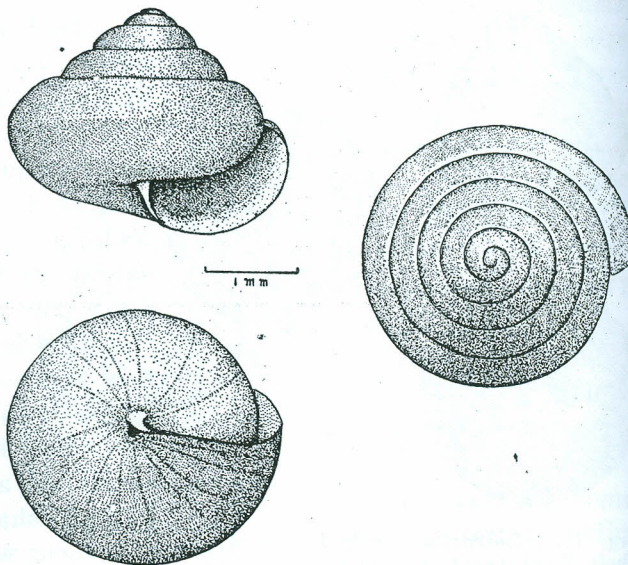


Fig. 18. *Liardetia densetorta* (MLLDFF). Type. Shell from front, top and base. LENSVELT del.

"shrugged" shoulder. Umbilicus narrow.

Dimensions: height 2.4-2.8, breadth 2.8-3.1, height of the aperture 0.6-0.7 mm. The type specimen from Mt. Gedeh (Mus. Senckenberg no. 4093) is high 2.5 and broad 3.0 mm, and has an aperture of 0.7 mm height. In the original diagnosis the height is given as 2.25, the breadth as 2.75 mm.

Distribution: Java, Bali, Lombok.

Habitat in Java: living in mountain forest on the ground among vegetable debris and low vegetation, at altitudes of 1100 m and more.

West Java: Mt. Gedeh, 4000 feet; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, soil fauna, 2400 m; Tjiwidej, S. of Bandung, 1100 m; Mt. Papandajan, 5000 feet.

Liardetia javana (BOETTGER, 1890) (fig. 20).

1890 BOETTGER, Ber. Senckenb. p. 142, pl. 5, fig. 4, 4a, 4b (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*).

1934 RENSCH, Trop. Binnengew. 4, p. 748 (*Kaliella*).

Shell globose-conical, base rounded, lateral sides convex. There is no peripheral keel, not even in young specimens. Straw coloured, transparent, shining. Delicately striated according to the growth lines, only visible under a strong lens. At a magnification of 50 times there is no spiral sculpture discernible.

Whorls 5-5 $\frac{1}{4}$, well rounded and with a rather deep suture. Last whorl with rounded outline at periphery and base. Top blunt, umbilicus narrow.

Aperture semicircular, oblique. Peristome not continuous, sharp. The columellar side somewhat reflected, hiding part of the umbilicus.

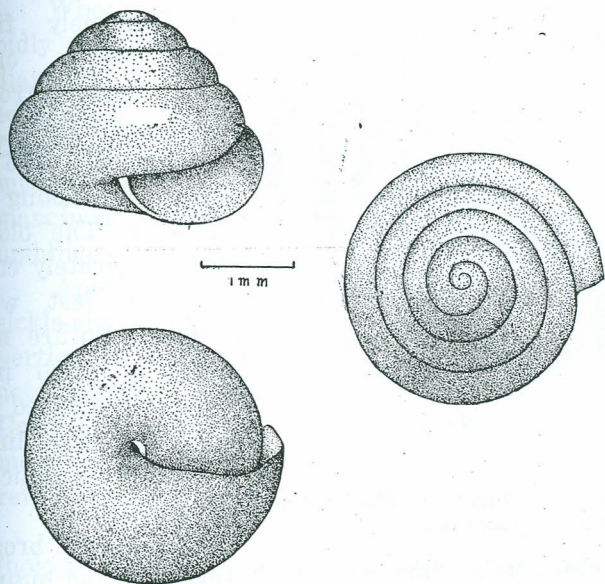


Fig. 20. *Liardetia javana* (BTG.). Shell from front, top and base. LENSVELT del.

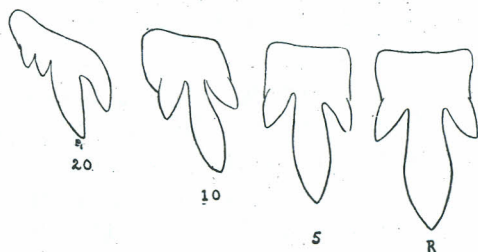


Fig. 19. *Liardetia densetorta* (MLLDF). Radula elements. Author del.

Dimensions: height 1.9-2.5, breadth 2.4-2.8, height of aperture 0.6-0.8 mm. In the original diagnosis the height is given as 3, the breadth as $3\frac{3}{8}$ mm.

Distribution: Java.

Habitat in Java: living on the ground, among fallen leaves and decaying wood, or on low vegetation.

West Java: Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Tjibodas, Mt. Gedeh, 1400 m; waterfalls near Tjibeureum, Mt. Gedeh, 1700 m (RENSCH, 1934); Mt. Malabar (BOETTGER, 1890).

In the original diagnosis BOETTGER defined the surface of the shell as "pruinosa", bedewed. This characteristic I could not find in the shells which I could investigate. Either it has disappeared from my specimens, or it was an accidental feature, only present in the holotype.

***Liardetia pisum* (MOELLENDORFF, 1897) (fig. 21).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 61 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*).

Shell low conical, spire short, last whorl large, embracing a considerable part of the previous one. No peripheral keel. Base rounded. Glassy yellowish-green. Transparent and shining. Surface ribbed with broad,

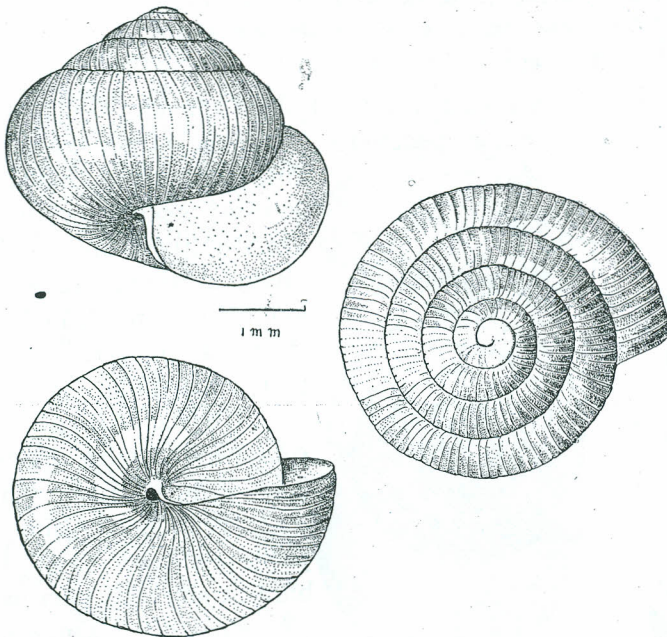


Fig. 21. *Liardetia pisum* (MLLDF). Paratype. Shell from front, top and base. Author del.

flat ribs, 4-6 in a mm on the last whorl, separated by narrow interstices. This sculpture is crossed by extremely fine spiral lines, only visible under strong magnification.

Whorls 5-5½, rapidly increasing in diameter. The older ones moderately curved, the last well rounded. Suture not deep, but well impressed, margined by a thread-like line. Top blunt, umbilicus narrow.

Aperture broad sickle-shaped. Columellar side almost vertical, a little reflected and hiding part of the umbilicus.

Dimensions: height 3.1-3.7, breadth 3.9-4.2, height of aperture 1.7-1.9 mm. The type specimen from Mt. Tjikorai (Mus. Senckenberg no. 62151) is high 3.2 and broad 4.1 mm, with an aperture of 1.8 mm height. In the original diagnosis the height is given as 3.0, the breadth as 4.0 mm.

Distribution: Java.

Habitat in Java: living on the ground, among dead leaves, moss, decaying wood etc., in hilly and mountainous country.

West Java: Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Mt. Gedeh, 3000 feet; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; Mt. Tjikorai, 6000 feet; Mt. Tjerimei, 1500 m.

Liardetia reticulata n.sp. (fig. 22).

Shell very low conical, spire hardly raised. Last whorl large and convex, embracing a great part of the previous one. No peripheral keel along the last whorl. Base rounded. Glassy brownish-green, transparent and shining. Surface elegantly sculptured by a reticulate pattern of flat radial ribs (9-10 in a mm on the last whorl), separated by narrow interstices, crossed by rather coarse spiral lines, so that the reticulation is almost visible to the naked eye.

Whorls $4\frac{1}{2}$, rapidly increasing in diameter. Well curved (more than in *Liardetia pisum*), suture rather deep, margined. Top blunt, umbilicus narrow.

Aperture broad sickle-shaped, almost vertical. Peristome not continuous, sharp. Columellar side almost vertical, a little reflected, hiding a small part of the umbilicus.

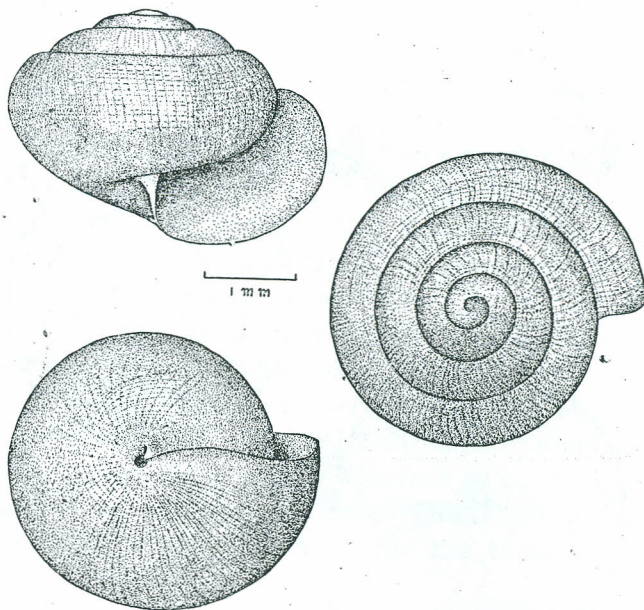


Fig. 22. *Liardetia reticulata* n.sp. Type. Shell from front, top and base. Author del.

Dimensions: height 2.5, breadth 3.4, height of aperture 1.7 mm (holotype). It is possible that the type specimen, though adult, is not full-grown. It is preserved in the Senckenberg Museum (no. 62157). Two paratypes are measuring: high 2.0, broad 2.8, height of aperture

1.3 mm (Tjibeureum) and high 2.9, broad 3.9, height of aperture 1.9 mm (Kandang Badak).

Habitat in Java: living on the ground, between fallen leaves, decaying wood, moss and other low vegetation, in the mountain region.

West Java: Mt. Gedeh, 6600 feet (type locality) collected by H. FRUHSTORFER in 1892; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna.

The new species differs from its nearest ally, *Liardetia pisum*, in being brownish-green instead of yellowish-green, in having a lower spire, and in possessing more numerous radial ribs, crossed by more conspicuous spiral lines.

***Liardetia platyconus* (MOELLENDORFF, 1897) (fig. 23).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 59 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 230 (*Kaliella*), not p. 208 and fig. 1 *Kaliella platyconus* which represents *Coneuplecta sitaliformis*.

1935 PARAVICINI, Arch. Moll. K. 67, p. 172 (*Kaliella*).

Shell low conical, with a moderately round base and a sharply keeled periphery of the last whorl. Sides of the shell a little convex, more in

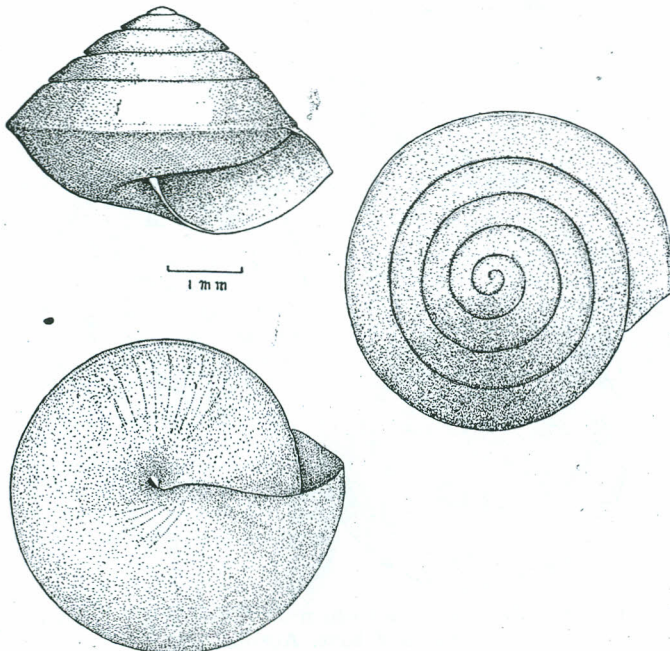


Fig. 23. *Liardetia platyconus* (MLLDF). Shell from front, top and base. LENSVELT del.

adult than in young animals. Yellowish or straw-colour, somewhat shining and transparent. Finely striated in radial and in spiral direction.

Whorls 5-5½, regularly increasing in diameter, moderately curved. Suture distinct, a condition which is the more marked by a slight scalariformity of the later whorls, causing the formation of a narrow channel between the thread-like keel and the suture. Last whorl

occasionally a little descending towards the aperture. Top blunt, umbilicus narrow.

Aperture rhombiform, oblique. Peristome not continuous, sharp. Columellar side vertical and somewhat reflected, hiding part of the umbilicus.

Dimensions: height 2.2-3.3, breadth 3.2-4.3, height of aperture 0.7-1.4. The type specimen from Java (without further locality) (Mus. Senckenberg no. 62103) is high 2.6 and broad 3.7 mm, with an aperture of 0.7 mm height. In the original diagnosis the height is given as 2.5, the breadth as 3.66 mm.

The species is rather variable in height: breadth ratio. Shells from the Gedeh-Pangerango massive (inclusive the locality Rarahan) are broader and more depressed than those from other stations in Java.

Distribution: Java.

Habitat in Java: living on the ground in forests of the mountain region, among dead leaves, decaying wood, moss and other low vegetation.

West Java: Mt. Gedeh, 7500 feet; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; Mt. Gedeh, craterfield, under moss, 2700 m; Mt. Pangerango, 2900 and 3000 m; limestone hill near Sukanegara, Djampang, 1000 m; Mt. Tangkuban Prah, 1000 m; Mt. Papandajan, 5000 feet; Mt. Malabar, 1600 m; Mt. Tjikorai.

East Java: Tengger Mts, 1200 feet; Vetshoogte, Nongkodjadar, Tengger Mts, 1250 m; Tosari, Tengger Mts, 1700 m; Idjen Highland, Kendeng III, 1400 m; Kawah Idjen-Merapi Game Reserve, 1600-1700 m; Ongop-Ongop, Idjen Highland, 1850 m.

There is a considerable amount of confusion in the nomenclature of this species. With the aid of type and paratypes, on loan from the Senckenberg Museum, I have tried to clear the matter.

The unpublished name *Kaliella platyconus* BOETTGER was used as a nude name, without description, by MOELLENDORFF (Nachr. Blatt, 28, 1896, p. 135) in combination with the varieties *intermedia* and *elatior*.

In the following year MOELLENDORFF (l. c. 1897), although pretending to describe BOETTGER's species, applied the name *platyconus* to an entirely different shell. This diagnosis of *Kaliella platyconus* MOELLENDORFF is valid and the use of the name in the Boettgerian sense has to be abandoned.

BOETTGER himself, however, continued to distribute his unpublished *Kaliella platyconus* BTG. to his many correspondents, and so his shell [which has now to be called *Coneuplecta sitaliformis* (MLLDF), see there], came into various collections of that epoch, including the SCHEPMAN Collection, now in the Amsterdam Zoological Museum. Evidently LESCHKE (l. c.) had also *Kaliella platyconus* BTG. before him as is proved by his fig. 1.

Apart from the main form BOETTGER also named and distributed, but never published, *Kaliella platyconus* var. *elator* BTTG. and *K. pl.* var. *subangulata* BTTG. from Java. Of these varieties the first was mentioned as a nomen nudum by MOELLENDORFF (1896, l. c., p. 135) and the second by the same author (1897, l. c., p. 60) and by myself (Treubia, 11, 1929, p. 78).

From the foregoing statement it is evident that these varieties are forms of *Coneuplecta sitaliformis* (MLLDFF) too.

Kaliella platyconus var. *intermedia* MLLDFF described from Bua Kraeng, S. Celebes (Nachr. Blatt, 28, 1896, p. 135) is certainly a form of BOETTGER's *platyconus* [now *Coneuplecta sitaliformis* (MLLDFF)].

As the indication of the variety (differt a typo javano spira magis elevata) is only a comparison of degree not in itself descriptive, it is insufficient to characterize a subordinate form of an undescribed species, or to replace in any way the nominal form. Hence it necessarily follows that the name var. *intermedia* MLLDFF is a nomen nudum too.

RENSCH quoted the name *Kaliella platyconus* var. *intermedia* MLLDFF in the list of synonyms of *Durgellina acutiuscula* (MLLDFF) [Zool. Jahrb. (Syst.) 63, 1932, p. 69], but it does not involve that the variety is also recorded from Java, Bali or Sumba.

I am afraid I cannot agree with RENSCH where he included *platyconus* MLLDFF, *platyconus* LESCHKE (= *Coneuplecta sitaliformis*), *acutiuscula* LESCHKE (= *Liardetia convexoconica*), and *platyconus* var. *intermedia* MLLDFF (= *Coneuplecta sitaliformis* var. *intermedia*) in *Liardetia acutiuscula* (MLLDFF). Apart from the question whether his shells from Bali and Sumba are true *acutiuscula* (a matter on which I have no opinion, because I have not seen the specimens) it is not allowable to throw together four forms which can rightly claim to be good species.

The status of what RENSCH considered to be *Liardetia acutiuscula* has been explained under that species in my paper.

The museum-label names *Kaliella euryconus* BOETTGER and *Kaliella brachyconus* BOETTGER of which I could examine the type and paratype specimens (Mus. Senckenberg nos. 62155-62156, resp. 62158-62159) are not, as RENSCH suggested (l.c. 1932, p. 62), synonyms of *Kaliella indifferens*, but of *Liardetia platyconus* (MLLDFF).

Herewith I am giving the measurements in mm of type and paratype of *Liardetia euryconus* and *L. brachyconus*:

	<i>euryconus</i> (Mt. Gedeh)		<i>brachyconus</i> (Tengger Mts)	
	type (62155)	paratype (62156)	type (62158)	paratype (62159)
height	2.8	2.4	3.1	2.8
breadth	4.1	3.7	4.3	3.9
height of apert.	1.3	1.2	1.2	0.9

Liardetia dendrophila n. sp. (fig. 24).

Shell low conical, sharply keeled at the periphery. Keel somewhat pinched, but not thread-like. Top whorl round, mammilliform. Other whorls almost flat, with shallow suture. Base rounded. Greyish-yellow to straw-colour, little transparent and with a soft silky lustre. Surface finely striate according to the growth lines. This sculpture is crossed by rather coarse and distant spiral lines (or better: rows of impressed points), about 26-30 on the upper surface of the last whorl, and numerous microscopical spiral lines between them.

Whorls 4-4½, rapidly increasing in diameter. Spire raised, but not sharp. Umbilicus very narrow to almost closed.

Aperture broad rhombiform, rather oblique. Peristome not continuous, sharp. Columellar side almost vertical, hiding the greater part of the umbilicus.

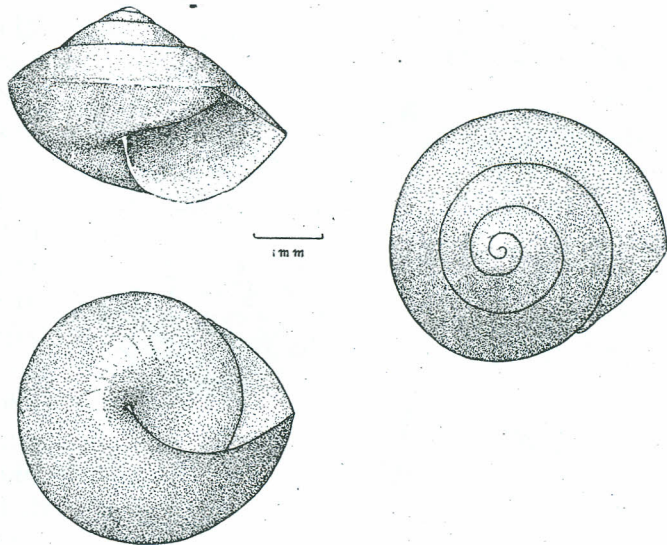


Fig. 24. *Liardetia dendrophila* n. sp. Type. Shell from front, top and base. LENSVELT del.

Dimensions: height 2.7, breadth 4.1, height of aperture 1.6 mm
(type)

height 2.7, breadth 3.9, height of aperture 1.6 mm
(paratype)

Distribution: Java.

Habitat in Java: living on the ground, among earth, dead leaves, decaying wood and low vegetation.

West Java: Mt. Masigit, near Padalarang, 700 m, Nov. 1937, in humus between limestone rocks, leg. Dr E. JACOBSON (paratype).

East Java: Tengger Mts, 1891, leg. H. FRUHSTORFER (Mus. Senckenberg no. 62076 (holotype)).

It is difficult to ascertain the affinities of this new species. Of the Javanese *Liardetia* perhaps *L. platyconus* is its nearest ally. This species however, has more whorls and the profile of the whorls is not so flat as in *L. dendrophila*.

***Liardetia indifferens* (BOETTGER, 1891) (fig. 25, 26).**1891 BOETTGER, Ber. Senckenb. p. 256, pl. 3, fig. 4, 4a, 4b (*Kaliella*).1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 62, fig. 23 (*Kaliella*).1934 RENSCH, Trop. Binnengew. 4, p. 749 and 758 (*Kaliella*).1940 VAN BENTHEM JUTTING, Treubia, 17, p. 332 (*Kaliella*).

Shell moderately conical, base rather flat. Young shells relatively broader, adult ones more elevated. Periphery angular, but not sharply keeled. Yellowish-brown, with a reddish tint and a soft silky lustre. Little transparent. Finely striated according to the growth lines. This sculpture is crossed by more delicate spiral lines.

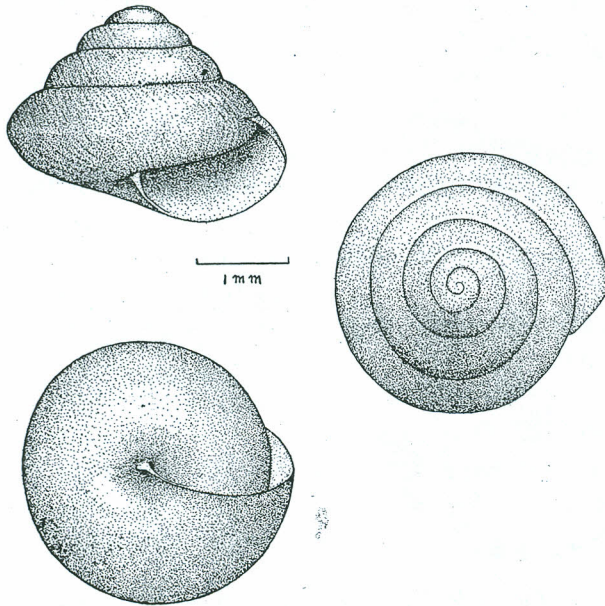


Fig. 25. *Liardetia indifferens* (BTTG.). Shell from front, top and base. LENSVELT del.

Whorls 5-5½, somewhat rounded. Suture distinct, but not deep. Top whorl flat and rather large, although not as large as in *Liardetia amblii*. From *Liardetia dolium* it differs in the finer sculpture and in the more conical shape of the entire shell. Umbilicus narrow.

Aperture rhombiform, somewhat oblique. Peristome sharp, not continuous. The columellar side

vertical and somewhat reflected, hiding part of the umbilicus.

Dimensions: height 1.5-2.8, breadth 2.1-3.2, height of aperture 0.6-0.7 mm. Paratypes from Amboina (Mus. Senckenberg no. 62161) are high resp. 1.6 and 1.5, broad 2.5 and 2.1 mm, and have an aperture of 0.7 and 0.6 mm height. In the original diagnosis the height is given as 1.5, the breadth as 2½ and the height of the aperture as 1 mm.

Distribution: Java, Bali, Sumba, Timor, Kalao, Amboina, Saparua.

Habitat in Java: living on the ground, among dead leaves, decaying wood, moss and other low vegetation. From sea level as high as the mountain region.

West Java: Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Kuripan, near Buitenzorg, 200 m; Tjigombong, S. of Buitenzorg, 500 m; forest between Tjisolak and hot springs, 200 m

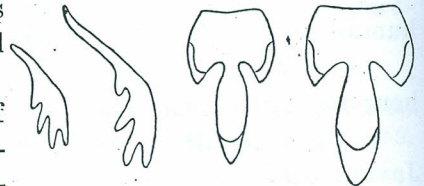


Fig. 26. *Liardetia indifferens* (BTTG.). Radula elements. After RENSCH.

(VAN BENTHEM JUTTING, 1940); Mt. Gedeh, 4000 feet; Tjibodas, Mt. Gedeh, 1400 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m.

Central Java: Bumiaju, Mt. Slamet, 600 m; Dieng plateau, 2000 m (RENSCH, 1932 and 1934) Kali Besèk, near Sulang, S. of Rembang.

East Java: Tjemorosewu, near Sarangan, Mt. Lawu, 3260 m (RENSCH, 1934), Sutji, near Grisee, 5 m; Durdjo estate, near Djember, 600 m; Tengger Mts.

RENSCH (1932) described and figured radula elements of *Liardetia indifferens*. The rhachis and adjoining laterals have a small ectocone on each side of the principal cusp. Towards the sides of the lingual band the teeth become narrow and stalk-like, with 3-5 cusps.

I am afraid I cannot agree with RENSCH (1932, p. 62) where he included the ms names *Kaliella brachyconus* BTG. and *Kaliella euryconus* BTG. in the synonymy of *Liardetia indifferens*. In my opinion these forms must be considered identical with *Liardetia platyconus* (MLLDFF) (see there).

The shells from Krakatau, Verlaten Island and Sebesi which I identified as *Kaliella indifferens* (VAN BENTHEM JUTTING, Treubia, 6, 1925, p. 142 and Arch. néerl. Zool. 5, 1941, p. 302) are not this species, but *Liardetia doliolum* (PFR).

*Liardetia ambli*a (MOELLENDORFF, 1897) (fig. 27).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 60 (*Kaliella*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Kaliella*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 66 (*Kaliella*).

Shell low conical, base rounded. Periphery angular, but not sharply keeled. Reddish-brown, little transparent, with soft silky lustre. Striated according to the growth lines. Above and below the periphery this sculpture is crossed by numerous undulating spiral lines.

Whorls 4-4½, well rounded. Top whorl large, apex blunt. In the initial whorls the suture is superficial; the later ones are more curved with a distinct suture.

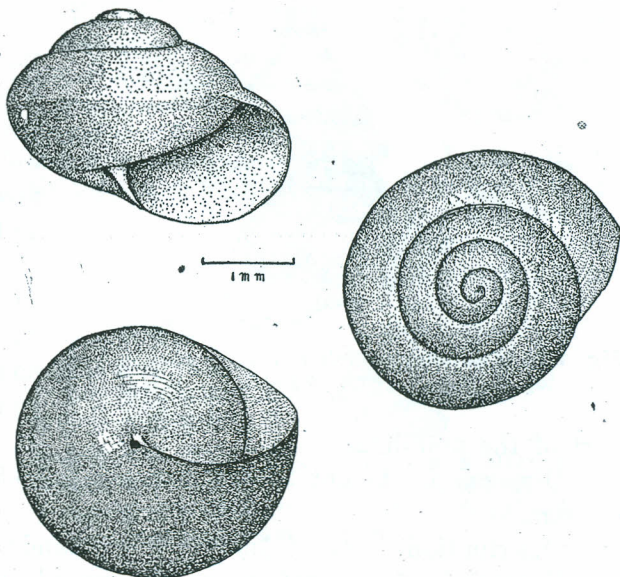


Fig. 27. *Liardetia ambli*a (MLLDFF). Type. Shell from front, top and base.

Aperture semicircular, oblique. Peristome sharp, not continuous. The columellar side is a little reflected, hiding part of the umbilicus.

Dimensions: height 2.2-2.5, breadth 3.0-3.3, height of aperture 0.9-1.2 mm. The type specimen from Sukabumi (Mus. Senckenberg no. 62139) is high 2.5 and broad 3.2 mm, with an aperture of 1.1 mm height. In the original diagnosis the height is given as 2.33, the breadth as 3 mm.

Distribution: Sumatra, Java, Sumba, Timorlaut.

Habitat in Java: living on the ground, among earth, fallen leaves, moss and low vegetation.

West Java: Sukabumi, 700 m; Mt. Gedeh, 2000 feet.

According to RENSCH (1932 p. 66) the radula of *Liardetia ambliia* is similar to that of *Liardetia angigyra*. In S. Sumatra specimens were collected by H. J. NEUTEBOOM in Muara Beliti on a low wall, March 1949. It is the first record for Sumatra.

Liardetia doliolum (PFEIFFER) (fig. 9, 28).

1846 PFEIFFER, Proc. Zool. Soc. London, p. 41 (*Helix*).

1934 RENSCH, Trop. Binnengew. 4, p. 749 (*Kaliella*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 301 (*Kaliella*).

Shell low conical, base rather flat. Periphery somewhat angular, but not sharp. Reddish-brown, little transparent, with soft silky lustre. Upper side of the whorls strongly striated, even ribbed, in the direction of the growth lines. Below the periphery these riblets fade away towards

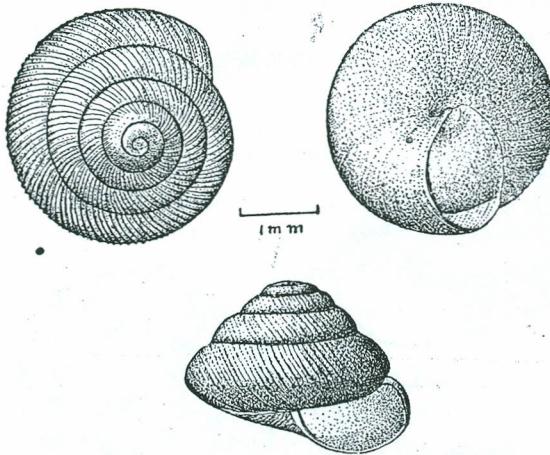


Fig. 28. *Liardetia doliolum* (PFR). Shell from top, base and front. ABDULKADIR del.

the umbilicus. On both upper and lower sides this sculpture is crossed by much weaker spiral lines.

Whorls 5-5½, the first one flat and rather large, though not as large as in *Liardetia ambliia*. All whorls well rounded, hence the suture is distinct. Top blunt, umbilicus narrow.

Aperture rhombiform, somewhat oblique. Peristome sharp, not continuous. The somewhat reflected, hiding columellar side vertical and

part of the umbilicus.

Dimensions: height 2.2-2.7, breadth 3.2-3.3, height of aperture 0.6-0.7 mm.

Distribution: several Indo-pacific Islands, including Java.

Habitat in Java: living on the ground, among earth, dead leaves, moss and other low vegetation. From near sea level as high as about 500 m.

West Java: garden of the British Parsonage, Batavia, 50 m.

Central Java: Sulang, near Kali Besèk, Rembang, 100 m.

East Java: Sutji, near Grissee, 5 m; estate of Sumber Arum, S. of Malang, 500 m, on stalks of young coffee berries.

The animal is ovoviviparous; the uterus can be seen through the shell, abnormally distended by 8 or 9 large, developing eggs (H. B. BAKER, Bull. B. P. Bishop Mus. no. 158, 1938, p. 27; VAN BENTHEM JUTTING, 1941, p. 302).

The shells from Krakatau, Verlaten Island and Sebesi which I identified as *Kaliella indifferens* (VAN BENTHEM JUTTING, Treubia, 6, 1925, p. 143 and id., 1941, l. c.) are not this species, but *Liardetia doliolum* (PFR).

Liardetia fimbriosa (QUADRAS & MOELLENDORFF, 1894) (fig. 29).

1894 QUADRAS & MOELLENDORFF, Nachr. Blatt, 26, p. 89 (*Sitala*).

1901 QUADRAS & MOELLENDORFF, in: SEMPER, Reisen Arch. Philipp. 8, p. 113, pl. 11, fig. 9 (*Sitala*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 67 [*Kaliella (Sitalinopsis)*].

Shell high conical, more or less turreted, the suture so laced that the whorls are descending step-like. Along the periphery there are two keels, the upper one is always free, the lower one, running parallel with the suture in the spire, is only visible on the last whorl. The keels are sharper in young than in adult animals and provided with short, stiff hairs in a fresh state. These hairs, however, are easily falling off. White or cream colour, somewhat transparent. Finely striated or almost ribbed, according to the very oblique growth lines. This sculpture is crossed by much finer spiral lines.

Whorls $6\frac{1}{4}$ - $6\frac{1}{2}$, suture deep. Top pointed, although not sharp, base rounded. Umbilicus very narrow, or closed.

Aperture trapezoidal, very oblique. Peristome sharp, not continuous. Columellar side more or less vertical, somewhat reflected over the umbilical slit.

Dimensions: height 1.9-2.2, breadth 1.4-1.8, height of the aperture 0.4-0.5 mm.

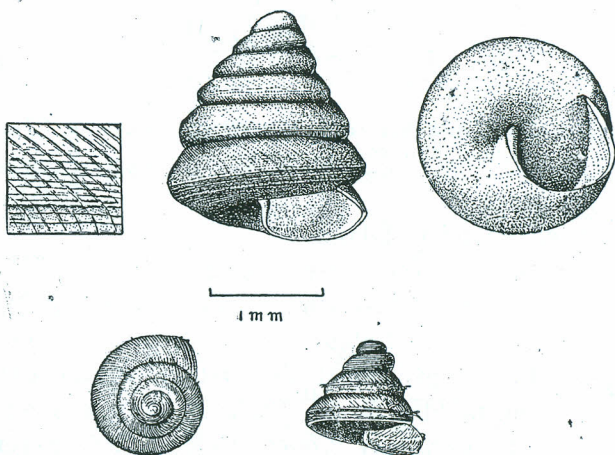


Fig. 29. *Liardetia fimbriosa* (QUADR. & MLLDFF). Adult shell from front and base, with detail of sculpture. Immature shell (with hairs) from front and base. ABDULKADIR del.

Distribution: Philippine Islands, Bali, Java, Celebes. The islands of Java and Celebes are new records.

Habitat in Java: occurring in the lower mountain region, 500-700 m alt., among earth, dead leaves, moss and other low vegetation. The species probably prefers limestone regions.

West Java: Mt. Pawon, near Padalarang, 700 m; limestone hills near Padalarang, in sand under overhanging rock, 500 m.

The Amsterdam Zoological Museum recently received a shell of this elegant species, collected in South Celebes at a pass in the limestone mountains between Ujung Lamuru and Watamponé, about 140 miles N. E. of Makassar, alt. 300-400 m, Sept. 1948, by Mrs. G. A. TAMMES-BOLT.

Genus *Lamprocystis* PFEIFFER, 1883

Shell small, imperforate, or narrowly perforate, low conical to almost flat, smooth and polished. Transparent, glossy. Aperture somewhat oblique, broadly lunar. Peristome sharp, not thickened or reflected, except in the umbilical region.

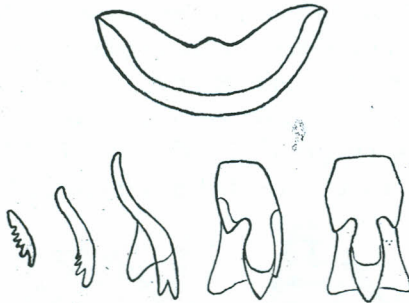


Fig. 30. *Lamprocystis infans* (PFR).
Mandibula and radula elements.
After RENSCH.

Mantle with one or more appendages. Right shell lobe of the mantle-collar usually well developed; left one absent.

Radula with tricuspid rhachis and bi- or tricuspid laterals. The marginals are multicuspoid (3-5 denticles) (fig. 30).

The animals are hermaphroditic, and — as far as observed — ovoviviparous. There is no dart sac in the male sexual organs.

Distribution: Malay Archipelago, several Pacific Islands.

In Java there are two species:

1. Profile of last whorl evenly rounded. Shell finely striated in radial direction. Colour more brownish-yellow *infans*
- In the profile of the last whorl the greatest width is lying above the middle. Radial striation of the shell more pronounced, so as to be irregularly ribbed. Colour more greenish-yellow *gedeana*

Lamprocystis infans (PFEIFFER, 1854) (fig. 31).

1854 PFEIFFER, Proc. Zool. Soc. London, p. 290 (*Helix*).

1867 MARTENS, Ostas. Landschn. p. 243 (*Nanina*).

1891 BOETTGER, Ber. Senckenb. p. 243.

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 63 (*radiatula*).

1912 SCHEPMAN, Proc. Mal. Soc. London, 10, p. 233 (*Microcystina*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Microcystina infans* and *Lamprocystis radiatula*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 52-53, fig. 14-16.

1934 RENSCH, Trop. Binnengew. 4, p. 752.

1935 PARAVICINI, Arch. Moll. K. 67, p. 172 (*radiatula*).

Shell low conical, broader than high, straw colour, sometimes more brownish, sometimes more greenish; the umbilical region often whitish (like in the European *Retinella nitidula*). Transparent, glossy, highly polished. With irregular, fine growth lines, crossed by extremely fine spiral ones (only discernible under magnification of at least 20 times).

Whorls 5-5½, at first slowly, later more rapidly increasing in diameter. Periphery rounded. Profile of the whorls evenly curved, the greatest width lying in the middle. Suture not deep, marginate. Top somewhat projecting, base round. Umbilicus open, but not wide.

Aperture oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected, except over a short distance in the umbilical region.

Dimensions: height 5½-7, breadth 9-11, height of aperture 4-5 mm.

Distribution: Borneo, Java, Sumatra, Bali.

Habitat in Java: hilly and mountainous country, up to high altitudes. Living on the ground, among earth, fallen leaves, low vegetation. During damp weather the snails are crawling actively over the trunks and leaves of shrubs and herbs.

West Java: near kampong Tjinjurup, Mt. Karang, 700 m; estate of Tjikopo, near Buitenzorg, 700 m; estate of Tjiliwung, near Buitenzorg, 1200 m; wood near Telaga Warna, Puntjak pass, 1450 m; Mt. Gedeh, 4000 feet; Tjibodas, Mt. Gedeh, 1400 m; near little waterfall, on leaf of *Elatostemma*, Tjibodas, Mt. Gedeh, 1500 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; Mt. Gedeh, craterfield, 2700 m; top of Mt. Gedeh, 2958 m.; Mt. Pangerango, 2900-3000 m; limestone hill near Sukanegara,

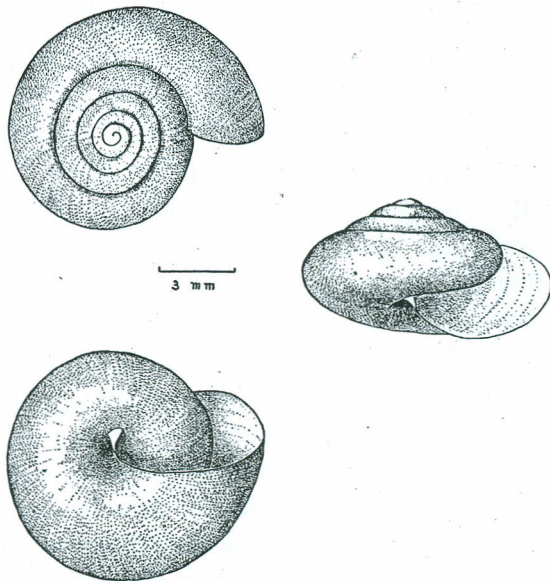


Fig. 31. *Lamprocystis infans* (PFR). Shell from top, side and base. Author del.

Djampang, 1000 m; Mt. Pawon, near Padalarang, 700 m; Bukanagara estate, Pamenukan- and Tjiasem-lands, 1200 m; Mt. Tangkuban Prah, 1000-1600 m; Tjiwidej, S. of Bandung, 1100 m; Mt. Tilu, 6300 feet; Mt. Malabar, 1600 m; Pengalengan, 1550 m; Tjinjiruan, 1800 m (PARAVICINI, l. c.); Tjibitung, E. of Pengalengan, 2000 m; Mt. Papandajan, 2100 m; Mt. Tjikorai, 2500 m; Mt. Guntur, 1500 m.

Central Java: near Sembungan, Dieng plateau, 1200 m; near origin of the Seraju river, Dieng plateau, 2000 m; Mt. Prah, 2500 m.

East Java: near Kali Djumok, Mt. Lawu, 1787 m (RENSCH, 1934); Mt. Ardjuno, 5600 feet; Vetshoogte, Nongkodjadar, Tengger Mts, 1250 m; Tengger Mts, 1200 m; road to Jang Highland, 6000 feet; Wonosari (MARTENS, 1867); Kendeng III, Idjen Highland, 1400 m; Kawah Idjen-Merapi Game Reserve, 1600-1700 m; Ongop-Ongop, Idjen Highland, 1850 m; estate of Glen Falloch, near Banjuwangi, 1200 feet.

The differences between this species and *Lamprocystis gedeana* MLLDFF will be discussed under the next species.

Lamprocystis infans is a very common and very variable species in Java, especially in the height: breadth ratio, in the colour and in the spiral markings. Hence it is not astonishing to find the species described under more than one name; it is even strange that not more authors have introduced it as new.

As to the name *Lamprocystis radiatula* MLLDFF this is another example of BOETTGER and MOELLENDORFF attaching one name to two different species, MOELLENDORFF publishing his diagnosis, but BOETTGER only distributing duplicate samples (of another species) with a ms name only.

BOETTGER, who in the nineties, received several lots of Javanese shells collected by H. FRUHSTORFER gave the name *Lamprocystis radiatula* to a small shell from Surabaya, East Java (now *Microcystina gratilla* n.sp., see there) but as he never published it, the name remained a museum-label name only (Mus. Senckenberg, no. 62484).

When MOELLENDORFF in 1897 published his *Lamprocystis radiatula* he took an altogether different species from the Tengger Mountains (Mus. Senckenberg no. 4090, type, no. 4091, paratypes), which I now consider identical with *Lamprocystis infans* (PFR).

This state of affairs would not have caused further confusion had not RENSCH (1932, p. 49) recorded as "*Microcystina radiatula* MLLDFF" specimens from Bali and Flores which are evidently *Lamprocystis radiatula* BTG. ms, non MLLDFF. I could check this assertion by examining a sample from RENSCH's expedition collected at Rana Mese, Flores (now in the Senckenberg Museum no. 62485) and besides it goes forth from his own remark where he is wondering why MOELLENDORFF gave as size: diam. 7 mm, alt. 4 mm, whereas the type specimen (of *L. radiatula* BTG. ms) is only 2.7 mm broad and 1.4 mm high. The nonconformity of the

two measurements is explained by the fact that RENSCH had before him the type of *Lamprocystis radiatula* BOETTGER ms (now *Microcystina gratilla* n. sp.) and not of *Lamprocystis radiatula* MOELLENDORFF [now *Lamprocystis infans* (PFR)].

Lamprocystis gedeana MOELLENDORFF, 1897 (fig. 32).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 61,

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229.

Shell low conical, broader than high, greenish-yellow. Thin, transparent, glassy, highly polished. With irregular growth lines which are more distinct than in *Lamprocystis infans*, rendering the shell a ribbed appearance. This radial sculpture is crossed by fine spiral lines (somewhat better visible than in *L. infans*).

Whorls 5, regularly increasing in size. Periphery rounded, the greatest width a little above the middle, causing the last whorl to be somewhat "shouldered". Suture not deep, marginate. Top slightly projecting, base rounded. Umbilicus open, not wide.

Aperture oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected, except over a short distance in the umbilical region.

Dimensions: height 5, breadth 8, height of aperture 3 mm.

Distribution: Java.

Habitat in Java: the exact habitat is unknown, but it is probable that the species lives under similar conditions as *Lamprocystis infans*.

West Java: Mt. Gedeh; 4000 feet and 9000 feet.

It is not easy to distinguish the present species from *Lamprocystis infans*. In the following table the principal features are compared:

<i>infans</i>	<i>gedeana</i>
Profile of the last whorl evenly rounded	In profile of the last whorl the greatest width is lying above the middle
Finely and regularly striated in radial direction	Radial striation more pronounced so as to appear as irregular ribs

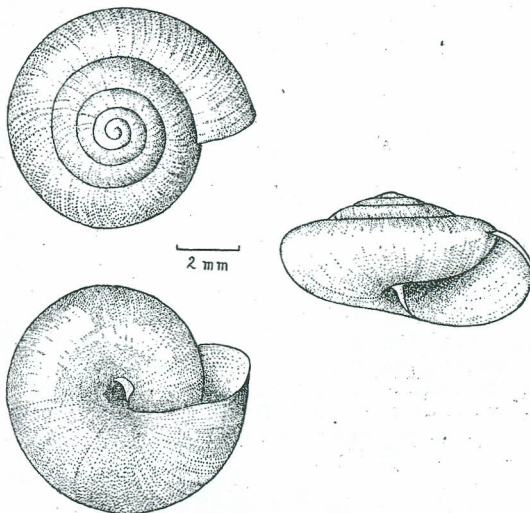


Fig. 32. *Lamprocystis gedeana* MLLDFF. Shell from top, side and base. Author del.

Fewer whorls than *L. gedeanana*
(in a shell of 7 mm max. diam.
there are $4\frac{1}{2}$ whorls)
More brownish-yellow

More whorls than in *L. infans* (in
a shell of 7 mm max. diam.
there are 5 whorls)
More greenish-yellow

Genus *Helicarion* FERUSSAC, 1820

Shell imperforate or nearly so, globular-conical to almost flat. Thin and transparent, with a small spire and only few, rapidly increasing whorls. Last whorl large and often inflated.

Aperture oblique, broadly lunar. Peristome sharp, not thickened; little or not reflected.

Mantle edge with a number of flap-like appendages: two shell-lobes hiding a large part of the shell on the right and left side, two neck-lobes on the animal's neck, and one back-lobe, covering part of the body in front of the shell like a shield. The side of the mantle flaps which is pressed against the shell is smooth; the exterior is warty with numerous small warts (fig. 33).

Foot with a terminal mucous gland, overhung by a "horn". Foot sole divided in 3 longitudinal fields.

Radula with a tricuspid central tooth and bicuspid to tricuspid laterals. The outer

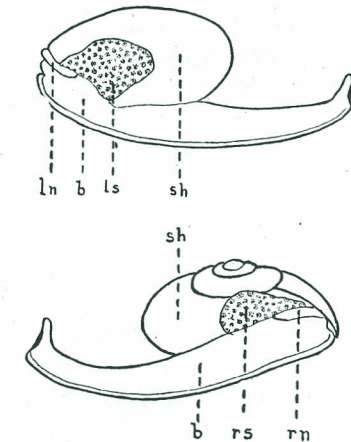


Fig. 33. *Helicarion albellus* MARTS. Outline sketch of animal. b. body; sh. shell; l.n. and r.n. left and right neck flaps; l.s. and r.s. left and right shell flaps. Author del.

marginals are multicuspid.

Mandibula with a weak median projection at the concave side (fig. 34).

The animals are hermaphroditic. A dart sac is absent.

Distribution: India, Malay Peninsula, Malay Archipelago, Philippines, Australia and various Pacific Islands.

In Java there are 2 species:

1. Shell with $4-4\frac{1}{2}$ whorls, low conical spire and fine spiral striae on all whorls.. **albellus**
- Shell with $3-3\frac{1}{2}$ whorls, an almost flat spire and without spiral striae **perfragilis**

Of various *Helicarion* species, the Javanese ones included, it is reported that they are very active snails, crawling rapidly when undisturbed. As soon as they are touched, however, the animals make violent

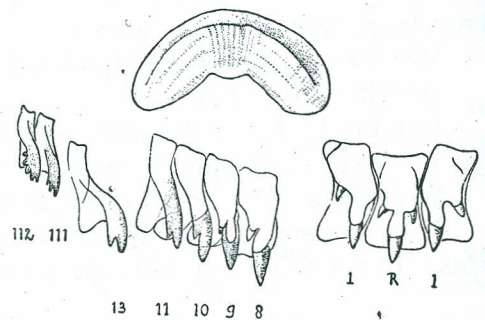


Fig. 34. *Helicarion albellus* MARTS. Mandibula and radula elements. After WIEGMANN.

convulsive movements, beating round with body and foot. By these wild spasmodic contractions they often loose their foot-hold on the vegetation and tumble head over heels to the ground.

***Helicarion albellus* MARTENS, 1867 (fig. 35).**

- 1867 MARTENS, Ostas. Landschn. p. 186.
 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1011.
 1890 BOETTGER, Ber. Senckenb. p. 138-139, pl. 5, fig. 1 a-c (*adolphi*).
 1892 MARTENS, Erg. Weber, 2, p. 223 (*adolphi* and *agilis* v. HASS. ms).
 1893 WIEGMANN, Erg. Weber, 3, p. 114, pl. 9, fig. 1-5 (*adolphi*).
 1894 MARTENS, Jenaische Denkschr. 8, p. 83 (*adolphi*).
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 231 (*adolphi*).
 1914 LESCHKE, Mitt. naturh. Mus. Hamburg, 31, p. 205 (*adolphi*) and p. 223 (*albellus* and *adolphi*).
 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 71, fig. 25 (*adolphi*).
 1934 RENSCH, Trop. Binnengew. 4, p. 753 (*adolphi*).
 1935 PARAVICINI, Arch. Moll. K. 67, p. 171 (*adolphi*).

Shell globose-conical, with rapidly increasing whorls. Cream-colour to fulvous, sometimes with a narrow whitish or reddish zone along the suture. Irregularly striated according to the growth lines, and with an extremely fine spiral striation, generally only visible under a magnification of 15 times or more. Highly polished and transparent, the internal organs shining through. Empty shells soon become opaque. Epidermis very thin.

Whorls 4-4½, evenly rounded, margined along the suture by a distinct zone which is sometimes more coarsely striated radially than the rest of the whorls. Top blunt, periphery and base round. Umbilicus closed, or hairlike. Overlapped by an outward fold of the columellar side of the aperture.

Aperture oblique, broadly lunar. Peristome not continuous, sharp, evenly rounded. Only the very short columellar side is perpendicular.

Dimensions: height 6-8, breadth 8-10½, height of the aperture 4-5 mm. The type specimen from Mt. Salak (Mus. Senckenberg no. 62497) is high 6, broad 8¼ mm and has an aperture of 4 mm height.

Distribution: Java, Sumatra, Bali, Lombok, S. Celebes, Nusa Kambangan.

Habitat in Java: living on leaves and trunks of shrubs and herbs, crawling actively during moist weather.

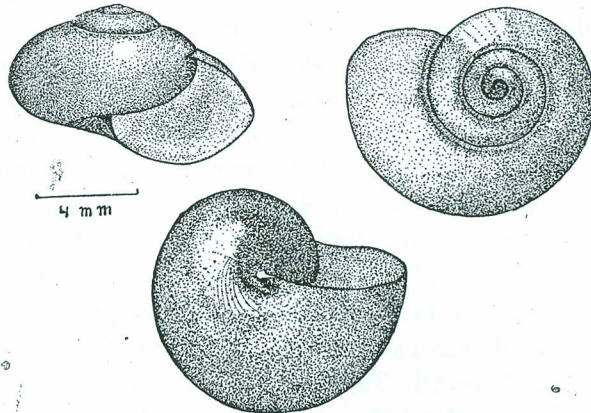


Fig. 35. *Helicarion albellus* MARTS. Shell from front, top and base. LENSVELT del.

West Java: Mt. Karang, near kampong Tjinjurup, in forest, 760 m; wood near crater of Mt. Karang, 1000 m; Leuwiliang, near waterfall of the Tjianten, 300 m; Purasèda, near Leuwiliang, in forest, 300 m; Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; wood near Tjisolak, 200 m; near Wijnkoopsbay, 25 m; Mt. Salak (BOETTGER, 1890); wood near Gunung Bunder, Mt. Salak, 900 m; on wet Araceae leaves, Gunung Bunder, Mt. Salak, 1000 m; Warangloa, Mt. Salak, 650 m; in Botanical Garden, Buitenzorg, 250 m; wood of Mt. Pantjar, near Buitenzorg, 500 m; saddle between Mt. Pantjar and Mt. Paniisan, near Buitenzorg, 500 m; estate of Tjisarua-Zuid, near Buitenzorg, 800 m; estate of Megamen-dung, 800 m; wood near Telaga Warna, Puntjak pass, 1450 m; top of Puntjak pass, 1450 m; Tjibodas, Mt. Gedeh, wood near pasanggrahan, 1400 m; near little waterfall, on leaf of *Elatostema*, Tjibodas, Mt. Gedeh, 1600 m; Pantjoran Mas, near Tjibodas, Mt. Gedeh, 1400 m; on a leaf, near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; between Tjibeureum and Kandang Badak, Mt. Gedeh, 2000 m; Pasir Sarongge, near Patjet, Mt. Gedeh, 1300 m; Sukabumi, 700 m; wood near Situ Gunung, S. slope of Mt. Gedeh, 1000 m; environs of Pagelaran, Djampang, 400 m; near Leuwimanggu, Djampang, 700 m; limestone hill near Sukanegara, Djampang, 1000 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m; estate of Radjamandala, near Padalarang, 200 m; near Maribaja, 100 m S. E. of hot springs, 1100 m; Mt. Tangkuban Prah, 500-1600 m; Tenggeragung, near Subang; estate of Bukanagara, Pamenukan- and Tjiasem-lands, 1200 m; wood of Mt. Wajang, 1600 m; Pengalengan, 4500 feet; Tjibitung, E. of Pengalengan, 2000 m; Mt. Dogdog, 1500 m; Mt. Papandajan, 7500 feet; Garut, 700 m; Tjibulu, near Tjikadjang, 1500 m; Mt. Tjikorai, 4500 feet.

Central Java: Baron, S. of Djokja, 100 m.

East Java: Southern Mountains, 1200-1500 feet; Nongkodjadar, near waterfall, Tengger Mts, 1200 m; Tengger Mts, 4000-5000 feet; Djabung estate, near Wlingi, 800 m; Kali Mrawan, 1000 m; Blawan, Idjen Highland, 950 m; estate of Glen Falloch, near Banjuwangi, 1200 feet.

MARTEN's diagnosis of *Helicarion albellus* (1867, p. 186) is rather superficial and not accompanied by a figure. Hence it is understandable that BOETTGER (1890, p. 138) described the species again, this time in precise terms and with good figures. But it is curious that MARTENS identified specimens from Tjibodas collected by M. WEBER (MARTENS, 1892, p. 223) as *Helicarion adolfi*. Obviously he did not associate them with his own *Helicarion albellus* from East Java.

BOETTGER (1890) mentioned that the shells of *H. adolfi* lacked the spiral lines on the middle part of the ultimate whorl. Now it is remarkable that on the type shell (Mus. Senckenberg no. 62497) and in some

of the paratypes the spiral lines, although weak, do occur on the entire last whorl. In the large material of *Helicarion albellus* from Java which I could examine there is a great deal of individual variation in sculpture and form.

I am not certain whether *Helicarion lineolatus* MARTENS (1867, Ostas. Landschn. p. 184) is really a Javanese species. According to the description the shell is much larger (high 12, broad 19 mm) than any helicarioniform species from Java that I have seen. Moreover the locality: Java, is very vague.

The animals from Sebesi Id. which I brought to *Helicarion lineolatus* in 1925 (VAN BENTHEM JUTTING, Treubia, 6, p. 143) have, on renewed investigation, proved to be *Vitrinopsis fruhstorferi* (MOELLENDORFF).

Helicarion fruhstorferi MOELLENDORFF, 1897 is not a *Helicarion*, but a *Vitrinopsis* [RENSCH, Zool. Jahrb. (Syst.) 63, 1932, p. 79]. The species is synonymous with *Vitrinopsis collingei* SCHEPMAN, 1912 from Nongko-djadjar (Proc. Mal. Soc. 10, p. 229), and also with the (unpublished) *Vitrinopsis dohrni* BOETTGER (museum label name in Senckenberg Museum no. 62538) from the Southern Mountains, residency of Pasuruan, 1500 feet, collected by H. FRUHSTORFER, 1891.

The type specimen of *Vitrinopsis fruhstorferi* (MLLDFF) was collected in the same locality (Mus. Senckenberg no. 62491) and not in West Java as RENSCH (l.c.) pretended. As the species does not belong to any of the four families treated in this report it will be discussed in a later part of these "Systematic Studies" with the *Zonitidae*.

On the other hand the shell of *Vitrinopsis dohrni* BOETTGER ms, collected at Mt. Tjikorai, West Java, by H. F. RUHSTORFER and preserved in the SCHEPMAN Collection of the Amsterdam Zoological Museum, is not a *Vitrinopsis* or a *Helicarion*, but a *Microparmarion* sp.

In addition it seems not out of place to state here that *Microparmarion fruhstorferi* SIMROTH, 1898 is a synonym of *M. austeni* SIMROTH, 1893 [HOFFMANN, Zool. Jahrb. (Syst.) 74, 1940, p. 43] and that *Semivitrina fruhstorferi* BOETTGER (museum label name in Mus. Senckenberg no. 62547) from Mt. Gedeh, West Java, 9000 feet, collected by H. FRUHSTORFER in 1892, is a *Microparmarion* sp.

***Helicarion perfragilis* MOELLENDORFF, 1897 (fig. 36).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 58,

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 206 and 223.

Shell low and broad, with rapidly increasing whorls and an almost flat, or very little elevated spire. Cream colour to corneous, without spiral striation. The growth lines are fine, somewhat more distinct at the suture. Very thin, highly polished and transparent, the internal organs shining through. Empty shells soon become opaque.

Whorls 3-3½, evenly rounded, margined at the suture by a distinct zone which is sometimes more coarsely striated radially than the rest of the whorls. Top blunt, periphery rounded, base a little so. Umbilicus closed, or hairlike, for the greater part covered by the columellar side of the aperture.

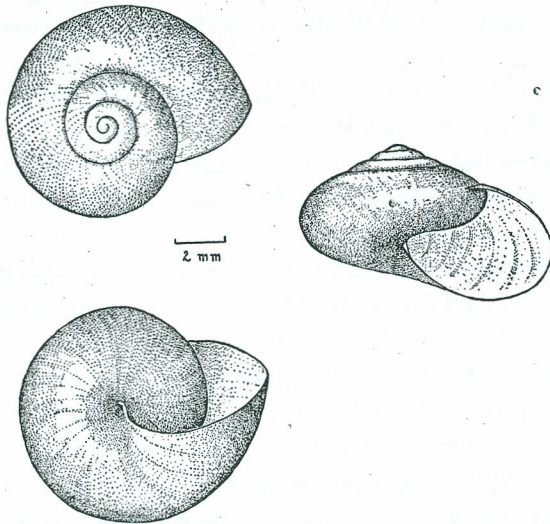


Fig. 36. *Helicarion perfragilis* MLLDFF. Shell from top, front and base. Author del.

Aperture oblique, very broadly lunar. Peristome not continuous, sharp, evenly rounded. Only the very short columellar side is perpendicular.

Dimensions: height 5½, breadth 9, height of aperture 5 mm.

Distribution: Java.

Habitat in Java: living on the ground, or on low

vegetation, in hilly and mountainous country.

West Java: Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; wood near Tjisolok, 200 m; Mt. Salak, 1700 m; wood of Mt. Pantjar, near Buitenzorg, 500 m; Depok (LESCHKE, 1914); estate of Tjisaruazuid, near Buitenzorg, on leaf of *Strobilanthes*, 1000 m; Mt. Gedeh, 4000 feet; environs of Sukanegara, Djampang, 1000 m; Mt. Malang, East Djampang, 1000 m; Mt. Papandajan, 4000 feet; Pengalengan, 4500 feet.

Genus *Inozonites* PFEIFFER, 1883

• Shell lenticular, very low conical to almost flat, smooth, acutely keeled at the periphery. Aperture somewhat oblique, peristome sharp, a little thickened at the columellar side.

Marginal plates of the radula bicuspid. Penis glandular, widened distally, with a glandular caecum at the origin of vas deferens and retractor penis.

Distribution: Philippines, Java.

The foregoing characters of the genus have been translated from THIELE, 1931 (*Handb. Syst. Weicht. Kunde*, Vol. 1, Part 2, p. 617). The systematic position of the genus, however, is very uncertain and there is no possibility of clearing it up unless material for anatomical investigation is obtained. The only Javanese species, *Inozonites imitator* MLLDFF, consists of a unique specimen, collected without the weak parts. Hence its

classification is double uncertain. Therefore I must leave the final opinion to further research whereby the anatomical results will have the last word.

In Java there is only one species:

Inozonites imitator MOELLENDORFF, 1897 (fig. 37).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 65.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 228.

Shell very low conical, almost flat, angular at the periphery. Greenish-yellow, glassy, hyaline, shining. Finely, somewhat irregularly striated according to the growth lines. Above the periphery without spiral striation, below it with about 10, distantly placed, wavy spiral lines.

Whorls 5, regularly coiled in an almost flat spiral. Profile of each whorl evenly curved. Suture well impressed, with a false double margin, due to the older whorl shining through. Periphery slightly angular, but not acute. Above the angulation rather flat, below it rounded. Umbilicus wide, showing all previous whorls.

Aperture oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected, except for a small region close to the umbilicus.

Dimensions: height 3, breadth $6\frac{1}{2}$, height of aperture $2\frac{1}{4}$ mm. (holotype). There is only the type specimen known. It is preserved in the Senckenberg Museum (no. 62543).

Distribution: Java.

Habitat in Java: nothing is known on the conditions under which the shell was found.

West Java: Mt. Gedeh, 3000 feet, collected by H. FRUHSTORFER in 1892.

Genus Dyakia GODWIN AUSTEN, 1891

Shell sinistral, low conical. Brown or yellowish-brown; in some species with one or more spiral bands of darker brown. Umbilicus narrow. Young shells acutely keeled at the periphery. In adult animals this carination can persist, or become obsolete.

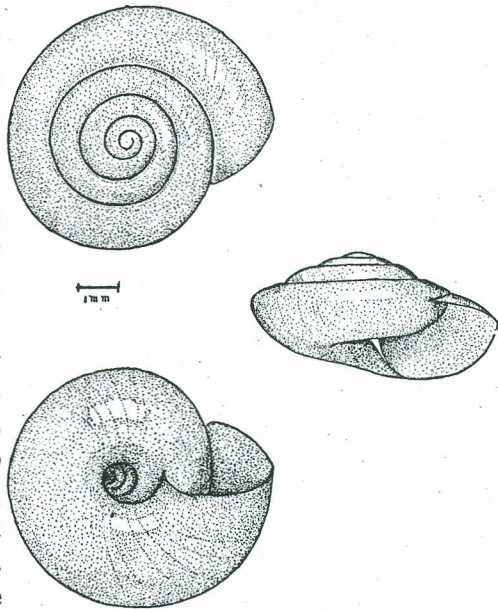


Fig. 37. *Inozonites imitator* MLLDFF.
Type. Shell from top, front and base.
LENSVELT del.

Radular teeth unicuspid. Mandibula without inner median projection, or with a very weak one (fig. 38).

Generative organs with a dart sac containing a long, slender, calcareous dart. The dart glands are flat and fan-shaped, opening into the dart sac by a common, narrow canal. Penis without coecum.

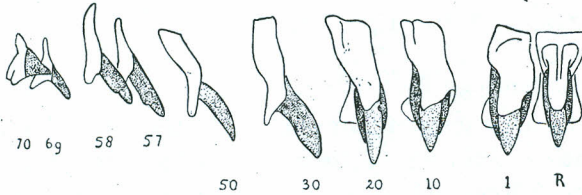


Fig. 38. *Dyakia rumphii* (VON DEM BUSCH). Radula elements. After WIEGMANN.

The footsole is undivided. In some individuals of *Dyakia rumphii* the footsole has dark lateral fields and a lighter central one, without being, in fact,

truly tripartite.

Distribution: Malaya, Sumatra, Java, Borneo, and some satellite islands.

In Java there are two species:

1. Spire low conical; periphery in adult shells rounded or slightly angular. Below the periphery is a chestnut-brown zone of moderate breadth **rumphii**
- Spire entirely flat; periphery sharply carinate in all stages of development. Below the periphery with a narrow band of somewhat darker colour than the rest of the shell **clypeus**

Dyakia rumphii (VON DEM BUSCH, 1842) (fig. 38, 39).

- 1842 VON DEM BUSCH, in: PHILIPPI, Abb. & Besch. 1, p. 9, pl. 1, fig. 2 (*Helix*).
 1849 MOUSSON, Land & Süßsw. Moll. Java, p. 18, pl. 1, fig. 2 (*Nanina*).
 1867 MARTENS, Ostas. Landschn. p. 220 (*Nanina*).
 1886 TRYON, Man. of Conch. (2) 2, p. 20, pl. 3, fig. 38 (*Nanina*).
 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1024 (*Nanina*).
 1890 BOETTGER, Ber. Senckenb. p. 140 (*Hemiplecta*).
 1892 MARTENS, in: WEBER, Erg. Reise Nied. Ost. Ind. 2, p. 229.
 1893 WIEGMANN, in: WEBER, Erg. Reise Nied. Ost. Ind. 3, p. 146, pl. 11, fig. 4-7.
 1912 SCHÉPMAN, Proc. Malac. Soc. London, 10, p. 231.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 206 (*clypeus*) and p. 228.
 1923 OOSTINGH, Meded. Landb. Hoogesch. 26, p. 147.
 1934 RENSCH, Trop. Binnengew. 4, p. 748.
 1935 PARAVICINI, Arch. Moll. K. 67, p. 172.

Shell sinistral, broad. Spire low conical, base rounded. Upper side of whorls straw-colour, yellowish-brown, or greenish-brown. Below the periphery with a dark chestnut zone of varying breadth, fading towards the umbilicus. In some individuals there is a narrow white band along the periphery just above the brown zone, thus accentuating the difference of colour above and below the periphery. Young shells are acutely keeled at the periphery. In adult animals this carination can disappear

towards the aperture. Rather strong shells, somewhat transparent and with a soft lustre.

First two whorls smooth, or granular. Subsequent ones strongly striated or faintly ribbed according to the lines of growth. This sculpture is crossed by fine spiral striae, causing a minute granulation all over the surface. Epidermis yellowish or greenish.

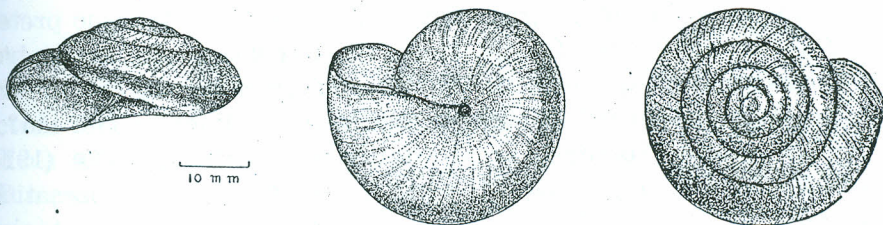


Fig. 39. *Dyakia rumphii* (VON DEM BUSCH). Shell from side, base and top. LENSVELT del.

Whorls 5-5½, regularly increasing in diameter. Moderately rounded, suture distinct, but not deep. Umbilicus narrow.

Aperture broadly lunar, oblique. Peristome not continuous, not reflected, generally sharp, in old shells somewhat thickened. The columellar side is overlapping the umbilicus a little.

Dimensions: height 17-20, breadth 35-40, height of aperture 14-16 mm.

Distribution: Java. The occurrence in Sumatra and Madura needs confirmation.

Habitat in Java: living on the ground, in damp forest, among dead leaves and low vegetation. Occurring between 250 and 2500 m altitude.

West Java: wood near kampong Tjinjurup, Mt. Karang, 700 m; ravine of Mt. Salak, 800 m; Mt. Paniisan, near Buitenzorg, 700 m; Gora, S. of Buitenzorg; estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 900 m; wood in estate of Tjiliwung, near Puntjak pass, 1400 m; wood near Telaga Saät, near Puntjak pass, 1400 m; wood near Telaga Warna, near Puntjak pass, 1450 m; Sindanglaja (MARTENS, 1867); Tjibodas, Mt. Gedeh, wood near pasanggrahan, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Sukabumi, 700 m; limestone hill near Sukanegara, Djampang, 1000 m; Bandung, 700 m; Tandjak Nangsi, Mt. Tilu; Mt. Tangkuban Prah, 1000-1600 m; Lembang, 1200 m (Paravicini, 1935); Mt. Manglajang, Preanger, 1600 m; estate of Sukanana, near Bandung; wood near Tegal Pandjang, Mt. Papandajan, 2100 m; Tegal Aloon Aloon, Mt. Papandajan, 2400 m; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; E. slope of Mt. Malabar, 1500 m; Cinchona estate Argasari, Mt. Malabar, 1600 m; Tjibitung, E. of Pengalengan, 1400-2000 m; Tjibulu, near Tjikadjang, 1500 m; Mt. Guntur,

1500 m; top of Mt. Guntur, 7300 feet; Kawah Kamodjan, near Garut, Mt. Guntur, 1500 m; Mt. Tjerimei, 3000-4000 feet.

Central Java: near Telaga Dringu, Diëng Plateau, 2100 m; Mt. Prahū, Diëng Plateau, 2500 m; Mt. Ungaran (SCHEPMAN, 1912).

Dyakia rumphii is rather variable in height: breadth ratio. Animals from a certain elevation (above 2000 m) have often smaller and more conical shells than those from lower altitudes.

I am afraid I cannot agree with RENSCH (1934, p. 748) who pretended that *Dyakia rumphii* and *D. clypeus* are synonymous. Hence I have treated the two as separate species here. It is true that young shells are not always easy to separate, but is that not the case in many other species too?

The juvenile specimen from Buitenzorg which LESCHKE (1914, p. 206) classified as *Dyakia clypeus* in all probability is an immature *D. rumphii*.

In the radula the central tooth and the inner latero-marginals are all unicuspid. In the exterior teeth a very small notch renders these radular elements imperfectly bicuspid. SEMPER, however, who examined an animal from Java (Reisen Arch. Philipp. Theil 2, Bd. 3, Heft 1, 1870, p. 50, pl. 3, fig. 18 a-c, pl. 7, fig. 7) found the rhachis and adjoining 15-16 laterals all tricuspid, the subsequent teeth until the 41-st dagger-shaped without accessory denticles, and from the 41-st tooth onwards dagger-shaped with a minute denticle. Mandibula horseshoe-shaped. The inner median projection is so weak that it is hardly discernible.

Posterior mucous gland with a large opening. There is no distinct "horn" projecting over it.

The snail is often eaten by monkeys. Traces of such meals were noticed in several of the above mentioned localities.

***Dyakia clypeus* (MOUSSON, 1857) (fig. 40, 41).**

1857 MOUSSON, Journ. de Conch. 6, p. 156 (*Nanina*).

1867 MARTENS, Ostas. Landsehn. p. 227 (*Nanina*).

1886 TRYON, Man. of Conch. (2) 2, p. 20, pl. 3, fig. 39, 40 (*Nanina*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1025 (*Nanina*).

1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 231.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 227 (not the record from Buitenzorg).

1934 RENSCH, Trop. Binnengew. 4, p. 748 (*rumphii*).

1935 PARAVICINI, Arch. Moll. K. 67, p. 172.

Shell sinistral, dead-flat on top except for a slight inflation in the upper part of the last whorl. Upper side of whorls straw-colour or greenish-yellow. Below the periphery with a vague, narrow, light brown zone, fading towards the umbilicus. Base rounded. All shells, old as well as young ones, acutely keeled at the periphery. The carina is more or less pinched and thread-like. It is sometimes of a lighter colour. Fragile, somewhat transparent and with a soft lustre.

First 2 whorls smooth or granular. Subsequent ones strongly striated or irregularly ribbed according to the lines of growth. This sculpture is crossed by fine spiral striae, rendering the surface of the shell minutely granular. Besides, the upper side of the whorls can be delicately hammered. Epidermis yellowish or greenish.

Whorls about 5, regularly increasing in diameter. No palpable suture. Umbilicus narrow.

Aperture broadly lunar or rhombiform, oblique. Peristome sharp, not continuous, not reflected. The columellar side is hiding the umbilicus a little.

Dimensions: height 18-20, breadth 36-40, height of aperture 18-20 mm.

Distribution: Java.

Habitat in Java: living on the ground, among earth, dead leaves and low vegetation, in hilly and mountainous country.

West Java: Sukabumi, 700 m (PARAVICINI); Tjibodas, 1400 m (PARAVICINI, 1935); Mt. Putri, Preanger; Garut, 800 m.

East Java: Nongkodjadar, 1200 m; Tengger Mts, 4000-5000 feet; Mt. Smeru (MOUSSON, 1857).

In the discussion of the preceding species I, have already given my opinion on the unwarranted synonymy of *Dyakia clypeus* and *D. rumphii*.

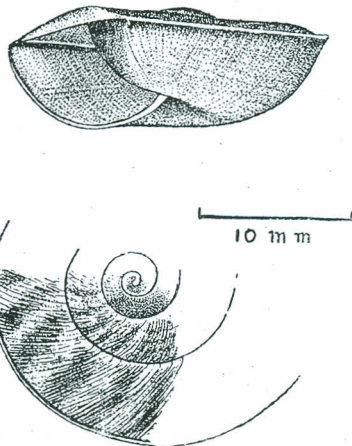


Fig. 40. *Dyakia clypeus* (MOUSS.). Shell from side and detail of upper surface sculpture. ABDULKADIR del.

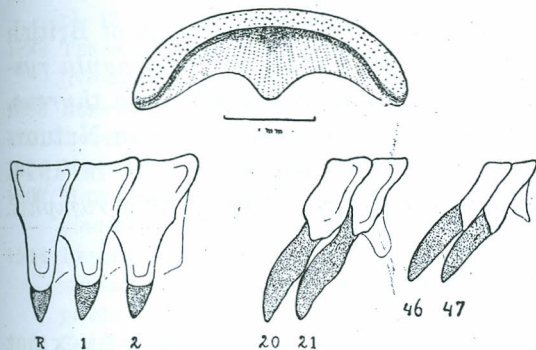


Fig. 41. *Dyakia clypeus* (MOUSS.). Mandibula and radula elements. Author del.

The immature shell from Buitenzorg which LESCHKE (1914, p. 206) classified as a young *Dyakia clypeus* was probably an immature *D. rumphii*.

The species is originally an element of the fauna of East Java. In later years some outposts have penetrated into West-Java. I could check the localities Mt. Putri, and Garut which are undoubtedly

D. clypeus, but I have not seen those from Sukabumi and Tjibodas.

Since RENSCH (1934) suggested to unite *D. clypeus* and *D. rumphii* it is possible that later authors (e.g. PARAVICINI) followed him in this respect. Therefore, unless such samples have been newly revised it is not sure that the quoted records deal with true *D. clypeus*. Yet in that case

one is obliged to employ the name *D. rumphii*; as it has 15 years priority over *D. clypeus*.

MARTENS (1867) described two varieties of *Dyakia clypeus*, viz. var. *zollingeriana* and var. *jagoriana*. The former agrees entirely with the typical form as described above, the principal features of the latter are a slightly convex spire, a less acute carina and the absence of a sub-peripheral brown zone. So long as the origin of these modifications and the conditions under which they are living, are not better known, it is perhaps wise not to continue a dubious classification on so slender a representation.

Doubtful species of *Dyakia*

Dyakia regalis (BENSON, 1850, described from Sarawak) has been recorded by LESCHKE (l.c. 1914, p. 227) as "fraglich" (doubtful) from Java. It is, indeed, not a Javanese species, but belongs to the fauna of Borneo.

According to MARTENS (1867, p. 221) *Dyakia ryssolema* (ALBERS, 1852) described by the author from "Habitat in Insula Java?" was based on a worn specimen of *Nanina thyreus* (BENSON, 1852) (now: *Ariophanta thyreus*) from India. MARTENS continued his argumentation: Java was suggested as its native country, because the shell originally had been sent by CUMING under the name *Helix Rumphii* (now: *Dyakia rumphii*) to ALBERS. The latter author noticed the difference between the new shell and *D. rumphii* and created a new species: *Helix ryssolema*. But he did not bother about the exactness of the location and so the locality Java remained erroneously connected with *Helix ryssolema*.

In the volume on *Testacellidae* and *Zonitidae* of the Fauna of British India (1908, p. 34) BLANFORD & GODWIN AUSTEN consider *Ariophanta ryssolema* to be a large variety with coarse sculpture of *Ariophanta thyreus*.

The specimen of *Dyakia ryssolema* in the Rijksmuseum van Natuurlijke Historie at Leiden, purchased from SOWERBY & FULTON in 1914, with the locality: Preanger, Java, however, is a form of *Dyakia rumphii*.

Genus *Elaphroconcha* GUDE, 1911

Shell low conical, or globular, generally broader than high. Apex not sharp, base rounded. Umbilicate, of various coloration, plain, or banded, or mottled with dark spots on a light background. Periphery keeled in young shells. In adult ones the carination can persist, or become obsolete towards the aperture. Striated or ribbed according to the growth lines. Some species with additional sculpture of irregular undulations.

Posterior mucous gland distinct. Footsole not divided in longitudinal zones. Generative organs with dart sac, containing a slender, calcareous

dart (fig. 43). At the distal end of the dart sac a number of accessory glands (1-4 in the species of Java) open into the dart sac by means of a common, narrow canal.

The generative organs of the three species occurring in Java have recently been studied by the author (VAN BENTHEM JUTTING, Journ. de Conch., in press) and compared with the sex organs of *Hemiplecta humphreysiana* (LEA).

Radula with unicuspid teeth. Central inner projection of the mandibula weak or absent (fig. 3, 45).

Distribution: Java, Lesser Sunda Islands, Celebes.

In Java there are three species:

1. Umbilical region of the shell brown 2
- Umbilical region of the shell uncoloured **patens**
2. Shell rather strong, the brown zone below the periphery broad; generally no other spiral brown band **bataviana**
- Shell rather thin, the brown band below the periphery narrow; generally with one or more accessory spiral brown bands .. **javacensis**

Elaphroconcha bataviana (VON DEM BUSCH, 1842) (fig. 3, 42, 43).

1842 VON DEM BUSCH, in: PHILIPPI, Abb. & Beschr. 1, p. 10, pl. 1, fig. 3 (*Helix*).

1845 PFEIFFER, Proc. Zool. Soc. London, p. 128 (*Helix induta*).

1849 MOUSSON, Land & Süßw. Moll. Java, p. 17, pl. 1, fig. 1 and pl. 20, fig. 1 (*Nanina bataviana*) and p. 17, pl. 2, fig. 1 (*Nanina centralis*).

1856 PFEIFFER, Proc. Zool. Soc. London, p. 327 (*Helix arguta*).

1867 MARTENS, Ostas. Landschn. p. 217 (*Nanina bataviana*), p. 219 (*Nanina arguta*), p. 219 (*Nanina centralis*).

1886 TRYON, Man. of Conch. (2) 2, p. 86, pl. 17, fig. 45-46 (*Nanina bataviana*), p. 41, pl. 13, fig. 79-80 (*Nanina centralis*) and p. 45 (*Nanina arguta*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1018 (*Nanina induta*), p. 1021 (*Nanina arguta*, *bataviana*, *centralis*).

1890 BOETTGER, Ber. Senckenb. p. 140 (*Hemiplecta bataviana*).

1891 BOETTGER, Ber. Senckenb. p. 242 (*Hemiplecta arguta*).

1894 MARTENS, Jenaische Denkschr. 8, p. 83 [*Nanina (Hemiplecta) centralis*].

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 64 (*Ariophanta acutecarinata* and *A. marginata*), p. 65 (*A. acelidota*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 207 (*Xestina arguta*), p. 225 (*Hemiplecta acelidota*, *acutecarinata*, *bataviana*, *induta*, *centralis*), p. 226 (*Hemiplecta induta*), p. 227 (*H. marginata*).

1924 SCHEIBENER, Trop. Natuur, 13, p. 108, fig. 5 [*Hemiplecta (Nanina) bataviana*].

1934 RENSCH, Trop. Binnengew. 4, p. 746 (*Hemiplecta bataviana*).

1935 PARAVICINI, Arch. Moll. K. 67, p. 172 (*Hemiplecta arguta*, *bataviana*, *centralis*).

1940 VAN BENTHEM JUTTING, Treubia, 17, p. 332 (*Hemiplecta bataviana*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 305 (*Hemiplecta bataviana*).

Shell low conical, broader than high; apex pointed, though never sharp, base rounded. Upper side of whorls yellowish-brown to cinnamon, sometimes with a tendency to violet-brown. Below the periphery with a broad chestnut zone which is the more accentuated, as there is a narrow

light zone just above the periphery. The umbilical region is also coloured chestnut. Size and colour of this band can vary considerably.

Young shells are acutely keeled at the periphery. In adult ones this carination disappears towards the aperture, leaving at most a slight angularity. There are, however, individuals in which the carination is persistent till in the adult stage. These have been distinguished as separate species: *acutecarinata*, *centralis*, *arguta*, *induta*, but it is impossible to keep them apart when large series of shells are available.

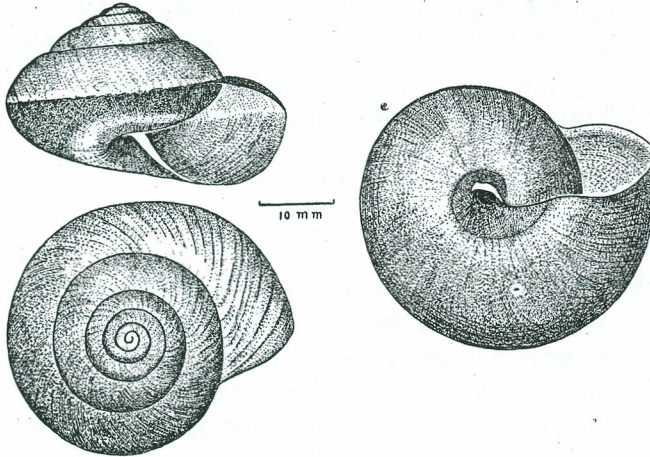


Fig. 42. *Elaphroconcha bataviana* (VON DEM BUSCH). Shell from front, top and base. Author del.

Rather strong shells, somewhat

transparent. Upper side without lustre, base glossy. From the very beginning the upper side of the whorls is rather coarsely striated or finely ribbed according to the lines of growth. These ribs are crossed by fine spiral striae, so that each of them seems beset with minute granules, like the buds of a pearl string. Epidermis yellowish, or greenish.

Whorls 6-6½, regularly increasing in diameter, not descending towards the aperture. Almost flat or little curved. Suture distinct, but not deep. Umbilicus narrow.

Aperture broadly lunar, oblique. Peristome not continuous. In adult shells it is somewhat thickened and reflected. The columellar margin partially overshadows the umbilicus.

Dimensions: height 25-28, breadth 40-47, height of aperture 16-18 mm.

Distribution: Sumatra, Java and some satellite islands (VAN BENTHEM JUTTING, 1941). The occurrence in Borneo needs confirmation.

Habitat in Java: living on the ground, among earth, dead leaves and low vegetation. Occurring from sealevel as high up as about 2500 m.

West Java: Tjibungur; wood of Mt. Karang, near kampung Tjijnjurup, 700 m; wood near craters of Mt. Karang, 1000 m; environs of Lake Danau, 150 m; wood near Tjisolak, 200 m; Palabuan, Wijnkoopsbay, sea level; wood on estate of Bolang, 300 m; Mt. Salak, 1000 m; wood near Gunung Bunder, Mt. Salak, 1000 m; Mt. Tjibodas, estate of Tjampea, 300 m; Kuripan, near Buitenzorg, 200 m; Batavia, sea level; Depok, N. of Buitenzorg, 100 m; Buitenzorg, 250 m; wood of Mt. Pan-

tjar, near Buitenzorg, 500 m; Gora, S. of Buitenzorg; estate of Tjisaruazuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 800 m; wood near Telaga Warna, Puntjak pass, 1450 m; Puntjak pass, 1450 m; Sindanglaja (MARTENS, 1867); Tjibodas, Mt. Gedeh, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; wood near Situ Gunung, Mt. Gedeh, 1000 m; estate of Tjilentab, near Tjibadak, 1000 m; estate of Ganesa, near Tjibadak, 1000 m; Sukabumi, 700 m; Tjikoja (MARTENS, 1867); Udjuŋ Genteng, Sandbay, sea level; Wangun, near Tjisampora, Djampang, 800 m; environs of Sukanegara, Djampang, 1000 m; Mt. Malang, East Djampang, 1000 m; between Tjisokan and Tjikea, 400 m (PARAVICINI, 1935); estate of Radjamandala, near Padalarang, 350 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m; N.E. of Bandung, near waterworks, under stone, 800 m; road to Lembang, near Maribaja, 1000 m; Lembang, 1200 m (PARAVICINI, 1935); Mt. Tangkuban Prah, 700-1600 m; Tjipandolih, in jungle near Bukanagara, Pamenukan and Tjiasem Lands, 400-500 feet; estate of Sukanana, near Bandung; Mt. Patuha, 1550 m; Mt. Tilu, 1400 m; Mt. Puntang, near Mt. Malabar, 2000 m; Tjibitung, E. of Pengalengan, 2000 m; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; estate of Ardjuno, Mt. Papandajan, 1400 m; environs of Garut, 800 m; Mt. Guntur, 1500 m; Mt. Galunggung, near Tjipanas, 1400 m; wood of Kawah Kamodjang, Mt. Guntur, 1550 m; Tjisurupan, 4000 feet; Tjibulu, near Tjikadjang, 1500 m; estate of Bandjarwangi, near Tjikadjang, 1500 m; Tjilaut estate, S. of Garut; Mt. Tjikorai; Mt. Tjerimei, 1200 m; Bandjar, 150 m; Kali-putjang, near Pangandaran, 200 m.

Central Java: Adjibarang (MARTENS, 1867); Djeruk Legi estate; Tjilatjap, sea level; Mt. Prah, Dieng plateau, 2500 m.

East Java: Sarangan, Mt. Lawu, 1200 m; environs of Surabaya, 100-200 m; Tengger Mts, 4000-5000 feet; Breml, Jang Mts, 1200 m; Wlingi, near Malang, 800 m.

Elaphroconcha bataviana is an extremely variable species. We have already alluded to the variation in size and in colour. This has given rise to the creation of about half a dozen names of presumably separate species which, on critical examination, must be reduced to the state of local or individual modifications without any hereditary significance (RENSCH, 1934).

Such shells as are ornated by an accessory narrow brown band just above the periphery can be separated as *Elaphroconcha bataviana* var. *duplocincta* (MOELLENDORFF, 1897). Nothing, however, is known of the genetics and distribution of this character: in which way it is inherited and how it occurs in local populations.

In Java the variety has been recorded from Depok, N. of Buitenzorg, 100 m (LESCHKE, 1914); Mt. Tjikorai; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m, and Tjibulu, near Tjikadjang, 1500 m. Besides it

is known from the island of Bawean, N. of East Java (VAN BENTHEM JUTTING, 1941).

The animals of *Elaphroconcha bataviana* are ornated with a dark horseshoe-shaped zone round the snout and two broad blue-black longitudinal zones stretching from the upper tentacles backwards to the pulmonary cavity. The rest of the body and the foot are yellowish-gray, with scattered dark spots and a more concentrated zone of black on each side of the posterior part of the foot. Footpore distinct. The dart is figured in fig. 43.



Fig. 43. *Elaphroconcha bataviana* (VON DEM BUSCH). Love dart. Author del.

Eggs almost spherical, 6-7 mm in diameter. The eggshell is white, calcareous. When hatching, the young are 3-3½ mm maximum diameter.

***Elaphroconcha javacensis* (FÉRUSAC, 1821) (fig. 44, 45).**

- 1821 FÉRUSAC, Tabl. Syst. Limaçons, p. 46 (*Helix*).
 1821 FÉRUSAC, Hist. Nat. partic. génér. Moll. 1, p. 187, pl. 92, fig. 2 (*Helix javanica*).
 1842 LE GUILLOU, Rev. Zool. p. 137 (*Helix umbilicaria*).
 1849 MOUSSON, Land & Süssw. Moll. Java, p. 15, pl. 1, fig. 3 (*Nanina javanica*).
 1867 MARTENS, Ostas. Landschn. p. 214 (*Nanina umbilicaria*) and p. 215, pl. 6, fig. 5 (*Nanina javana*).
 1886 TRYON, Man of Conch. (2) 2, p. 79, pl. 22, fig. 39 (*Nanina umbilicaria*), p. 79, pl. 22, fig. 40 (*Nanina desgrazii*), p. 80, pl. 23, fig. 41 (*Nanina javanica*).
 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1017 (*Nanina umbilicaria* and *N. javanica*).
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 226 (*Hemiplecta javana* and *H. umbilicaria*).
 1921 PARAVICINI, Arch. Moll. K. 53, p. 116 [*Nanina* (*Xesta*) *javana*].
 1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 148 (*Hemiplecta umbilicaria*).
 1932 VAN BENTHEM JUTTING, Treubia, 14, p. 103 (*Hemiplecta javanica*).
 1934 RENSCH, Trop. Binnengew. 4, p. 746 (*Hemiplecta javacensis*).
 1935 PARAVICINI, Arch. Moll. K. 67, p. 172 (*Hemiplecta javana* and *H. umbilicaria*).
 1941 VAN BENTHEM JUTTING, Arch. néel. Zool 5, p. 306 (*Hemiplecta javacensis*).

Shell low conical, broader than high. Apex pointed though never sharp, base rounded. Ground colour yellowish-brown to greenish-yellow, ornated by three narrow brown bands: one at the upper suture of each whorl, one just above the periphery,

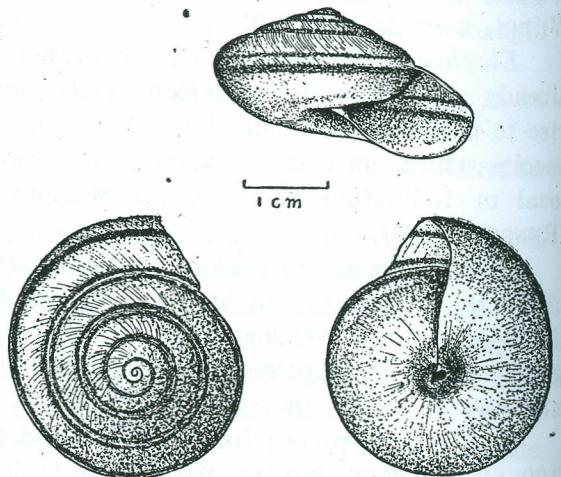


Fig. 44. *Elaphroconcha javacensis* (FÉR.). Shell from side, top and base. LENSVELT del.

and a somewhat broader one below it. The umbilical region is also coloured chestnut. Occasionally one of the bands can fall out. Young shells are acutely keeled at the periphery. In adult animals this carination becomes obsolete towards the periphery, leaving at most a slight angularity. Rather thin shells, somewhat transparent and with a glassy lustre, especially on the base.

From the very beginning the upper side of the whorls is rather coarsely striated according to the lines of growth. These radial striae are crossed by fine spiral ones, creating a regular and elegant granulation. Epidermis yellowish to greenish.

Whorls 6-6½, regularly increasing in diameter, not descending towards the aperture, moderately rounded. Suture distinct, but not deep. Umbilicus narrow.

Aperture broadly lunar, oblique. Peristome not continuous. In adult shells it is slightly thickened and reflected at the columellar side, hiding part of the umbilicus.

Dimensions: height 16-22, breadth 29-37, height of aperture 10-14 mm.

Distribution: Sumatra, Bangka, Java, Karimon Djawa, Madura, Kangean.

Habitat in Java: living on the ground, among fallen leaves, decaying wood and low vegetation. Occurring from sea level up to 2200 m altitude.

West Java: Tjibungur; Tjikoja (MARTENS, 1867); near Palabuan, along the Wijnkoopsbay, sea level; Depok, N. of Buitenzorg, 100 m, in decaying wood, in low vegetation of a garden, under the bark of a tree, along a rivulet, flowing into the Tjiliwung, in the grass along the verges; Buitenzorg, 250 m; estate of Tjiliwung, near Puntjak pass, 1450 m; Tjisaaranang, kampong Tjariang, near Sumedang; teakwood near Indramaju, 25 m; Kedung Djati, Tjitotot and Palimanan, near Cheribon (PARAVICINI, 1935); above Madja, Mt. Tjerimei, 1800 m (PARAVICINI, 1921).

Central Java: teakwood near Bodja, S.W. of Semarang; teakwood along road of Purwodadi to Wirosari; Penawangan and Gundih (OOSTINGH, 1923); Telawah, in teakwood; Sulang, S. of Rembang; Mantingan, near Rembang; Solo (MARTENS, 1867); Baron, S. of Djokja, 50 m.

East Java: Sampung Cave, near Ponorogo; Parangtritis, 100 m; between Kediri and Modjokerto (MARTENS, 1867); environs of Surabaya, sea level; Grissee, near iodine spring Genok-wati (MARTENS, 1867); Grissee, sea level; Sutji near Grissee, sea level; Gedangan, S. of Surabaya, 50 m; garden in Malang, 500 m; Djaboong estate, near Wlingi, S. of Malang, 800 m; Southern Mountains, 1200-1500 feet; Tengger Mts, 4000-5000 feet; near Ranu Klakah, 300 m, Ranu Pakis, 100 m and Ranu Bedali, 100 m (RENSCH, 1934); Wonosari, Tengger Mts (MARTENS, 1867); Durdjo estate, near Djember, 600 m; Puger, sea level; Rogodjampi, near Banjuwangi (MARTENS, 1867); Banjuwangi, sea level.

One specimen was found as a fossil in the so-called "bone-layers" of the Trinil deposits, Middle Pleistocene, East Java (VAN BENTHEM JUTTING, Zool. Meded. 20, 1937, p. 159, s.n. *Hemiplecta umbilicaris*).

Elaphroconcha javacensis is a variable species. High and flat individuals are occurring in mixed populations. The arrangement of the colour

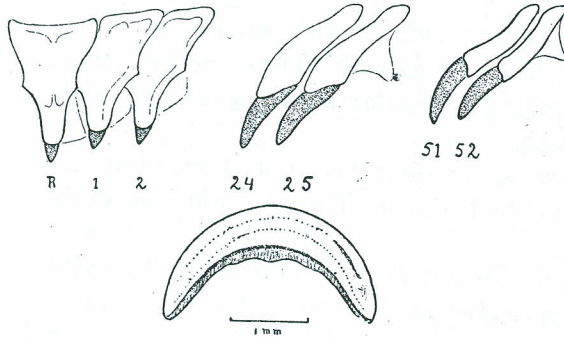


Fig. 45. *Elaphroconcha javacensis* (FÉR.). Radula elements and mandibula. Author del.

bands is also variable: the two upper ones can enlarge, so that they are nearly coalescent, or the uppermost one can be so narrow that it is hardly visible.

In this species sinistral individuals are not rare. MARTENS (1867) mentioned one from the South coast of Java. In the Amsterdam Museum there are lefthanded specimens from Java (with-

out further locality); Southern Mountains, 1200-1500 feet; and Dja-boong estate, near Wlingi, S. of Malang, 800 m.

The amatory dart is unusually long, curved at the tip. The opening is relatively large, situated laterally at a short distance from the tip.

The spawning act was observed by PARAVICINI (1921, p. 116). He gives the following description (translated by me: W.S.S. v. B.J.): "... occurs everywhere in Java up to 2200 m altitude. October 23rd I found the species in great numbers near Panjekoran (1800 m alt.) above Madja on Mt. Tjerimei (residency of Cheribon). All animals were spawning. The animals deposit their eggs in the huge leaf-sheaths of bananas (*Musa sapientum*). Almost every adult plant contained one of the flat snails in one of the leaf-sheaths. The number of eggs ... is 23, 18, 34, 29, 38, on the average 28, in a cluster, and still the spawning act had not quite ceased. The eggs are white, globular to oval. Their diameter is 3½-4 mm. The egg shell is more calcareous than that of *Amphidromus purus*. Therefore the eggs do not shrink when drying, but they easily break when they fall to the ground."

Elaphroconcha patens (MARTENS, 1898) (fig. 46, 47).

- 1898 MARTENS, Sitz. Ber. Ges. naturf. Freunde Berlin, p. 160 [*Nanina* (*Hemiplecta*)].
 1899 MARTENS, Arch. f. Naturgesch. 65, p. 27, pl. 3, fig. 1 [*Nanina* (*Hemiplecta*)].
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 230 (*Hemiplecta*).
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 227 (*Hemiplecta*).
 1915 SCHEPMAN, Bijdr. t. d. Dierk. Afl. 20, p. 19 (*Hemiplecta*).

Shell low conical, broader than high. Apex blunt, base rounded. Ground colour greenish-yellow to greenish-brown, sometimes with a ten-

dency to violet-brown. Below the periphery with darker brown zone, fading towards the umbilical region. Young shells are acutely keeled at the periphery. In adult animals this carination disappears towards the aperture, leaving only a slight angularity.

Fragile shells, somewhat transparent and with a soft lustre. From the very beginning the whorls are striated according to the lines of growth, at first delicately, later on more coarsely. These striae are minutely granular. From the 4th whorl onward the shell is furnished also with irregular undulations and hammerings, sometimes spirally, sometimes obliquely arranged. Epidermis yellowish, or greenish.

Whorls 4-5, rapidly increasing in diameter, the last one large and inflated, not descending towards the aperture. Moderately convex. Suture distinct, not very deep. Umbilicus narrow.

Aperture broadly lunar, oblique. Peristome not continuous, sharp, not reflexed, except at the columellar side where it is hiding part of the umbilicus.

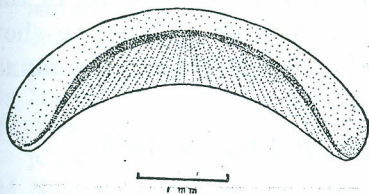


Fig. 47. *Elaphroconcha patens* (MARTS). Mandibula. Author del.

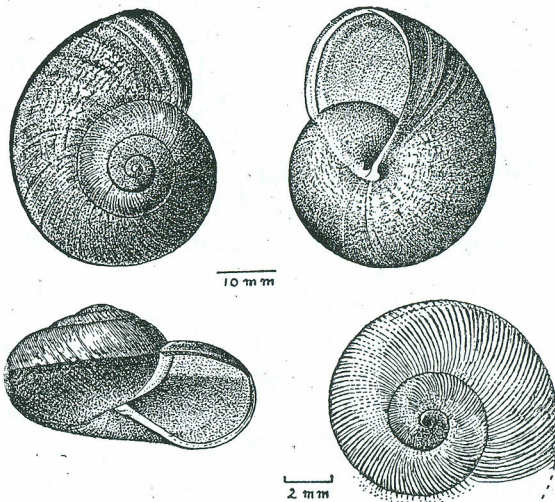


Fig. 46. *Elaphroconcha patens* (MARTS). Shell from top, base and side. Detail of sculpture of top whorls enlarged. ABDULKADIR del.

Dimensions: height 28-31, breadth 44-47, height of aperture 22-23 mm.

Distribution: Java. The species seems confined to the eastern tail-end of Java.

Habitat in Java: living on the ground, among fallen leaves, decaying wood and low vegetation. Occurring between 1100 and 1800 m.

East Java: Pudjon, Mt. Kawi, 1100 m; Nongkodjadjar, Tengger Mts, 1600 m; Tengger Mts, 4000-5000 feet; Tosari, 1777 m; Mt. Smeru; Ngadas, Tengger Mts, 1800 m; Breimi, Jang Mts, 1200 m; Kawah Idjen-Merapi Nature Reserve, 4000 feet.

Doubtful species of *Elaphroconcha* and *Asperitas*

The locality "Java" for *Helix inquinata* VON DEM BUSCH, 1842 (now *Asperitas inquinata* (V. D. BUSCH) is certainly erroneous, as has been stated by SCHEPMAN (Notes Leyden Mus. 6, 1895, p. 136) and RENSCH

[Zool. Jahrb. (Syst.) 60, 1931, p. 439]. The nominal race occurs in the Banda Islands and Ceram. Geographical subspecies in Sumbawa, Kalao, Wetar, Damar, Babar, Roma, Timor, Samau and perhaps other Lesser Sunda Islands.

The locality Dampo, Java for *Nanina halata* MOUSSON (now *Asperitas bimaënsis halata*) as recorded by TENISON WOODS [Proc. Linn. Soc. N.S. Wales (2) 3, 1888, p. 1014] is an error for Dampo, Sumbawa.

MARTENS (1867, p. 196, p. 210, p. 211 and p. 229) has already remarked that the shells of *Nanina citrina* (L.), *Nanina nemorensis* (MÜLL.), *Nanina trochus* (MÜLL.) and *Nanina rugata* MARTS recorded from Java in ancient collections or in old literature are undoubtedly mentioned erroneously from this island. *Xesta citrina* (L.) is widely distributed in Celebes and various Moluccan islands, *Asperitas nemorensis* (MÜLL.) occurs in Lombok and Sumbawa, *Asperitas trochus* (MÜLL.) in the island of Flores, and *Hemiplecta rugata* (MARTS) in Celebes.

Nanina waandersiana MOUSSON, 1857 and *Nanina baliensis* MOUSSON, 1857 mentioned from Java in old literature [e.g. TRYON, Man. of Conch. (2) 2, 1886, p. 81, pl. 15, fig. 8 and 9] are the banded and unbanded form of one species, which has now to be called *Asperitas waandersiana* (MOUSSON). It does not occur in Java, but in the island of Bali.

The locality Java of *Helix cincta* LEA [now *Xesta cincta* (LEA)] [Trans. Americ. Philos. Soc. Philad. 5, 1837, p. 162, pl. 19, fig. 68; see also TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, 1888, p. 1020] is certainly erroneous. The species is indigenous in North Celebes.

Apart from the species mentioned above MARTENS (Ostas. Landschn. 1867, p. 388-394) mentioned quite a number of landmollusks which have been wrongly recorded from Java. Not one of these species has, in later years, made pretensions to being indigenous in this island. Hence MARTENS's evidence all goes to show that these species should be omitted from the faunal list of Java.

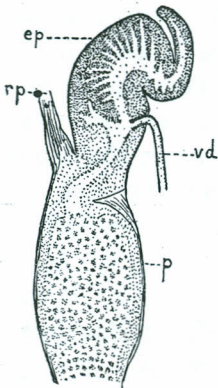


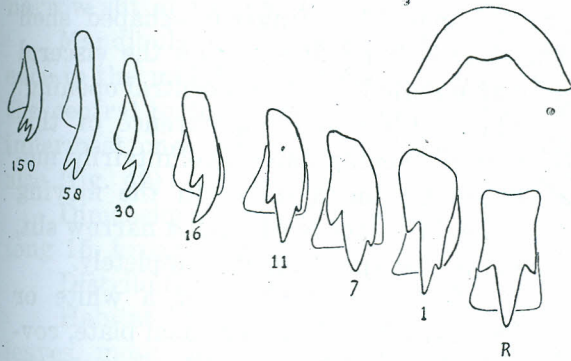
Fig. 48. *Parmarion pupillaris* HUMB.
Penis and epiphallus.
p. penis; ep. epiphallus;
r.p. retractor penis;
v.d. vas deferens.
After HOFFMANN.

Genus *Parmarion* P. FISCHER, 1855

Animal slug-like, with a small, flat shell, without any trace of a spiral whorl. The shell is lying dorsally, on the intestinal sac, surrounded by a mantle lobe with a central opening. Neck with a longitudinal crest and two lateral longitudinal grooves.

Reproductive organs with a dart sac, containing a dart papilla and a calcareous dart. The dart is longitudinally traversed by a canal, which opens at the tip of the dart in a long, oblique groove. Epiphallus of the penis developed as a lateral coecum at the transition of vas deferens to penis (fig. 48).

Mandibula smooth, horseshoe-shaped, the concave border with a central prominence. Radula $\infty .1. \infty$. Rhachis with 3 cusps: a large central one and two small ectocones. Other teeth bifid, the innermost with a minute accessory endocone (fig. 49).



Distribution: South China, Annam, Malay Peninsula, Sumatra, Java, Borneo, Lombok.

For the preparation of this genus I have greatly profited of the revision of *Parmarioninae* by HOFFMANN [1940, Zool. Jahrb. (Syst.) 74, p. 1-156].

In Java there are two species which can only be distinguished with certainty by means of an anatomical feature, viz. the form of the dart gland and dart.

- 1. Dart gland long, dart short **pupillaris**
- Dart gland short, dart long **martensi**

Parmarion pupillaris HUMBERT, 1864 (fig. 48, 49, 50, 51, 52, 53).

1864 HUMBERT, Mém. Soc. Genève, 17, p. 109, fig. 1.
 1867 MARTENS, Ostas. Landschn. p. 178, pl. 5, fig. 7-8, pl. 12, fig. 3 (incl. vars. *punctata*, *marmorata* and *vittata*), p. 182 (*taeniatus*, *reticulatus*, *luteus* and *planus*).
 1885 TRYON, Man. of Conch. (2) 1, p. 166, pl. 37, fig. 71-74 (incl. vars. *punctata*, *marmorata*, *vittata* and unfigured species *luteus*, *planus*, *taeniatus* and *reticulatus*).
 1891 BOETTGER, Ber. Senckenb. p. 242 (*problematicus*).
 1892 MARTENS, Erg. Weber, 2, p. 221, pl. 12, fig. 24, 25 (*reticulatus*).
 1893 SIMROTH, Erg. Weber, 3, p. 105, pl. 7, fig. 6, 9, pl. 8, fig. 18, 19 (*weberi*) and p. 106, pl. 7, fig. 7, 10, pl. 8, fig. 16, 17 (*pupillaris*).
 1894 MARTENS, Jenaische Denkschr. 8, p. 83.
 1898 SIMROTH, Zool. Jahrb. (Syst.) 11, p. 161, pl. 15, fig. 11-12 (*weberi*).
 1899 COLLINGE, Ann. Mag. Nat. Hist. (7) 4, p. 397, pl. 7, fig. 1-2 (*pupillaris*) and p. 398 (*weberi*).
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 231.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 223.
 1914 KEUCHENIUS, Meded. Besoekisch Proefstat. no. 10, p. 7 (*reticulatus*).
 1915 SCHEPMAN, Bijdr. t. d. Dierk. Afl. 20, p. 17 (*Microparmarion* n. sp.).
 1922 PARAVICINI, Teysmannia, 33, p. 26, fig. 3 (*pupillaris* and *reticulatus*).
 1928 VAN DER MEER MOHR, Meded. Deli Proefstat. (2) no. 52, p. 3-7, pl. 1, fig. 3-4 (*reticulatus*).
 1929 DAMMERMAN, Agric. Zool. Mal. Archipel. p. 118 (*reticulatus*).
 1934 MARTOSOEDIRO, Het Bosch, 2, p. 179 (*Parmarion* sp. probably *pupillaris*).
 1934 RENSCH, Trop. Binnengew. 4, p. 758.

- 1934 HOFFMANN, Trop. Binnengew. 5, p. 266-289, fig. 6-11 (incl. *luteus*, *planus*, *reticulatus*, *punctatus*, *taeniatus*).
- 1940 HOFFMANN, Zool. Jahrb. (Syst.) 74, p. 4 and 5 (? *luteus* and ? *planus*), p. 6-7 (*punctatus*, ? *reticulatus* and ? *taeniatus*), p. 8 (*pupillaris*), p. 23 (*weberi*, *intermedius*).

Animal slug-like, with a small, almost flat, fingernail-shaped shell in which it cannot withdraw. The shell is lying dorsally, on the visceral hump, and is surrounded by a circular mantle lobe with a central opening.

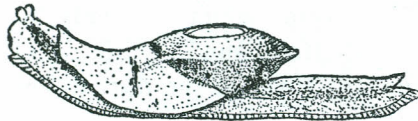
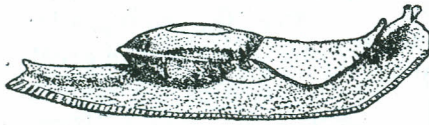


Fig. 50. *Parmarion pupillaris* HUMB. Outline sketch of animal from right and left side. Author del.

The width and circumference of this mantle opening can be voluntarily modified by the animal. In the moving animal it is not more than a narrow slit, hiding the shell almost completely.

The shell consists of a white or bluish-white calcareous basal plate, covered by a chitinous yellow, greenish-yellow, or brownish membrane with a high glassy lustre.

The animal itself is grey, darker to the back and with 2 black lines running obliquely backwards from the base of the large tentacles to the shield. The shield covers the back anteriorly of the intestinal sac, merging almost imperceptibly into the mantle lobe covering that sac. Horizontally a horseshoe-shaped keel or angle is encircling the intestinal sac. On the right side lies the breathing hole (pneumostome) communicating with the mantle edge by a groove.

Behind the visceral hump the body tapers to the tail-end. On each side there is a dark longitudinal band. The back of this part of the body is keeled, and generally a little paler than the sides.

Above the tip of the tail the body forms a fingerlike process, under which the mucous gland is situated.

The skin is divided in long, narrow, quadrangular or spindle-shaped tubercles. Only the footfringe, the shield and the mantle lobes of the visceral mass are of a different structure. Shield and mantle lobes are minutely wrinkled. They are more or less distinctly ornated with an irregular network of black or drab lines, with a local concentration of black, like a band, above the breathing hole. The footfringe which is separated from the rest of the body by a narrow furrow, is divided into small squares by vertical grooves.

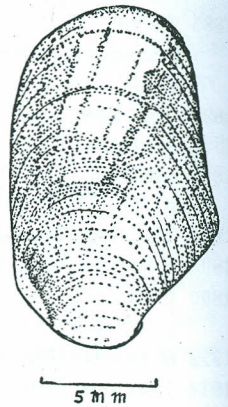


Fig. 51. *Parmarion pupillaris* HUMB. Shell. Author del.

Foot sole divided in three longitudinal zones. In young animals these zones are all unicolorous grey, but in older ones the lateral ones are darker than the central one.

Dart sac containing a long, slender, dart, with a sharp point and a narrow slit at the pointed end (fig. 52, 53).

Mandibula horseshoe-shaped, with a blunt prominence in the middle of the concave side. Radula 192.1.192, the central tooth tricuspid, the other teeth bicuspid, the innermost ones with an additional endocone of minute size (fig. 48).

Dimensions: animal long till about 80-90 mm; shell long 15, broad 11 mm.

Distribution: Hainan, Sumatra, Java, Lombok.

Habitat in Java: living on the ground among dead leaves, moss and low vegetation. Also climbing actively on herbs and shrubs, wet rock, trunks of trees, etc. Occurring from sealevel up to mountainous country.

West Java: wood of Mt. Karang, near kampong Tjinjurup, 700 m; Warangloa, Mt. Salak, 650 m; wood near Gunung Bunder, Mt. Salak, 800 m; Tjiapus, Mt. Salak; Mt. Salak above Tjigombong, 1000 m; Buitenzorg, 250 m; Mt. Paniisan, near Buitenzorg, 600 m; saddle between Mt. Pantjar and Mt. Paniisan, 500 m; estate of Tjisarua-Zuid, near Buitenzorg, in Nepenthes beaker, 1750 m; wood near Telaga Saät, base of Mt. Limo, 1200 m; Telaga Warna, near Puntjak pass, in decaying wood of tree trunk, 1450 m; Sindanglaja (MARTENS, 1867); Mt. Gedeh, 4000 feet; Tjibodas, 1400 m, in leaf sheath of banana; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh,

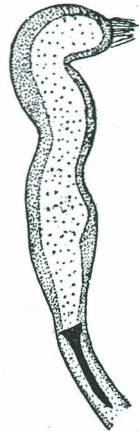


Fig. 52. *Parmarion pupillaris* HUMB. Dart gland and dart. After HOFFMANN.

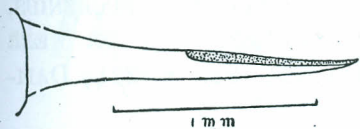


Fig. 53. *Parmarion pupillaris* HUMB. Dart. After HOFFMANN.

1700 m; between Tjibeureum and Kandang Badak, Mt. Gedeh, near hot springs, 2100 m; Lebak Saät, Mt. Gedeh, 2400 m, on Polyporus and Gaultheria; Tapos, Mt. Gedeh, 1000 m; Pasir Sarongge, near Patjet, Mt. Gedeh, 1300 m; between Patjet and Runtjak, in hull of fruit of cotton tree, 600 m; Sukabumi, 700 m; near Wijnkoopsbay, sea level; Udjung Genteng, near Sandbay, South Djampang, sea level; Mt. Malang, East Djampang, 1000 m; in small cave in limestone of Pasir Babeasan, 800 m; Mt. Pawon, near Padalarang, 700 m; Bandung, under tree bark, 700 m; road to Lembang, near Mari-Baja, 1000 m; Maribaja, S. E. of hot springs, 1100 m; Lembang, Post-road near Isola, under leaf of Arum, 1200 m; Mt. Tangkuban Prah, 1000-1600 m; Mt. Burangrang, 1300 m; Mt. Malabar, near wireless station on mangoetrunk, 1300 m; Mt. Papandajan, 2000 m; Tjisurupan, 1200 m (MARTENS, 1867); top of Mt. Papandajan, 2600 m; Mt. Malabar, near

Pengalengan, 1600 m; estate of Tjinjiruan, Mt. Malabar, 1700 m; environs of Garut, 700 m; near hot springs of Telagabodas, 1700 m; estate of Argasarie, Mt. Malabar, 5000 feet; estate of Buni Sarie, S. of Garut; Mt. Tjerimei, 1200 m.

Central Java: Bumiaju, Mt. Slamet, 1000 m. Dieng plateau, 2000 m; near origin of the Seraju river, Dieng plateau, 2100 m; Mt. Ungaran.

East Java: Mt. Lawu, under fallen trees, 1300-1500 m; above Sarangan, Mt. Lawu, on trees, 1300 m (HOFFMANN, 1940); waterfall of Kali Djumok, Mt. Lawu, 1450 m (HOFFMANN, 1940); Kali Djumok, on wet stones, Mt. Lawu, 1787 m (HOFFMANN, 1940); Kawah Lawu, on tree trunks, 2400 m (HOFFMANN, 1940); Mt. Lawu, under fallen tree, 2400 m (HOFFMANN, 1940); Mt. Lawu, 2800 m; spring near Lake Ngebel, 730 m (HOFFMANN, 1940); near Modjopahit (MARTENS, 1867); Tengger Mts, in vegetable gardens (PARAVICINI, 1922); Tosari, 1777 m; Djember district (KEUCHENIUS, 1914); Sentul estate, near Djember; Kendeng III, Idjen Highland, 1400 m; Blawan lor, Idjen Highland. Ongop Ongop, Idjen Highland, 1850 m; Litjin, above Banjuwangi (MARTENS, 1867); Banjuwangi district, 2000 feet (KEUCHENIUS, 1914).

There is considerable variation in the colour pattern of the animals. Old individuals are generally darker than young and semi-adult ones. Shield and mantle can be more or less reticulated. This has given rise to the creation of numerous "species", often quite insufficiently characterised. Some of them are quoted at the head of the paragraph. The very careful work of HOFFMANN (1934, 1940) has proved, that most of these doubtful species must be assimilated with *Parmarion pupillaris*.

The animals have some notoriety in vegetable gardens and plantations of tobacco and rubber for the damage they cause by eating young shoots and leaves ("pupus") and drinking latex. Moreover they attack the ground weeds which are planted as green manure plants. (KEUCHENIUS, 1914; DAMMERMAN, Landb. Dierk. 1919; PARAVICINI 1922; VAN DER MEER MOHR, 1928; MENZEL & TENGWALL, Arch. Rubber, 13, 1929, p. 241; DAMMERMAN, 1929; MARTASOEDIRO, 1934).

***Parmarion martensi* SIMROTH, 1893 (fig. 54).**

1893 SIMROTH, Erg. Weber, 3, p. 107, pl. 7, fig. 8, pl. 8, fig. 20-22.

1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 232 (*Microparmarion jacobsoni*).

1940 HOFFMANN, Zool. Jahrb. (Syst.) 74, p. 32 (*martensi*), p. 41 (*Microparmarion jacobsoni*).

Animal slug-like, with a small, almost flat, fingernail-shaped shell in which it cannot withdraw.

The outward features are much the same as in *Parmarion pupillaris*, but *P. martensi* is never so large (max. foot sole length in preserved animals 38 mm). Besides, the reticulation of the skin is somewhat less well marked. Even the anatomical arrangement is similar to *P. pupil-*

laris. Only in the dart gland and dart there are conspicuous differences. Contrary to the situation in *P. pupillaris* where the dart gland is long and the dart itself short, the dart gland is much shorter and the dart longer in *P. martensi* (fig. 54). Hence the construction of dart gland and dart is the only reliable feature for distinguishing between the two species.

Dimensions: animal long to about 40-50 mm; shell long 11, broad 6 mm.

Distribution: Cambodja, Annam, Malaya, Sumatra, Java, Borneo.

Habitat in Java: living on the ground, among fallen leaves, on stones, on low vegetation. Climbing actively on tree trunks, among moss, in fissures of tree bark, as far as recorded in mountainous country only.

West Java: Sindanglaja, 1100 m; Tegal Aloon Aloon, Mt. Papandajan, 2100 m.

East Java: Nongkodjadar, Tengger Mts, 1200 m.

Genus *Microparmarion* SIMROTH, 1893

Animal slug-like, with a small, flat shell, composed of one whorl only. The animal cannot withdraw into the shell. The shell is lying dorsally, on the intestinal sac, surrounded by a circular mantle lobe with a central opening. Neck with a central longitudinal crest and two lateral longitudinal grooves.

Reproductive organs with dart gland and dart. The dart is longitudinally traversed by a canal, which opens laterally at a short distance before the tip. The epiphallus of the penis is a direct prolongation of the vas deferens and not developed as a coccum (fig. 55, 60).

Mandibula smooth, horseshoe-shaped, the concave side with a central prominence. Radula ∞ .1. ∞ . Rhachis with 3 cusps: a large central one and two small ectocones. Other teeth bifid, the innermost ones with a minute accessory endocone (fig. 56).

Distribution: Malay Peninsula, Sumatra, Java, Borneo, Anambas and Natuna Islands.

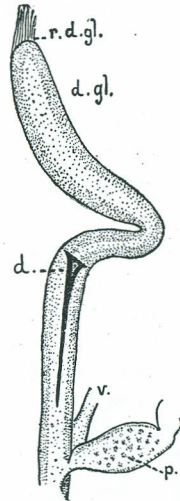


Fig. 54. *Parmarion martensi* SIMR. Dart gland and dart. p. penis; v. vagina; d. gl. dart gland; r. d. gl. retractor of dart gland; d. dart. After HOFFMANN.

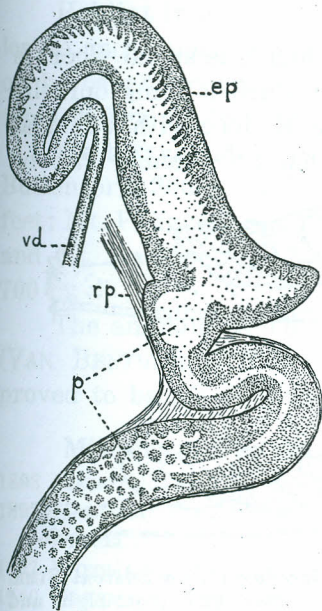


Fig. 55. *Microparmarion musteni* SIMR. Penis and epiphallus. p. penis; ep. epiphallus; r.p. retractor penis; v.d. vas deferens. After HOFFMANN.

For the preparation of this genus I have greatly profited of the revision of *Parmarioninae* by HOFFMANN (1940).

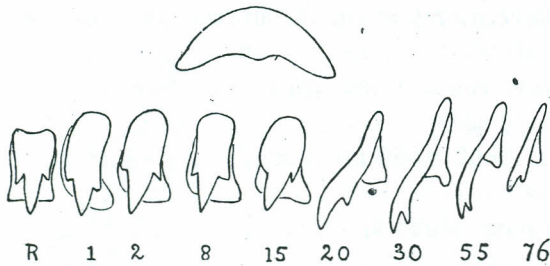


Fig. 56. *Microparmarion austeni* SIMR. Mandibula and radula elements. After HOFFMANN.

In Java there are 2 species:

1. Penis with a curious lateral "handle" at the point where the retractor penis is inserted *strubelli*
- Penis without such a "handle" *austeni*

***Microparmarion austeni* SIMROTH, 1893 (fig. 55, 56, 57, 58).**

1893 SIMROTH, Erg. Weber, 3, p. 109, pl. 7, fig. 4, pl. 8, fig. 13, 14.

1898 SIMROTH, Zool. Jahrb. (Syst.) 11, p. 164, pl. 15, fig. 16-22 (*fruhstorferi*), p. 165, pl. 15, fig. 24-26 (*böttgeri*), p. 165 (*austeni*).

1899 COLLINGE, Ann. Mag. Nat. Hist. (7) 4, p. 398, pl. 7, fig. 3-10 (*austeni*), p. 400, pl. 8, fig. 11-19 (*javanica*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 224 (*austeni*, *boettgeri*, *fruhstorferi*, *javanica*).

1925 VAN BENTHEM JUTTING, Treubia, 6, p. 143 (*Collingea strubelli*).

1940 HOFFMANN, Zool. Jahrb. (Syst.) 74, p. 44 (*austeni*, inclus. *fruhstorferi* and *böttgeri*), p. 56 (*javanica*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 309 [*Microparmarion (Collingea) strubelli*].

Animal slug-like, with a small, flat shell, in which one spiral whorl is visible. The animal cannot withdraw into its shell. Shell is lying dorsally on the visceral hump, surrounded by a circular mantle lobe with a central opening. The width and circumference of this mantle opening can be voluntarily modified by the animal. In the living slug it is not more than a narrow slit, hiding the shell almost completely.

The thin, calcareous shell is covered by a chitinous, yellowish-green, or yellowish-brown membrane with a high glassy lustre.

The animal is yellowish-gray or dark brown, darker to the back and with 3 longitudinal black bands (sometimes coalescent) between the head and the visceral mass. Anteriorly of the intestinal sac the back is covered by the shield. Horizontally a horseshoe-shaped keel or angle is encircling the visceral sac. On the right side lies the breathing hole (pneu-

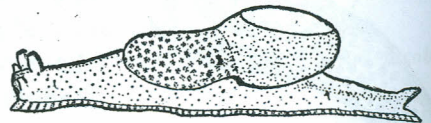
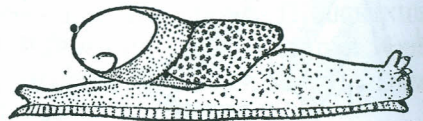


Fig. 57. *Microparmarion austeni* SIMR. Outline sketch of animal from right and left side. Author del.

On the right side lies the breathing hole (pneu-

mostome), communicating with the mantle edge by a groove. Shield and mantle are spotted with black, with a local concentration of black above the breathing hole. In old individuals the black pigment is more developed than in immature ones. Behind the intestinal hump the body tapers to the tail-end which is provided with a caudal keel. On each side of this part of the foot there is a dark longitudinal band.

The skin is divided into lozenge-shaped tubercles. Only the foot fringe, the shield and the mantle lobe of the visceral mass are of a different structure. Shield and mantle are, in preserved specimens, covered with small warts, rendering these organs a granular appearance. They are vaguely spotted or reticulated with black. The foot fringe which is separated from the rest of the body by a narrow furrow, is divided into small squares by vertical grooves.

Foot sole divided into three longitudinal zones. All three are unicolorous drab, or the central zone is somewhat paler than the lateral ones.

The most conspicuous specific character is the form of the penis which is not provided with such a curious "noose" as in the following species (fig. 55).

Dimensions: length of animal up to about 40 mm; shell long 8-8½, broad 5½ mm.

Distribution: Java, Sebesi.

Habitat in Java: living on the ground among dead leaves, moss and low vegetation. Also climbing actively on herbs and shrubs during wet weather. Occurring from 250 m up to 2400 m.

West Java: Mt. Tjibodas, estate of Tjämpea, near Buitenzorg, 300 m; Buitenzorg, 250 m; Mt. Gedeh, 4000 feet; Mt. Pangerango, 2000 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; Mt. Pawon, near Padalarang, 700 m.

The animals which I recorded as *Collingea strubelli* from Sebesi Id. (VAN BENTHEM JUTTING, 1925, 1941) have, on renewed investigation, proved to be *Microparmarion austeni* SIMR.

***Microparmarion strubelli* SIMROTH, 1893 (fig. 59, 60, 61).**

1893 SIMROTH, Erg. Weber, 3, p. 108, pl. 7, fig. 5, 11, pl. 8, fig. 12, 15.

1892 MARTENS, Erg. Weber, 2, p. 222, pl. 12, fig. 26 (*Parmarion taeniatus*, non VAN HASSELT).

1897 WIEGMANN, Abh. Senchenb. 24, p. 299, pl. 31, fig. 8-26 (*Parmarion maculosus*).

1940 HOFFMANN, Zool. Jahrb. (Syst.) 74, p. 65.

Animal slug-like, with a small, flat shell in which one spiral whorl is still present. The animal cannot withdraw into the shell.

The exterior characters are much the same as in *Microparmarion austeni*. Even the anatomical arrangement is similar in the two species.



Fig. 58. *Microparmarion austeni* SIMR. Dart sac and dart. After HOFFMANN.

Only in the form of the penis we find a specific character. At the point where the retractor penis is inserted and where the penis-sheath is extended proximally, the penis makes a curious loop, projecting laterally out of the sheath (fig. 60).

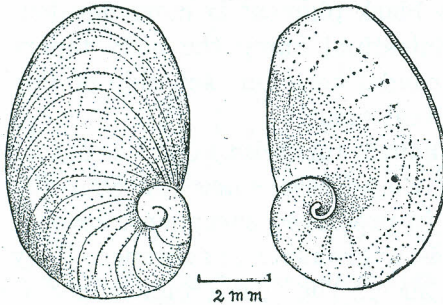


Fig. 59. *Microparmarion strubelli* SIMR. Shell from top and base. Author del.

Hiding in leaf sheaths of higher plants. Climbing actively during moist weather. Occurring in hilly and mountainous country, from 250 up to 2400 m.

West Java: Buitenzorg, Botanical Garden, 250 m; on Phoenix spinosa, estate of Megamendung, near Buitenzorg, 800 m; estate of Tjiliwung, near Buitenzorg, 1000 m; Mt. Gedeh, 4000 feet; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m; limestone hills near Padalarang, 500 m; Dago, near Bandung, left bank of the Tjikapundung, near first waterfall, under dead leaf, 900 m; Mt. Tangkuban Prah, 1500 m; wood in Tegal Pri-mula, Mt. Papandajan, 2200 m; estate of Tjinjiruan, Mt. Malabar, 1700 m.



Fig. 61. *Microparmarion strubelli* SIMR. Dart gland and dart. After HOFFMANN.

***Microparmarion strubelli* var. makrokaulis HOFFMANN, 1940 (fig. 62).**

1940 HOFFMANN, Zool. Jahrb. (Syst.) 74, p. 72, fig. 34.

The variety differs from the nominal form in the excessively developed penis-handle (fig. 62).

Distribution: Sumatra, Java.

West Java: Mt. Malabar, 1600 m.

That author himself is not very certain of the basic value of his new variety. In preserved specimens there arises always the question whether a special morphological feature has not been artificially caused by unexpected spasmodical contraction of the tissues

Dimensions: length of animal up to 25-30 mm; shell long 8-9, broad 5½ mm.

Distribution: Sumatra, Java.

Habitat in Java: living on the ground, among fallen leaves, decaying wood and low vegetation. Hiding in

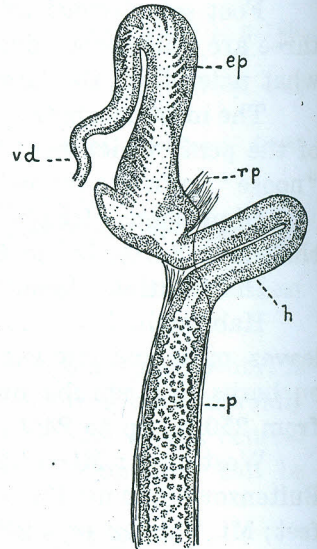


Fig. 60. *Microparmarion strubelli* SIMR. Penis with "handle". p. penis; h. handle; ep. epiphallus; r.p. retractor penis; v.d. vas deferens. After HOFFMANN.

during fixation. HOFFMANN (1940, p. 69) supposes that the "handle" disappears when the proximal part of the penis is protruded, as e.g. in copula.

Therefore it remains to be seen whether this characteristic can be maintained as a taxonomic feature, or whether *Microparmarion austeni*, *M. strubelli* and *M. strubelli* var. *makrokaulis* should be united in one species: *M. strubelli*.

It has already been pointed out under *Helicarion* that the shell of *Vitrinopsis dohrni* BOETTGER ms, collected at Mt. Tjikorai, West Java, by H. FRUHSTORFER and now preserved in the Amsterdam Zoological Museum is not a *Vitrinopsis* or a *Helicarion*, but a *Microparmarion* sp. It was mentioned by me from West Java in *Treubia*, 1929, 11, p. 76.

Besides, it is worth repeating here that *Microparmarion fruhstorferi* SIMROTH, 1898 is a synonym of *M. austeni* SIMROTH, 1893 (HOFFMANN, 1940, p. 43) and that *Semivitrina fruhstorferi* BOETTGER (museum-label name in Senckenberg Museum, no. 62547, from Mt. Gedeh, West Java, 9000 feet, collected by H. FRUHSTORFER in 1892) is a *Microparmarion* sp.

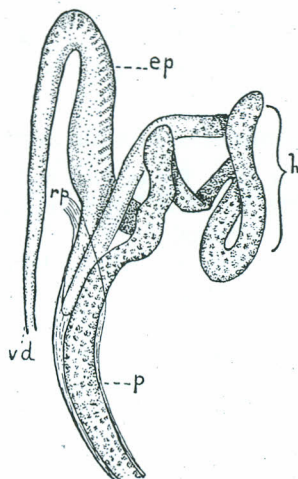


Fig. 62. *Microparmarion strubelli* var. *makrokaulis* HOFFM. Penis with "handle" p. penis; h. handle; ep. epiphallus; v.d. vas deferens; r.p. retractor penis. After HOFFMANN.

Genus *Hemiplecta* ALBERS, 1850

Shell low conical or globular, generally broader than high. Apex not sharp, base rounded. Umbilicate. Brown or yellowish, some species with a greenish tint. Plain or banded. Periphery keeled in young specimens. In adult shells the carination can be persistent or become obsolete towards the aperture. Striated or ribbed according to the growth lines. Some

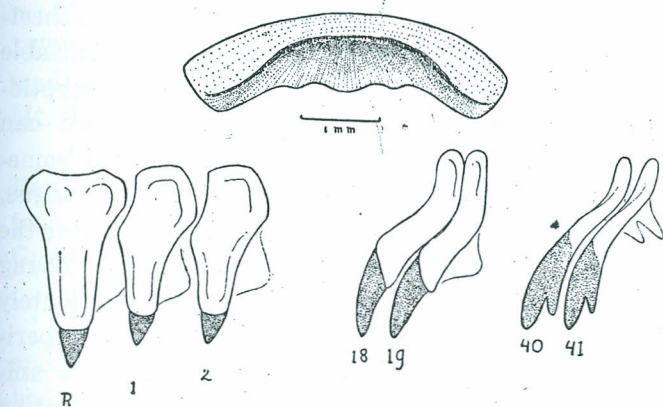


Fig. 63. *Hemiplecta humphreysiana* (LEA). Mandibula and radula elements. Author del.

species with additional sculpture of irregular undulations, running spirally or obliquely over the whorls.

Posterior mucous gland distinct. In the generative organs (BLANFORD & GODWIN AUSTEN, *Fauna Brit. India, Testacellidae and Zonitidae*, 1908, p. 290; VAN BENTHEM

JUTTING, Journ. de Conch., in press) the dart gland is continuous with the dart sac. There is no calcareous dart.

Mandibula with or without a central inner projection. In the radula of the Javanese species the rhachis and laterals are unicuspid, the marginals bicuspid (fig. 63).

Distribution: Malaya, Greater Sunda Islands, Philippines.

In Java there is only one species:

Hemiplecta humphreysiana (LEA, 1841) (fig. 63, 64).

1841 LEA, Trans. Americ. Philos. Soc. Philadelphia, 7, p. 463, pl. 12, fig. 16 (*Helix*).

1842 VON DEM BUSCH, in: PHILIPPI, Abb. & Beschr. *Helix*, p. 9, pl. 1, fig. 1 (*Helix gemina*).

1849 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Nanina gemina*).

1857 MOUSSON, Journ. de Conch. 6, p. 156 (*Nanina corrossa* and *N.c.* var. *depressior*).

1860 DOHRN, Malak. Blätt. 6, p. 206 (*Nanina herklotsiana*).

1867 MARTENS, Ostas. Landschn. p. 230, pl. 10, fig. 1, 1b (*Nanina densa*, the Javanese specimens), p. 231 (*N. corrossa*), p. 233, pl. 10, fig. 3, 4 and 6 (*N. humphreysiana*).

1886 TRYON, Man. of Conch. (2) 2, p. 36, pl. 11, fig. 52, 53, pl. 12, fig. 54 (*Nanina*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1020 (*Nanina corrossa*), p. 1021 (*N. herklotsiana*).

1890 BOETTGER, Ber. Senckenb. p. 139 (*humphreysiana* var. *gemina*).

1891 BOETTGER, Ber. Senckenb. p. 242 (*humphreysiana* var. *complanata*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 226 (*densa* and vars. *herklotsiana* and *moussoniana*; *humphreysiana* and vars. *turbinata*, *complanata* and *gemina*).

1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 148 (*densa*), p. 149 (*humphreysiana*).

1934 RENSCH, Arch. Moll. K. 66, p. 322-327.

1935 PARAVICINI, Arch. Moll. K. 67, p. 172.

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 306.

Shell low conical, broader than high. Apex pointed, though not sharp, base rounded. Upper side of whorls yellowish-brown to yellowish-green,

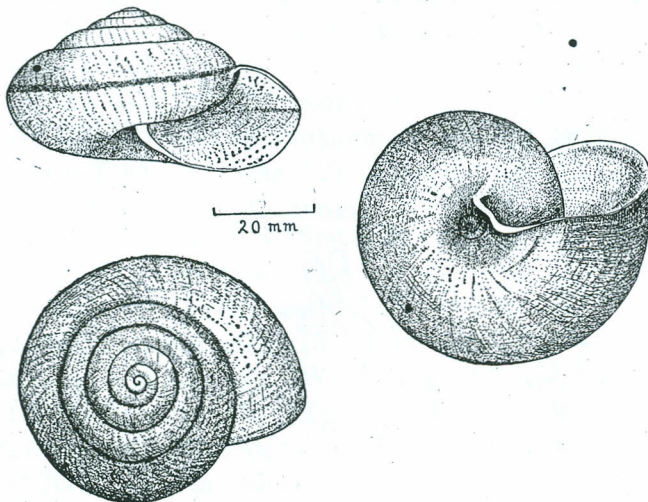


Fig. 64. *Hemiplecta humphreysiana* (LEA). Shell from side, top and base. Author del.

sometimes with a tendency to violet-brown. Below the periphery with a chestnut band of variable breadth. In exceptional cases there can occur a second, somewhat more vague, brown band above the periphery too. Young shells are acutely keeled at the periphery. In adult animals this carination can persist, or — ge-

nerally — become obsolete towards the aperture. In the latter case a certain feeble angularity remains.

Rather solid shells, somewhat transparent and with a soft lustre. From the very beginning the whorls are striated radially. After about 2 whorls these striae are crossed by a spiral sculpture which soon becomes coarser and more irregular as a pattern of rugulose undulations, sometimes spirally, sometimes obliquely arranged. Epidermis yellowish or greenish.

Whorls $6\frac{1}{2}$ -7, rapidly increasing in size, the last one rather broad, not descending towards the aperture. Whorls regularly rounded, suture distinct, but not deep. Young shells relatively higher than adult ones, so long as the broad last whorl is not quite complete.

Aperture broadly lunar, oblique. Peristome not continuous. In adult shells slightly thickened. The columellar side is hiding part of the umbilicus.

Dimensions: height about 25, breadth 55, height of aperture 18 mm.

Distribution: Malaya, Sumatra, Pulu Weh, Nias, Batu Ids, Java, Noesa Kembangan, Meeuwen Id., Borneo.

Habitat in Java: living on the ground, among earth, moss, decaying wood, and low vegetation. Occurring from sea level up to mountainous country.

West Java: wood near Tjisolok, near Wijnkoopsbay, 200 m; Depok, N. of Buitenzorg (PARAVICINI, 1935); Mt. Pantjar, near Buitenzorg, 800 m; Buitenzorg, Botanical Garden, 250 m (MARTENS, 1867); Mt. Salak (BOETTGER, 1890); estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; estate of Tjiliwung, near Buitenzorg, 1200 m; near Telaga Warna, Puntjak pass, 1400 m (PARAVICINI, 1935); Sindanglaja, 1100 m (MARTENS, 1867); Mt. Gedeh, 2000-4000 feet; Tjibodas, Mt. Gedeh, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; estate of Ganesa, near Tjibadak, 900 m; Tjikasintu estate, near Sukabumi; Mt. Tangkuban Prah, 1000-1500 m; Tandjak Nangsi, Mt. Tilu; forest N. slope of Mt. Malabar (OOSTINGH, 1923); Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; Kawah Kamodjan, Mt. Guntur, 1500 m; Mt. Galunggung, near Tjipanas, 1300 m; Mt. Tjikorai; Mt. Tjerimei, 4000 feet; teak wood near Bandjar, 150 m.

Central Java: Adjibarang (MARTENS, 1867); Tjilatjap, sea level; Banjurip; wood 20 km S. of Doro, 1500 m; teak wood near Subah, 500 m; teak wood near Bodja, S. W. of Semarang; base of Mt. Telemojo, 1400 m; Gundih, S. of Purwodadi (OOSTINGH, 1923).

East Java: Brëmi, Jang Mts, 1200 m.

RENSCH (1934) suggested to unite a number of Malaysian *Hemiplecta* species into one "Rassenkreis" of *Hemiplecta humpreysiana*. The subject has, however, not been fully worked out, especially on anatomical basis.

It is not clear either what is the value of the various forms of *Hemiplecta* described from Java: *gemina*, *herklotsiana*, *corrosa*, *turbinata*,

complanata, *moussoniana*. The variety *bifasciata* (MARTENS, 1867) is of a smaller size and has an additional suprasutural band. Perhaps *gemina* and *corrosa* can be united with it. In that case the variety ought to be called *gemina*, as it has priority.

Genus *Microcystina* MÖRCH, 1876

Shell small, imperforate or narrowly rimate. Low conical to almost flat. Finely striated spirally and in some species with radial sculpture too. Shining and transparent.

Aperture somewhat oblique, broadly lunar. Peristome sharp, not thickened or reflected, except in the umbilical region where the columellar side has a curious sinuosity.

Mantle collar with a right shell lobe only; the left one is absent.

Radula with a tricuspid rhabdus and bicuspid or tricuspid laterals. The marginals are unicuspid or bicuspid (fig. 65).

The animals are hermaphroditic and — as far as observed — ovoviviparous. The male organs are provided with a small dart sac.

Distribution: Southern India, Ceylon, Western Bengal, Malay Archipelago.

In Java there are 7 species:

- 1. Spiral sculpture very delicate 2
- Spiral sculpture distinct **circumlineata**
- 2. Radial striae curved backward in S-shaped sinuosity, shell rather large, up to 6 mm max. diam. **fruhstorferi**
- Radial striae without special curve, shell much smaller 3
- 3. Shell globose above and below the periphery **subglobosa**
- Shell flatter 4
- 4. Radial lines closely set 5
- Radial lines distantly placed 6
- 5. Initial whorl of shell relatively large, spire somewhat elevated **exigua**
- Initial whorl of shell relatively small, spire flat or very little elevated **nana**
- 6. Shell yellowish-brown, often with reddish margin along suture. Transparent, but not translucent **gratilla**
- Shell greenish, hyaline, translucent. No reddish margin along suture **vitreiformis**

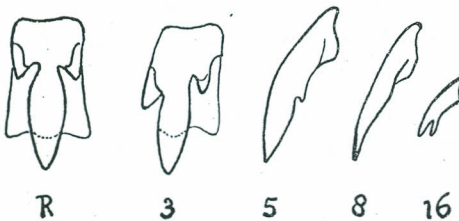


Fig. 65. *Microcystina subglobosa* (MLLDF). Radula elements. After RENSCH.

Microcystina exigua (MOELLENDORFF, 1897) (fig. 66).

1897 MOELLENDORFF, Nachr. Blatt. 29, p. 63 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Lamprocystis*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 47, fig. 11.

Shell small, spire somewhat elevated. Light yellowish, somewhat transparent and shining. Provided with weak, regular, rather closely set, radial striae above the periphery. Below with fine growth striae only. This radial sculpture is crossed by still more delicate spiral lines.

Whorls $4\frac{1}{2}$, regularly increasing in size, slightly convex. Suture shallow, with an additional margin. Initial whorl rather large, larger than in any of the other six species in Java. Base moderately rounded; last whorl slightly angular at the periphery. Umbilicus very narrow.

Aperture little oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

Dimensions: height 1.7-1.9, breadth 2.6-3.2, height of aperture 1.0-1.2 mm. The type specimen from Mt. Gedeh, 6000 feet (Mus. Senckenberg no. 4086) is high 1.7 and broad 2.6 mm and has an aperture of 1.0 mm height. In the original diagnosis the height is given as 1.5, the breadth as 2.5 mm.

Distribution: Java, Lombok, Flores.

Habitat in Java: living on the ground, among earth, dead leaves, moss, decaying wood etc. Occurring between 200 and 2400 m altitude.

West Java: Kuripan, near Buitenzorg, 200 m; Mt. Gedeh, 6000 feet; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, in soil fauna.

Central Java: Dieng Plateau (RENSCH, 1932); Sulang, near Kali Besèk, S. of Rembang, 200 m.

East Java: Road to Jang plateau, 6000 feet.

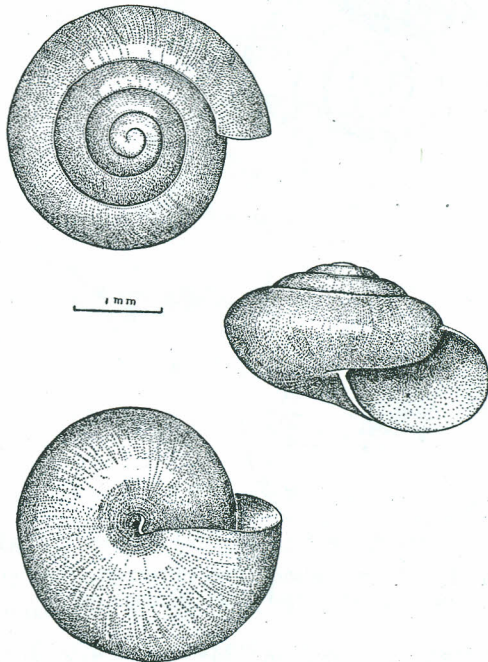


Fig. 66. *Microcystina exigua* (MLLDF). Shell from top, side and base. Author del.

Microcystina nana (MOELLENDORFF, 1897) (fig. 67).

1897 MOELLENDORFF, Nachr. Blatt. 29, p. 63 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 209, fig. 3 and p. 229 (*Lamprocystis*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 48, fig. 12.

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 304.

Shell very small, flat, or a little elevated. Yellowish, horncolour, somewhat transparent and shining. Ornated above with close set radial striae, below with fine growth lines only. This radial sculpture is crossed by very delicate spiral lines.

Whorls $4\frac{1}{4}$ - $4\frac{1}{2}$, regularly increasing in diameter. Suture shallow, with an additional margin. Base moderately rounded, last whorl slightly angular at the periphery. Umbilicus very narrow.

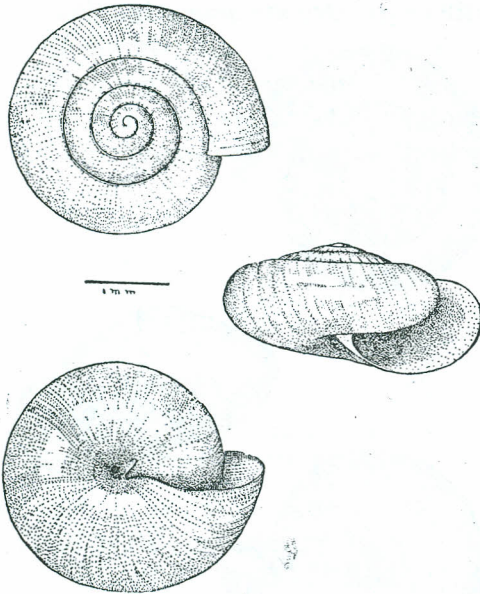


Fig. 67. *Microcystina nana* (MLLDF). Shell from top, side and base. Author del.

Aperture little oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

Dimensions: height 1.2-2, breadth 2.3-3.6, height of aperture 0.8-1.5 mm. The type specimen from Mt. Tilu, 6300 feet (Mus. Senckenberg no. 4088) is high 1.2 and broad 2.3 mm, with an aperture of 0.8 mm height.

Distribution: Java, Karimon Djawa Islands, Bali, Flores.

Habitat in Java: living on the ground, among vegetable debris, earth, moss, low vegetation. Occurring from about 200 m up to 2400 m.

West Java: Kuripan, near Buitenzorg, 200 m; Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m, Buitenzorg (LESCHKE, 1914); Tjibodas, Mt. Gedeh, 1400 m; Tjibodas, Mt. Gedeh, road to Huis ten Bosch, 1800 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; Mt. Pawon, near Padalarang, 700 m; Mt. Tilu, 6300 feet; Talun, near Bandung.

Central Java: Sulang, near Kali Besèk, S. of Rembang, 200 m.

East Java: Blawan, Idjen Highland, 950 m; Kendeng III, Idjen Highland, 1400 m; Kawah Idjen-Merapi Game Reserve, 1600-1700 m.

The species is somewhat variable in height-breadth ratio: flat and elevated shells occurring pell mell in several populations.

Microcystina gratilla n. sp. (fig. 68, 69).

Shell small, flat, or very little elevated. Yellowish to yellowish-brown, highly polished, somewhat transparent. Ornated with regular, distantly placed radial grooves, crossed by much finer spiral striae. In

the type shell these grooves continue on the base of the shell; in some paratypes they fade away below the periphery.

Whorls 4-4½, in exceptional cases up to 5. Regularly increasing in diameter. Suture shallow, with an additional, sometimes red-brown, margin. Base moderately rounded. Umbilicus very narrow.

Aperture little oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinusity in the umbilical region.

Dimensions: height 1.0-2.1, breadth 1.8-2.8, in exceptional cases to 3.5, height of aperture 0.9-1.4 mm.

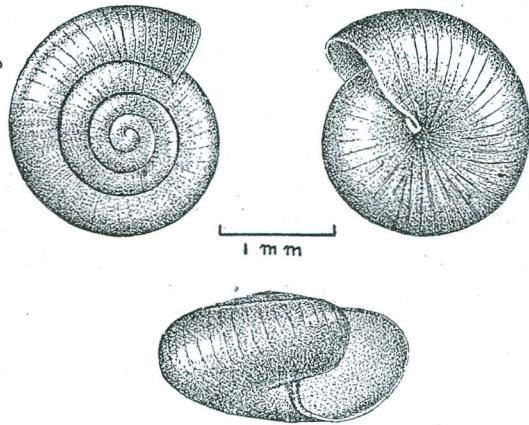


Fig. 68. *Microcystina gratilla* n. sp. Type. Shell from top, base and front. ABDULKADIR del.

	type	paratypes				
height	1.2	1.3	1.1	1.2	1.0	} mm
breadth	2.0	2.1	2.0	1.9	1.8	
height of aperture	0.9	1.0	0.9	0.9	0.8	

All the five specimens were taken by the author at Leuwiliang, near Buitenzorg, West Java. The snails were living in the soil fauna, among moss, fallen leaves etc. near the waterfall of the Tjianten, at 300 m altitude, January 18, 1931. Type and paratypes are preserved in the Zoological Museum, Amsterdam. A specimen from Surabaya, collected by H. FRUHSTORFER in 1890 (Mus. Senckenberg no. 62484) is high 1.8, broad 2.8 mm and has an aperture of 1.2 mm height.

Four very old shells collected by the author at Mt. Pawon, near Padalarang, West Java, 700 m alt., September 25, 1931 have the following dimensions:

height	2.1	2.1	1.8	1.8	} mm
breadth	3.4	3.5	3.2	3.2	
height of aperture	1.4	1.4	1.3	1.3	

Distribution: Java, Bali, Flores.

Habitat in Java: living on the ground, in soil fauna, among vegetable debris, moss, decaying wood, low vegetation. Recorded from sea level up to 2400 m.

West Java: near waterfall of the Tjianten, near Leuwiliang, 300 m (type locality); Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Buitenzorg, Botanical Garden, 250 m, under leaf of *Phoenix spinosa*; Tjibodas, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh,

1700 m; Kandang Badak, saddle between Mt. Gedeh and Mt. Pangerango, 2400 m, soil fauna; limestone hill near Sukanegara, Djampang, 1000 m; Mt. Pawon, near Padalarang, 700 m; Pasir Pabeasan, near Padalarang, 800 m; Maribaja, N. of Bandung, near hot springs along river, 1100 m; Mt. Puntang, near Mt. Malabar, 2000 m.

East Java: Surabaya, sea level; Sutji, near Grisee, sea level; Kawah Idjen-Merapi Nature Reserve, 1600-1700 m.

There is some variation in the degree of elevation of the spire. The type and paratypes from Leuwiliang are rather flat. Other lots contain shells with higher spires. Besides there is some variation in the distance between the radial grooves.

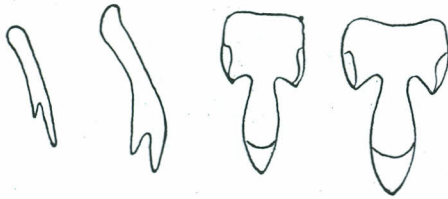


Fig. 69. *Microcystina gratilla* n. sp.
Radula elements. After RENSCH.

As has been pointed out already under *Lamprocystis infans* (PFR), the present species was named *Lamprocystis radiatula* by O. BOETTGER. But, as he never published it, the name remained a museum label name only.

When MOELLENDORFF in 1897 published his *Lamprocystis radiatula* he took an altogether different species (Mus. Senckenberg no. 4090 type, 4091 paratypes) which I now consider to be synonymous with *L. infans* (PFR). This confusion would not have led to further complications, had not RENSCH (1932, p. 49-50) recorded as "*Microcystina radiatula* MLLDFF" specimens from Bali and Flores which are evidently *Lamprocystis radiatula* BTG. non MLLDFF. I could check this opinion by examining a sample from RENSCH's expedition collected at Rana Mese, Flores (now in the Senckenberg Museum no. 62485) and besides it goes forth from his own remark, where he says that MOELLENDORFF's dimensions: diam. 7 mm, alt. 4 mm, do not correspond with the type specimen: diam. 2.7, height 1.4 mm. The nonconformity of the two measurements can be explained by the fact that RENSCH had before him the type of *Lamprocystis radiatula* BOETTGER ms (now *Microcystina gratilla* n.sp.) and not of *Lamprocystis radiatula* MOELLENDORFF [now *L. infans* (PFEIFFER)].

Microcystina vitreiformis (MOELLENDORFF, 1897) (fig. 70).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 63 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Lamprocystis*).

1934 RENSCH, Trop. Binnengew. 4, p. 750, fig. 4 (*Microcystina* ?).

Shell small, flat, or very little elevated. Glassy greenish-white, highly polished, translucent. Ornated with regular, distantly placed, radial striae which are generally equally distinct on both upper and lower side of the shell. This sculpture is crossed by much finer spiral lines.

Whorls $4\frac{1}{2}$, rapidly increasing in size, almost flat. Initial whorl rather large. Suture shallow, with an additional margin. Base moderately rounded. Umbilicus very narrow.

Aperture little oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

Dimensions: height 2.0-2.1, breadth 3.5-3.9, height of aperture 1.6-1.9 mm. The type specimen from Mt. Tjikorai (Mus. Senckenberg no. 2486) is high 2.1 and broad 3.9 mm and has an aperture of 1.9 mm height. A topotype in the Amsterdam Zoological Museum is high 2.0 and broad 3.5 mm, with an aperture of 1.6 mm height.

Distribution: Java, Bali.

Habitat in Java: living on the ground, among earth, vegetable debris and low vegetation. Occurring in mountainous regions, 2400 up to 2500 m.

West Java: Mt. Pangerango, 2400 m; Mt. Tjikorai, 2500 m.

There is some variation in the elevation of the spire. The holotype is almost entirely flat, the topotype more elevated. If there might rise some uncertainty in distinguishing between *Microcystina gratilla* and juvenile shells of *M. vitreiformis* the size of the initial whorl: small in *gratilla*, large in *vitreiformis*, can decide.

Some radula elements were figured by RENSCH, 1934.

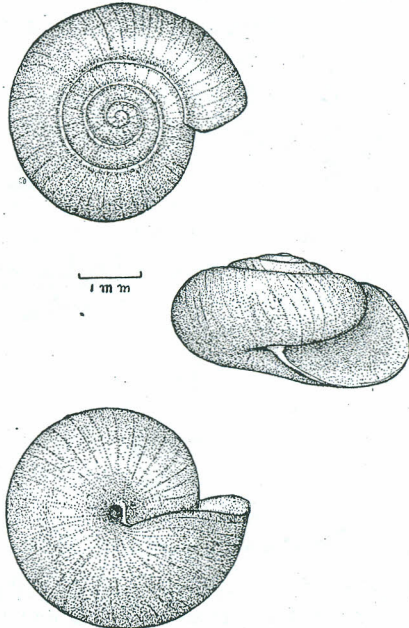


Fig. 70. *Microcystina vitreiformis* (MLLDFF). Type. Shell from top, base and side. LENSVELT del.

***Microcystina fruhstorferi* (MOELLENDORFF, 1897) (fig. 71).**

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 62 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Lamprocystis*).

Shell rather large for the genus, spire somewhat elevated. Light greenish-yellow, highly polished, somewhat transparent. Ornated above with regular, distant, radial striae which make a peculiar curve in backward direction. Below the periphery the striae become weaker. The radial sculpture is crossed by much finer spiral lines.

Whorls $5\frac{1}{4}$, regularly increasing in diameter. Little curved above, hence the suture is only shallow. An additional margin runs parallel with the suture. Base moderately rounded. Last whorl subangular just above the periphery in juvenile and semi-adult individuals. Umbilicus very narrow.

Aperture somewhat oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

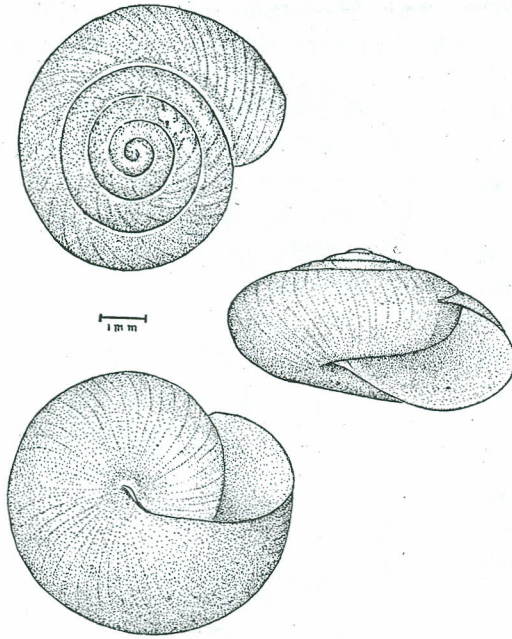


Fig. 71. *Microcystina fruhstorferi* (MLLDF).
Type. Shell from top, base and front.
LENSVELT del.

***Microcystina subglobosa* (MOELLENDORFF, 1897) (fig. 65, 72).**

1897 MOELLENDORFF, Nachr. Blatt, 29,
p. 62 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus.
Hamburg, 31, p. 229 (*Lamprocystis*).

1934 RENSCH, Trop. Binnengew. 4,
p. 752 (*Microcystina* ?).

Shell small, globose above and below the periphery. Yellowish-brown, highly polished, somewhat transparent, ornated with rather close set, well-developed radial striae, crossed by very delicate spiral ones. Below the periphery the radial sculpture is usually less distinct.

Whorls 5 - 5 $\frac{1}{4}$, regularly increasing in diameter, well rounded. Last whorl somewhat

Distribution: Java.

Habitat in Java: living on the ground among dead leaves, decaying wood, moss and other low herbs. Recorded from 800 to 1400 m altitude.

Dimensions: height 2.8-3.3, breadth 5.1-6.2, height of aperture 2.1-2.4 mm. The type specimen from Mt. Gedeh (Mus. Senckenberg no. 62479) is high 3.3 and broad 6.2 mm, with an aperture of 2.4 mm height.

West Java: estate of Megamendung, near Buitenzorg, 800 m; Mt. Gedeh; Tjibodas, Mt. Gedeh, 1400 m; Tjiwidej, S. of Bandung, 1100 m.

East Java: Kendeng III, Idjen Highland, 1400 m.

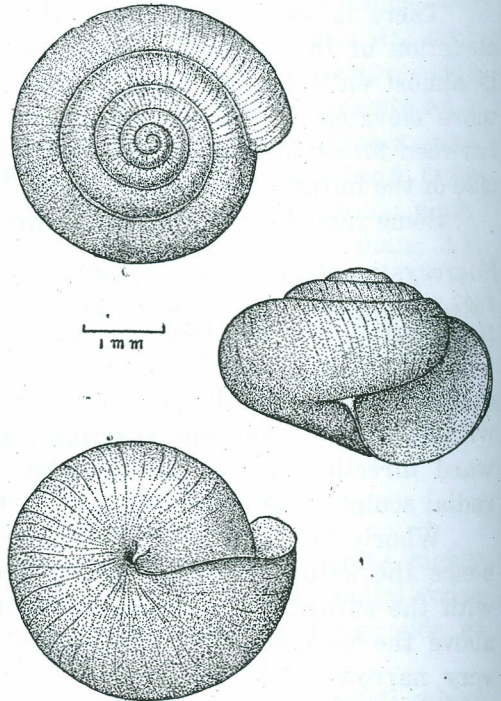


Fig. 72. *Microcystina subglobosa* (MLLDF).
Type. Shell from top, base and front.
LENSVELT del.

compressed laterally. Suture distinct, with additional margin. Base well rounded, umbilicus very narrow.

Aperture little oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

Dimensions: height 1.9-2.5, breadth 3.0-3.7, height of aperture 1.2-1.7 mm. The type specimen from Mt. Tilu, 6300 feet (Mus. Senckenberg no. 4087), is high 2.5 and broad 3.7 mm, with an aperture of 1.7 mm height.

Distribution: Java.

Habitat in Java: living on the ground among earth, fallen leaves, decaying wood, under moss and stones. Recorded between 250 and 3265 m.

West Java: near waterfall of the Tjianten, near Leuwiliang, 300 m; Buitenzorg, 250 m; Tjibodas, Mt. Gedeh, 1400 m; Tjibodas, Mt. Gedeh, road to Huis ten Bosch, 1800 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Mt. Tilu, 6300 feet.

Central Java: springs near Tjemorsewu, Mt. Lawu, 3265 m (RENSCH, 1934).

East Java: Nongkodjadar; 1200 m.

There is a certain amount of variation in globosity of the shells, some specimens being more rounded than others. The globoseness increases with advancing age.

Microcystina circumlineata (MOELLENDORFF, 1897) (fig. 73).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 62 (*Lamprocystis*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 229 (*Lamprocystis*).

Shell rather large for the genus, broad globose-conic. Yellowish-brown, highly polished, somewhat transparent. Ornated with distinct spiral lines, crossed by delicate growth lines. Of the spirals there are about 25 above the periphery and about double that number below it.

Whorls $5\frac{1}{4}$ - $5\frac{1}{2}$, regularly increasing in size. Somewhat convex, the sides subangular. Suture shallow, with an additional margin. Base moderately rounded, umbilicus very narrow.

Aperture moderately oblique, broadly lunar. Peristome not continuous, sharp, not thickened or reflected. With a minute sinuosity in the umbilical region.

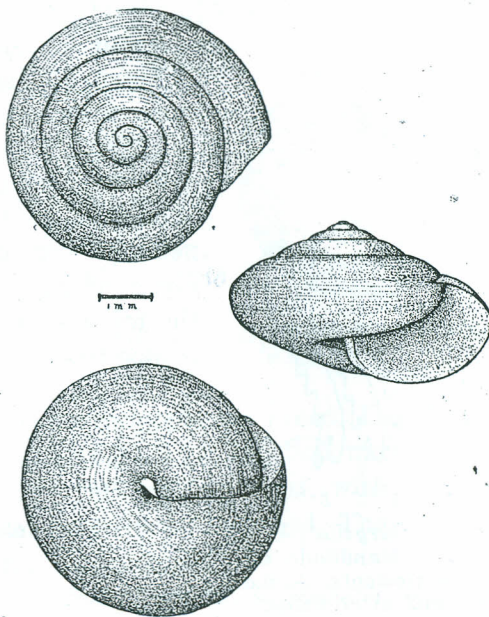


Fig. 73. *Microcystina circumlineata* (MLLDFF). Type. Shell form top, base and front. LENSVELT del.

Dimensions: height 3.2-4.0, breadth 5.1-6.1, height of aperture 1.8-2.1 mm. The type specimen from the Djampangns, S. of Sukabumi (Mus. Senckenberg no. 4085) is high 3.3 and broad 5.1 mm, with an aperture of 1.8 mm height. In the original diagnosis the height is given as .3, the breadth as 5 mm.

Distribution: Java.

Habitat in Java: living on the ground, among earth, dead leaves, moss, and other low vegetation. Occurring between 300 and 1400 m altitude.

West Java: near waterfall of the Tjianten, near Leuwiliang, 300 m; estate of Tjisarua-Zuid, 800 m; estate of Megamendung, near Puntjak pass, 1000 m; Tjibodas, Mt. Gedeh, 1400 m; Djampangns, S. of Sukabumi; Mt. Pawon, near Padalarang, 700 m; Maribaja, N. of Bandung, near hot springs, 1000 m.

Genus *Durgella* BLANFORD, 1863¹⁾

Shell thin, consisting of few, rapidly increasing whorls, with a large oblique aperture.

Lobes of the mantle partially covering the shell when expanded, the right shell-lobe being broad and triangular, the left also triangular and reflected over the edge of the shell from near the respiratory orifice. Dorsal lobes moderate. A broad peripodial fringe; the mucous pore is well developed with a large overhanging lobe; sole divided into three parts longitudinally.

In the generative organs a dart sac is usually present and large; the spermatheca is of moderate size, wide at the base, then constricted, and broader again at the end; there is no distinct dart-sac, though an expansion may be noticed at the junction of the vas deferens.

The jaw is thin, membranaceous, almost straight on the cutting edge. The odontophore is broader than long, with a minute rhachidian tooth, generally unicuspid; the lateral teeth are excessively numerous, there being no broad plates near the middle, but a gradual diminution takes place in size from the innermost to the outermost tooth, all having a serrated curved edge with numerous cusps (fig. 74).

Distribution: East Himalaya, Assam, Burma, Java, Bali, Sumbawa, Flores.

In the description of the genus mention is made of an unicuspid central tooth in the radula. The figure, however, (l. c. p. 214, fig. 75) shows a

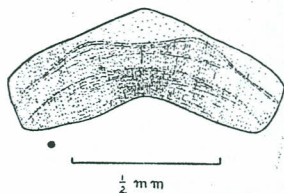


Fig. 74. *Durgella pusilla* (MARTS). Mandibula and radula elements. Author del., and after RENSCH.

¹⁾ The characteristics of the genus have been compiled after BLANFORD & GODWIN AUSTEN, Fauna of British India, Testacellidae and Zonitidae, 1908, p. 213.

somewhat imperfect tricuspid rhachis, a discrepancy certainly due to the minute size of this tooth. As the other features of the description fit so well with the two Javanese species, I do not hesitate to place them in *Durgella*.

In Java there occur two species:

1. Shell with 5-5½ whorls, keeled, and generally with a brown spiral band above the keel **pusilla**.
- Shell with 3 whorls, not keeled, and without spiral band **sundana**

Durgella pusilla (MARTENS, 1867) (fig. 74, 75).

1867 MARTENS, Ostas. Landschn. p. 254 (*Helix pusilla* and *Helix jenynsi* part).
 1903 GUDE, Journ. Malac. 10, p. 53 (*Macrochlamys ? dwipaënsis*).
 1903 GUDE, Proc. Mal. Soc. 5, p. 264, pl. 7, fig. 15-17 (*Xesta dwipana*).
 1912 SCHEPMAN, Proc. Mal. Soc. 10, p. 230 (*Xesta dwipana* var. *concolor*).
 1931 THIELE, Sitz. Ber. Ges. naturf. Freunde, Berlin, p. 397, fig. 8 (*Durgella dwipana*).
 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 59, fig. 21 (*Durgella dwipana*).

Shell low conical, keeled at the periphery, creamy-white, greenish-white, or light-brown, sometimes unicolorous, sometimes with a brown band above the periphery. In exceptional cases a second brown band can occur below the periphery. The keel which occasionally can be somewhat pinched, is generally lighter than the rest of the shell. In adult specimens the keel becomes obsolete towards the aperture.

Fragile, glassy, shining, a little transparent. First whorl smooth or minutely punctate. Following ones regularly striated according to the growth lines. This structure is crossed by numerous delicate spiral lines. Base rounded. Apex blunt.

Whorls 5-5½, very little curved, hence the suture is only shallow. The suture is indistinctly margined. Last whorl not descending towards the aperture. Umbilical perforation narrow.

Aperture oblique, rhombiform or broad sickle-shaped, with rounded basal side. Peristome not continuous, sharp, not thickened. The columellar side slightly reflexed over the umbilicus.

The two lateral mantle lobes are — in preserved specimens — finger-shaped, the two dorsal lobes broadly triangular. Foot sole tripartite, the central zone narrower than the lateral ones.

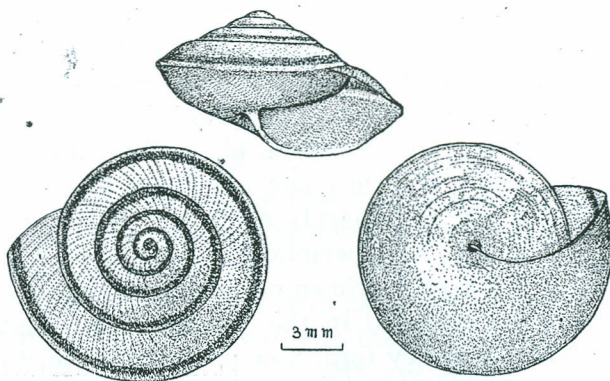


Fig. 75. *Durgella pusilla* (MARTS). Shell from top, front and base. LENSVELT del.

Dimensions: height 7-8, breadth 12-13, height of aperture $5\frac{1}{2}$ -6 mm.

Distribution: Java, Bali.

Habitat in Java: living in the wood on the ground, among fallen leaves and herbs; in wet weather climbing actively on shrubs and branches. Between 500 and 1500 m altitude.

West Java: Mt. Pawon, near Padalarang, 700 m; limestone hill near Sukanegara, Djampang, 1000 m; Mt. Dogdog, 1500 m.

Central Java: Mt. Lawu, 1300 m.

East Java: Tengger Mts. 4000-5000 feet; Nongkodjadjar, 1200 m; Blawan, Idjen Highland, 950 m; Kali Mrawan, 1500 feet; Wonosari (MARTENS); Pasuruan (GUDE, RENSCH).

The species is rather variable in coloration. A form characterized by its more or less uniform yellowish-brown colour, without band, was called var. *concolor* SCHEPMAN (l.c.) after a ms name of BOETTGER. It is recorded from Mt. Ungaran in Central Java, and from Tengger Mts, 1220 m and Blawan, Idjen Highland, 950 m in East Java.

Two other colour forms distinguished by BOETTGER, but never published, are: *acutecarinata* and *semirufa*. In the var. *acutecarinata* nov. var. the peripheral keel is very sharp and pinched, like a thread running round the ultimate whorl. The coloration of this form corresponds with the description above: a creamy white ground colour with a brown band above the periphery. The type specimen of this form (together with 2 similar shells) was collected in the Tengger Mts, East Java, 4000 feet, by H. FRUHSTORFER. This lot is now in the Amsterdam Zoological Museum. Other samples are in the Senckenberg Museum from the Djampang, 2000 feet; Artjamanik, N. of Bandung, 3000 feet; Mt. Gedeh, 3000 feet and Pengalengan, 4500 feet, all in West Java.

The var. *semirufa* nov. var. in which the brown band instead of being narrow and sharply delimited, is broad and vague, decreasing in intensity from the periphery upwards to the suture of the previous whorl. The type specimen of this colour variety (together with 2 similar shells) was collected in the Tengger Mts, East Java, 4000 feet, by H. FRUHSTORFER. They form now part of the Amsterdam Zoological Museum Collection. Other samples are in the Senckenberg Museum from Mt. Gedeh, West Java, 3000 feet.

In Java I have never seen shells with an extra brown band below the periphery, as described by RENSCH (l. c. p. 59) from Bali.

Durgella sundana RENSCH, 1930.

1930 RENSCH, Zool. Anz. 89, p. 85, fig. 13.

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 59-60, fig. 22.

Shell depressed-globular, finely striate, shining, glassy hornbrown, horny yellow, or redbrown; consisting of 3 rounded whorls, the 2 uppermost ones emerging only very little above the ultimate one. Suture shall-

low, margined. Surface with fine conspicuous growth lines. Columellar side only shortly reflexed, nearly perpendicular, making an obtuse angle with the basal side of the peristome.

The body of the living animal is greyish brown. The foot sole consists of 3 parts. Above the mucous pore there is a small horn. The right mantle lobe is acuminate, narrow, the left one broader, rounded.

The radula consists of pectiniform teeth, each with 5-7 cusps. The central tooth is different and varying within one and the same radula: either small and broad, with 2-3 cusps on each side or consisting of 2 irregular parts. In several rows the rhachis is missing. In an animal from the island of Flores 117 rows were counted, consisting of 585-603 teeth in the middle part of the radula.

Dimensions: height 5-5.1, breadth 3.2-3.4 mm.

Distribution: Java, Sumbawa, Flores.

Habitat in Java: among dry leaves on the ground, and on leaves of shrubs where they move with great rapidity. When touched the animals sway their foot energetically, like *Vitrinopsis* species.

West Java: Depok, north of Buitenzorg, 150 m.

The species is characterized by the small, depressed-globular shell, with not more than 3 rounded whorls, the first two emerging only very little above the last one. The shortly reflexed columellar side is almost perpendicular. The shells from Java are glassy brown, the Flores shells more redbrown, and those from Sumbawa more corneous.

[I have not seen the species. The diagnosis and description are combined and translated after RENSCH, 1930 and 1932.]

The genera *Vitrinoconas*, *Trochomorpha* and *Eurybasis* which were classified by THIELE (Handb. Syst. Weicht. Kunde, 1, part 2, 1931, p. 622) in his family *Ariophantidae* have proved to be members of the subfamily *Trochomorphinae* of the family *Zonitidae*. They will be treated in the next part of these "Systematic Studies".

The species which for many years was known as *Macrochlamys amboinensis* (MARTENS, 1867) must now be relegated to the family *Zonitidae*, on account of the radula in which the marginal teeth are dagger-shaped, and not bicuspid or multicuspoid as in *Helicarionidae*. The species will be treated with the other representatives of the Zonitid family in the next part of these "Systematic studies".

Familia PLEURODONTIDAE

Shell flat, low conical, or turreted. Perforate, or with closed umbilicus. Aperture in some genera with folds and lamellae; in the Javanese genera without such mouth armature. Peristome thickened and reflected.

Radula ∞ .1. ∞ . Mandibula ribbed (odontognathous), or smooth. Generative organs generally with dart sac and amatory dart.

Distribution: tropical zones of the Indo-Australian region and of America.

Key to the genera living in Java:

1. Shell higher than broad, or as high as broad 2
- Shell broader than high 4
2. Shell about as high as broad, forming an almost ideal cone: with flat sides and little bulging base. Dextral **Ganesella**
- Sides of the whorls more curved, base more descending. Dextral or sinistral 3
3. Shell rather small, max. height not more than 21 mm. Plain white, or white with a brown spiral band, and a brown stripe along the interior margin of the peristome. Always sinistral ... **Pseudopartula**
- Shell higher than 25 mm. Plain white, yellow, brown or pink, or ornated with different patterns of brown, green, purple etc. Dextral or sinistral **Amphidromus**
4. Shell acutely carinated at the periphery 5
- Periphery round, or obtusely angular, but never sharply keeled ... 6
5. Umbilicus wide **Landouria** (species *ciliocincta*, *epiplatia*, *rotatoria*, *winteriana*)
- Umbilicus not so wide **Chloritis** (*helicinoides*)
6. Umbilicus narrow **Landouria** (species *monticola*, *smironensis*)
- Umbilicus wider **Chloritis** (species *crassula*, *fruhstorferi*, *transversalis*)

Genus **Ganesella** BLANFORD, 1863

Shell high or low conical, perforate. Top mammillar, periphery carinate. Last whorl slightly descending.

Aperture rhombiform, oblique. Peristome not continuous, thickened and reflected, the columellar side somewhat hiding the umbilicus.

The internal organisation of the Javanese species is unknown. For other members of the genus PILSBRY (Man. of Conch. (2) 9, 1894, p. 168, pl. 60, fig. 1, 2, frontispiece fig. 1, 2) gave the following account.

"Animal (of *G. japonica*) with the foot very long and narrow, sole not distinctly tripartite; upper surface finely and feebly granular, back with a pair of dorsal grooves, no facial grooves; tail narrow, long, with a median longitudinal groove above.

"Jaw arcuate, with about 9 ribs denticulating the lower margin. Radula of the type usual in ground snails. Middle tooth with mesocone only developed, shorter than the basal plate, side-cusps represented by slight lateral extensions. Laterals similar but with the cusp longer. Marginals with oblique, bifid inner cusp and an ectocone.

"Genital system having the penis long and twisted, ending in a curved blind sack with corrugated inner walls; epiphallus long, bearing

the retractor, terminating in a flagellum and the vas deferens. Vagina extremely long, the spermatheca duct inserted high. Spermatheca oblong, on a stout duct, neither duct nor bulb being bound to the uterus. No dart sac or mucous glands”.

It remains to be seen whether *Ganesella bantamensis* (SMITH), the Javanese species, must be definitely relegated to this genus. The shells found in Java did not contain the weak parts of the animal.

Distribution: India, Japan, China, Indo-China, Malaya, Sumatra, Java, Borneo, Philippines, New Guinea.

In Java only one species:

Ganesella bantamensis (SMITH, 1887) (fig. 76).

1887 SMITH, Ann. Mag. Nat. Hist. (5) 20, p. 132 [*Helix* (*Geotrochus*)].

1887 SMITH, Ann. Soc. Roy. Malac. Belg. 22, p. 217, pl. 9, fig. 11 [*Helix* (*Geotrochus*)].

1891 PILSBRY, Man. of Conch. (2) 7, p. 84, pl. 18, fig. 51 [*Helix* (*Geotrochus*), in explanation of plate as: *Satsuma*].

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 234.

“Shell elevated conic, about as high as broad. Obtuse at the apex, narrowly perforated, somewhat thin, grayish-white, scarcely shining; whorls 7, slowly increasing, the three upper ones convex, the remainder nearly flat, all over minutely granulate, sculptured with very oblique delicate growth-striae, at the scarcely oblique sutures margined with a slender carina; last whorl acutely carinated at the periphery, nearly flat beneath, slightly descending in front. Aperture oblique, small,

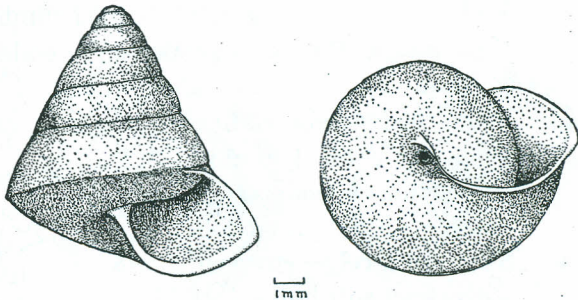


Fig. 76. *Ganesella bantamensis* (SMITH). Shell from front and base. Author del.

equaling $\frac{1}{3}$ the entire length; peristome whitish,

upper margin oblique, thin, sinuous, slightly reflexed, the basal margin broadly expanded, half covering the umbilicus above.

“Alt. 12, greater diam. 11, lesser 10 mm.

“Remarkable for its elevated form, granulated surface, and the acute peripheral carina, which continuing upwards gives the suture a carinated appearance.” (PILSBRY, 1891).

The type is in the British Museum (Natural History). It was collected in the residency of Bantam, West Java. I have not seen the shell.

Another shell, from the Southern Mountains, residency of Pasuruan, East Java, collected in 1891 by H. FRUHSTORFER (Mus. Senckenberg no. 27471) is high $10\frac{1}{2}$ and broad 10 mm, with an aperture of 4 mm height.

It is curious that, in spite of the rather intensive malacological exploration of Java, such a peculiar shell has only been found twice.

Genus *Landouria* GODWIN AUSTEN, 1918

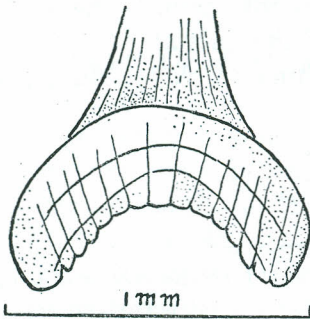


Fig. 77. *Landouria rotatoria* (VON DEM BUSCH). Mandibula. Author del.

Shell low conical or flat, openly umbilicate. Periphery generally with a more or less sharp keel. Periostracum fibrous, scaly or granular, in some species hairy, or with stiff bristles along the peripheral keel.

Aperture oblique, without teeth. Peristome continuous, sharp and somewhat thickened.

There is no dart sac. Mandibula with several ridges. Radula $\infty.1.\infty$. The central tooth unicuspid or with feeble ectocones. Latero-marginals bicuspid, in the outer teeth both denticles becoming bifid.

Distribution: India, Burma, China, Malaya,

Malay Archipelago, Philippines.

In Java there are six species:

1. Shell almost flat, narrowly coiled, umbilicus very wide ... **epiplatia**
— Shell not so flat, not so narrowly coiled, umbilicus not so extremely wide 2
2. Shell moderately conical, umbilicus narrow **monticola**
— Shell low conical, umbilicus wide, or moderately wide 3
3. Shell entirely covered with short soft hairs, the peripheral ones of equal strength as the others **smironensis**
— Shell not hairy, or if it does bear hairs there is a difference between the soft and small ones of the general surface and the stronger stiff bristles of the peripheral keel 4
4. Shell with a brown band along, or somewhat above the peripheral keel. Umbilicus moderately narrow **ciliocincta**
— Shell without a brown band. Umbilicus wider 5
5. Whorls almost flat, suture superficial. Umbilicus rather wide. Peripheral keel acute and generally somewhat pinched **rotatoria**
— Whorls more rounded, suture impressed. Umbilicus not so wide. Peripheral keel acute, angular or even obsolete towards the aperture **winteriana**

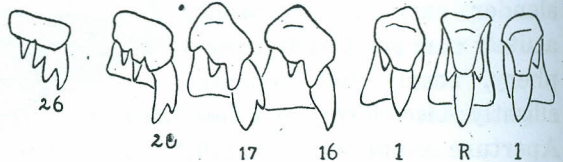


Fig. 78. *Landouria rotatoria* (VON DEM BUSCH). Radula elements. After WIEGMANN.

Landouria rotatoria (VON DEM BUSCH, 1842) (fig. 77, 78, 79).

- 1842 VON DEM BUSCH, in: PHILIPPI, Abb. & Beschr. 1, p. 2, pl. 1, fig. 5 (*Helix*).
 1849 MOUSSON, Land & Süsw. Moll. Java, p. 24, pl. 2, fig. 8 (*Helix*).
 1849 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix*).
 1867 MARTENS, Ostas. Landschn. p. 264 (*Helix rotatoria*) and p. 266 (*Helix sumatrana* var. *moussoniana*).
 1888 PILSBRY, Men. of Conch. (2) 4, p. 54, pl. 12, fig. 77 (*Helix tapeina* var. *rotatoria*), p. 56 (*Helix sumatrana* var. *moussoniana*).
 1888 TENISON WOODS, Proc. Linn. Soc. N. S. Wales (2) 3, p. 1032 (*Helix sumatrana*).
 1890 BOETTGER, Ber. Senckenb. p. 144 [*Helix (Plectotropis)*].
 1892 MARTENS, Erg. Weber, 2, p. 234 [*Helix (Plectotropis)*].
 1893 WIEGMANN, Erg. Weber, 3, p. 166, pl. 12, fig. 11-14 [*Helix (Plectotropis)*].
 1897 MOELLENDOFF, Nachr. Blatt, 29, p. 66-67 (*Plectotropis leucomphala*, with forms *subfasciata* and *castanea*; *Plectotropis trichotrochium*).
 1905 GUDE, Journ. of Malac. 12, p. 14, pl. 3, fig. 1 a-c (*Plectotropis leucochila*).
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 211-212, 235, fig. 5-7 (*Plectotropis kraepelini*), p. 212, 235, fig. 8-9 (*Plectotropis conoidea*), p. 211, 236 (*Plectotropis sumatrana* var. *moussoniana*), p. 235 (*Plectotropis leucochila, leucomphala* and *rotatoria*), p. 236 (*Plectotropis trichotrochium*).
 1921 PARAVICINI, Trop. Natuur, 10, p. 153, fig. 9a and 9b (*Plectotropis*).
 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 91-93 (*Landouria rotatoria rotatoria*).
 1934 RENSCH, Trop. Binnengew. 4, p. 754 and 758 (*Landouria rotatoria rotatoria*).
 1935 VAN BENTHEM JUTTING, Treubia, 14, p. 103 (*Plectotropis*).
 1935 PARAVICINI, Arch. Moll. K. 67, p. 173 (*Plectotropis rotatoria* and *P. leucomphala*).
 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 310.

Shell low conical, keeled at the periphery. Unicolorous yellowish-brown to greyish-brown or reddish-brown. Moderately thin and shining, somewhat transparent, the dark-blotched mantle shining through the shell. Epidermis thin, fibrous. In young and fresh shells the cuticle bears fine short hairs, with a row of stronger bristles along the peripheral keel. In old specimens where the hairs have disappeared, only irregular scales or granules are left.

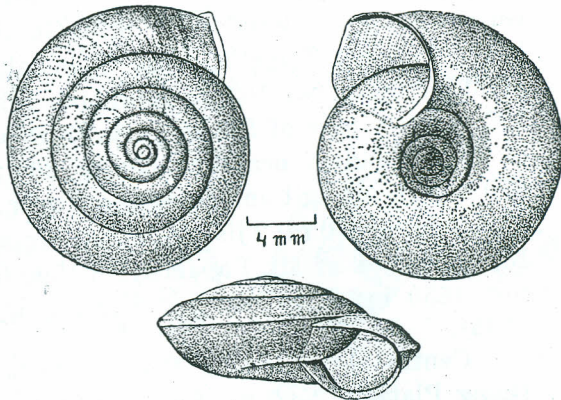


Fig. 79. *Landouria rotatoria* (VON DEM BUSCH). Shell from top, base and side. ABDULKADIR del.

Whorls 6-6½, the first two smooth, the following ones striated according to the growth lines, crossed by much finer spiral lines. Whorls increasing in size regularly, almost flat, hence the suture is superficial. Last whorl generally descending a little towards the aperture. Periphery acutely keeled by a thread-like keel which may be whitish in some individuals. Base rounded, angular round the umbilicus. Umbilicus wide, showing all previous whorls. The umbilical region often lighter yellow than the rest of the shell.

Aperture oblique, broad sickle-shaped. Peristome not continuous, sharp, somewhat reflected and a little thickened by a whitish or pink ridge just in the interior of the aperture.

Dimensions: height about 8, breadth 15-18, height of aperture $3\frac{1}{2}$ -5 mm.

Distribution: Sumatra, Java with several satellite islands, Bali, Lombok, Sumbawa, Flores, Sumba, Timor, Philippine Islands.

Habitat in Java: living on the ground, among leaves, grass, decaying wood, under stones, not avoiding human settlements. Occurring from sea level up to 2500 m altitude.

West Java: Mt. Karang, wood near kampong Tjinjurup, 700 m; Bantam, on plants (MARTENS, 1867); Leuwiliang, near waterfall of the Tjianten, 300 m; Mt. Salak (BOETTGER, 1890); Warangloa, Mt. Salak, 650 m; wood near Gunung Bunder, Mt. Salak, 1000 m; Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; near Palabuan, sea level; Tjisolak, near Wijnkoopsbay, 200 m; Buitenzorg (LESCHKE, 1914; RENSCH, 1932); saddle between Mt. Pantjar and Mt. Paniisan, near Buitenzorg, 500 m; Gora, S. of Buitenzorg; estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 800 m; estate of Tjiliwung, near Puntjak pass, 1200 m; wood near Telaga Saät, base of Mt. Limo, near Puntjak pass, 1100 m; Mt. Gedeh, 4000 feet; Tjibodas, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; wood near Situ Gunung, Mt. Gedeh, 1000 m; Sukabumi, 700 m; Tjipeitir, near Tjibadak, 600 m; Selabatu, near Sukabumi, (PARAVICINI, 1935); limestone hill near Sukanegara, Djampang, 1000 m, environs of Sukanegara, Djampang, 700 m; Pegantenan; estate of Radjamandala, near Padalarang, 200 m; near kampong Radjamandala, 350 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m; environs of Bandung, 800 m; Tjisurupan, Mt. Papandajan, 1300 m (MARTENS, 1867) Bungbulan, S. of Mt. Papandajan, 1500 feet; Kawah Kamodjan, Mt. Guntur, 1550 m; Mt. Tjikorai; Kedung Djati, near Cheribon (PARAVICINI, 1935).

Central Java: Dieng Plateau, 2000 m (RENSCH, 1934); Mt. Prah, Dieng Plateau, 2500 m; Lake Pasir, near Sarangan, Mt. Lawu, 1300 m (RENSCH, 1934); Gamping, near Djokja, 150 m; Baron, S. of Djokja, 100 m.

East Java: Sampung Cave, near Ponorogo, 200 m (VAN BENTHEM JUTTING, 1935); Sutji, near Grisse, sea level; Southern Mountains, 1200-1500 m; Wonosari (MARTENS, 1867).

The species is very variable in height: breadth ratio, in the width of the umbilicus, in the sharpness of the peripheral keel and of the umbilical angle. Some shells have a lighter, yellowish zone encircling the umbilicus. Such species were described by MOELLENDORFF (1897) as *Plectotropis leucomphala*. Others, with a whitish zone just before the pe-

ristome, were defined by GUDE (1905) as *Pl. leucochila*. Both forms, however, are only individual modifications, without taxonomic value.

In several populations shells with a more or less pronounced scalari-form spire have been recorded (MOUSSON, 1849, p. 24, pl. 2, fig. 8). They occur among the normal ones, in several of the samples of the above-mentioned stations.

One specimen was found in the so-called "bone-layers" of the Trinil deposits, Middle Pleistocene, East Java, (VAN BENTHEM JUTTING, Zool. Meded. 20, 1937, p. 95).

Landouria winteriana (PFEIFFER, 1841) (fig. 80).

- 1841 PFEIFFER, Symb. Hist. Helic. 3, p. 41 (*Helix*).
- 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix*).
- 1849 MOUSSON, Land & Süßsw, Moll. Java, p. 23, pl. 2, fig. 7, pl. 20, fig. 2 (*Helix*).
- 1867 MARTENS, Ostas. Landschn. p. 263, pl. 13, fig. 10 (*Helix intumescens*), p. 264, pl. 13, fig. 11 (*Helix winteriana*).
- 1888 PILSBRY, Man. of Conch. (2) 4, p. 54, pl. 11, fig. 53-55 (*Helix Huttoni* var. *winteriana*), p. 54, pl. 11, fig. 64-66 (*Helix intumescens*).
- 1888 TENISON WOODS, Proc. Linn. Soc. N. S. Wales (2) 3, p. 1032 (*Helix*).
- 1890 BOETTGER, Ber. Senckenb. p. 144 [*Helix (Plectotropis)*].
- 1891 BOETTGER, Ber. Senckenb. p. 264 [*Helix (Plectotropis)*].
- 1892 MARTENS, Erg. Weber, 2, p. 234 (*Plectotropis intumescens*).
- 1897 MOELLENDORFF, Nachr. Blatt, 29, p. 68 (*Plectotropis schepmani*).
- 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 235 (*Plectotropis intumescens*), p. 236 (*Pl. winteriana* and *Pl. schepmani*).
- 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 88-90, fig. 35 (*L. winteriana winteriana*).
- 1935 PARAVICINI, Arch. Moll. K. 67, p. 173 (*Plectotropis winteriana*).
- 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 312.

Shell low conical, keeled, or feebly angular at the periphery. Unicolorous yellowish-brown to reddish-brown. Moderately thin and shining, somewhat transparent, the dark-blotched mantle shining through. Epidermis thin, fibrous, granular or scaly. In young and fresh shells the cuticle bears fine, short hairs and, besides, a row of stronger bristles along the peripheral keel. In older specimens where the hairs have disappeared, only irregular scales are left.

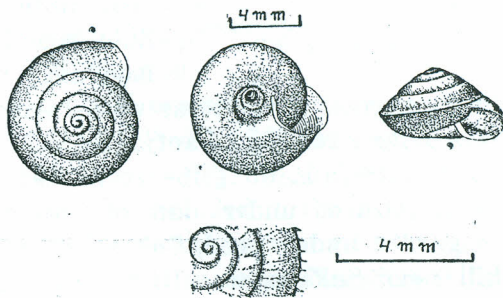


Fig. 80. *Landouria winteriana* (PFR). Shell from top, base and front. Detail of sculpture with peripheral hairs, enlarged. ABDULKADIR del.

Whorls 5-6, the first two smooth, the following ones irregularly striated according to the growth lines, crossed by much finer and undulating spiral lines. Whorls increasing in size regularly, moderately convex, hence the suture is well impressed. Last whorl descending a little to-

wards the aperture. Periphery keeled, sharp in young shells. With increasing age the carination becomes less acute. In some individuals the keel is whitish. Base rounded, somewhat angular round the umbilicus. Umbilicus rather large, showing all previous whorls. Yet it is less wide than in *L. rotatoria* or *L. epiplatia*.

Aperture oblique, broad sickle-shaped. Peristome not continuous, sharp, somewhat reflected, a little thickened by a white or pale reddish-brown interior ridge.

Dimensions: height 5-6, breadth 11-12, height of aperture 4 mm.

Distribution: Sumatra, Borneo, Java, Sumba, Flores, Timor, Celebes, Batjan, Ternate, Halmaheira, Philippines.

Habitat in Java: living on the ground, among leaves, rubbish, decaying wood, vegetation, under stones, often in the neighbourhood of human dwellings. Occurring from sea level up to 2800 m altitude. During the dry monsoon the snail can shut its shell by means of an epiphragma (fig. 81).

West Java: cocoa-nut plantation near Pasauran, sea level; Mt. Karang, wood near kampong Tjinjurup, 700 m; Leuwiliang, near waterfall of the Tjianten, 300 m; Kuripan, near Buitenzorg, 200 m; Mt. Salak, on leaf of Arum, 1200 m; wood near Lake of Tjigombong, Mt. Salak, 500 m; Depok, N. of Buitenzorg, under low vegetation, verge near churchyard, 100 m; Buitenzorg, Botanical Garden, 250 m, on orchid leaf and on leaf of *Phoenix spinosa*; Buitenzorg, garden in the town, 250 m; wood of Mt. Pantjar, near Buitenzorg, 500-800 m; estate of Tjisaruazuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 800 m; Puntjak

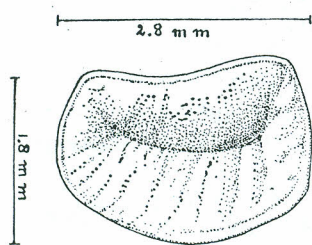


Fig. 81. *Landouria winteriana* (PFR). Epiphragma. ABDULKADIR del.

pass, in grass along stone wall, 1400 m; Mt. Gedeh, 4000 feet; Tjibodas, Mt. Gedeh, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Patjet, in grass in a garden, under hull of cotton tree fruit, 1100 m; Sukabumi, in garden under wood, 700 m; near Wijnkoopsbay, sea level; limestone hill near Sukanegara, Djampang, 1000 m; environs of Sukanegara, Djampang, 700 m; Tjiandjur, under stones in cocoa nut garden near Hospital, 470 m; Tjiseëng, under banana trunk; estate of Radjamandala, near Padalarang, 200 m; Pasir Pabeasan, near Padalarang, 800 m; Mt. Masigit and Mt. Pawon, near Padalarang, 500-700 m; Bandung, near river along Huygensroad, opposite Geological Institute, 700 m; Bandung, near auto dump along road to Lembang, under decaying banana trunk, 900 m; Lembang, 1200 m (PARAVICINI, 1935); Bandung, Dago, under ruins of houses, 700 m; Bandung, Dago, in soil near first waterfall of the Tjikapundung, 800 m; N. of Bandung, near triangulation point KQ 13, in high grass, 1250 m; Maribaja, road along river near hot springs, 1100

m; Maribaja, S. E. of hot springs, 1100 m; on basalt stones on the bank of the Tjikapundung, near second waterfall, 1200 m; road to Lembang, near Maribaja, 1000 m; steep valley near Lembang, close to side road to Tjiater, 1400 m; near waterfall of Tjisarua, N. of Bandung, 1300 m; Mt. Tangkuban Prahū, 700-1000 m; Tjisaranang, near kampong Tjariang, district of Tomo, near Sumedang estate of Sukanana, near Bandung; Kedung Djati, near Cheribon (PARAVICINI, 1935); Mt. Tilu, 1400 m; Tjiwidej, S. W. of Bandung, 1100 m; Mt. Patuha, 1550 m; Tjisurupan, 3500 feet; Tjibulu near Tjisurupan, Mt. Papandajan, 1300 m; wood near Tegal Pandjang, Mt. Papandajan, 2190 m; Bungbulan, S. of Mt. Papandajan, 1500 feet; estate of Arjamanik, 3000 feet; Mt. Malabar, 1600 m; Mt. Malabar, under dead wood near wireless station, 1500 m; Tjibitung, above Pengalengan, 2000 m; estate of Ardjuno, Mt. Papandajan, 1200 m; Garut, 700 m; Mt. Guntur, 1500 m; E. slope of Mt. Galunggung; Tjibulu, near Tjikadjang, 1500 m; Mt. Tjikorai, 5000 feet.

Central Java: Tjilatjap, seal level; near kampong Sembungan, Diëng Plateau, 1200 m; Dempet, near Demak, under piece of paper 150 m; Purwodadi, in earth; between Purwodadi and Wirosari; Mantingan; Bulu, near Mantingan, residency of Rembang; Sulang, S. of Rembang, near Kali Besèk, 100 m.

East Java: Mt. Lawu, 2800 m; Surabaja, sea level (MARTENS, 1867); Grisse, sea level (MARTENS, 1867); Tengger Mts, 4000-5000 feet; Malang, 450 m; Djaboong estate, near Wlingi, 800 m; Kali Mrawan, S. of Malang, 1500 feet; Durdjo estate, near Djember, 600 m; road to Jang plateau, 7000 feet; near Wonosari (MARTENS, 1867), Glen Nevis, near Kalibaru, Banjuwangi district, 1250 feet.

There is some variation in the height: breadth ratio, in the width of the umbilicus and in the sharpness of the keel.

According to RENSCH (1932) who could examine the holotype, *Helix intumescens* MARTENS, 1867 which was described by MARTENS after specimens with a relatively high spire (height 9, resp. 6½, 5½, 5½ mm, breadth 14, resp. 11, 9, 8 mm), this species must be included in the synonymy of *Landouria winteriana*. The *intumescens* form can occur in gradual transition in any population of *Landouria winteriana* in Java. Therefore it falls within the variation range of this species and it is not recommendable to keep it separate as a special form, race, variety or whatsoever. A shell from Malang in the Amsterdam Museum, collected by VAN HOËVELL, and identified by MARTENS, confirms this opinion. In the Senckenberg Museum, however, I came upon 3 samples (nos. 23973, 23974 and 24233) classified as *Plectotropis intumescens*, which are undoubtedly *Landouria smironensis*. They were collected at Malang (no. 23974) and in the Tengger Mountains at 1220 m (nos. 23973 and 24233).

For the discussion of *Landouria schepmani* MOELLENDORFF and *L. schepmani* BOETTGER ms, see under *Landouria monticola* n. sp.

Landouria epiplatia (MOELLENDORFF, 1897) (fig. 82).1897 MOELLENDORFF, Nachr. Blatt, 29, p. 67 (*Plectotropis*).1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 235 (*Plectotropis*).

Shell very low conical, almost flat. Keeled at the periphery. Yellowish-brown, thin and shining. Somewhat transparent, the dark mantle-flecking shining through the shell. Epidermis thin, fibrous. In adult

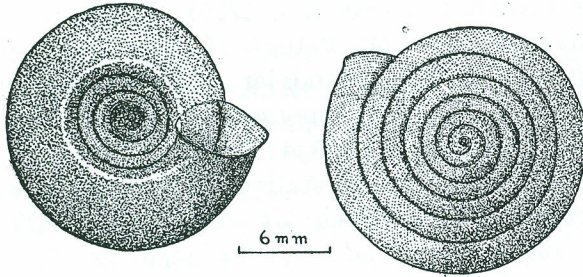


Fig. 82. *Landouria epiplatia* (MLLDFF). Shell from base and top. LENSVELT del.

shells there are no traces of hairs, or their scale-like remnants along the peripheral keel, but it is not impossible that in immature shells such bristles do occur.

Whorls 6-7, the first two smooth, the subsequent ones finely striated according to the growth

lines, crossed by much finer spiral lines. Whorls increasing in size slowly and regularly, almost flat, hence the suture is superficial. Last whorl descending a little just before the suture. Periphery acutely keeled by a thread-like keel. Base rounded, angular round the umbilicus. Umbilicus very wide, about half the basal diameter, showing all previous whorls.

Aperture oblique, broad sickle-shaped or rhombiform. Peristome not continuous, sharp, somewhat reflected and a little thickened by an interior white ridge.

Dimensions: height 6, breadth 17-18, height of aperture 5 mm. The type specimen from the Djampangans, 2000 feet (Mus. Senckenberg no. 8909) is high 6 and broad 17 mm, with an aperture of 5 mm height.

Distribution: Java.

Habitat in Java: little is known of the natural habitat of the species but judging from the way of life of its congeners it can be expected living in the soil fauna. About its vertical distribution we are hardly better informed, the two records mentioned below being the only places where it has been found.

West Java: Sukabumi; Djampangans, 2000 feet.

Landouria ciliocincta (MOELLENDORFF, 1897) (fig. 83).1897 MOELLENDORFF, Nachr. Blatt, 29, p. 67 (*Plectotropis*).1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 235 (*Plectotropis*).1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 150 (*Plectotropis*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 310.

Shell low conical, keeled at the periphery. Whitish, with a brown peripheral band. Moderately thin and shining, a little transparent, the dark-spotted mantle shining through. Epidermis thin, fibrous, with con-

spicuous short brown hairs along the peripheral keel. In old specimens where the hairs are lost, only irregular scales are left.

Whorls 5-6, the first two smooth, the following ones irregularly striated in the direction of the growth lines, crossed by much finer spiral lines. Whorls increasing in size regularly, somewhat rounded, hence the suture is well impressed. Spire little elevated. Last whorl a little descending towards the aperture. Periphery keeled, sharp in young shells, but more obsolete in adult ones. Base rounded, somewhat angular round the umbilicus. Umbilicus moderately wide, less wide than in *epiplatia*, *rotatoria*, or *winteriana*.

Aperture oblique, broad sickle-shaped. Peristome not continuous, sharp, somewhat reflected, a little thickened by a white interior ridge.

Dimensions: height 6-7, breadth 14-15, height of aperture 4-5 mm. The type specimen from the Southern Mountains, residency of Pasuruan (Mus. Senckenberg no. 9176) is high 6.6 and broad 13.5 mm, with an aperture of 4.5 mm height.

Distribution: Java, Nusa Kambangan.

Habitat in Java: living amongst herbage, in damp hedge-banks and hollows and on the ground among dead leaves. During damp weather it ascends bushes and basks on the upper surface of the leaves.

West Java: Mt. Salak; Mt. Paniisan, near Buitenzorg, 600 m; estate of Tjisarua-Zuid, near Buitenzorg, 1000 m; estate of Megamendung, near Buitenzorg, 800 m; border of the wood, estate of Tjiliwung, near Puntjak pass, 1200 m; wood near Telaga Saät, base of Mt. Limo, 1200 m; Telaga Warna, near Puntjak pass on banana-leaf, 1400 m; Mt. Gedeh, 4000-8000 feet; Tjibodas, Mt. Gedeh, 1400 m; Pegantenan; Djampang, 2000 feet; Mt. Tangkuban Prah, 1000-1600 m; Mt. Papandajan, 3500 feet; Mt. Tjikorai.

Central Java: wood 20 km S. of Doro, 1500 m; Gundih, residency of Semarang.

East Java: Southern Mountains, 1500 feet.

Landouria smironensis (MOUSSON, 1849) (fig. 84).

1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix smimensis*).

1849 MOUSSON, Land & Süsw, Moll. Java, p. 21, pl. 2, fig. 10 (*Helix smimensis*).

1849 MOUSSON, Zeitschr. f. Malak. 6. p. 177 (*Helix smironensis* emendation)

1867 MARTENS, Ostas. Landschn. p. 268 (*Helix smiruensis*).

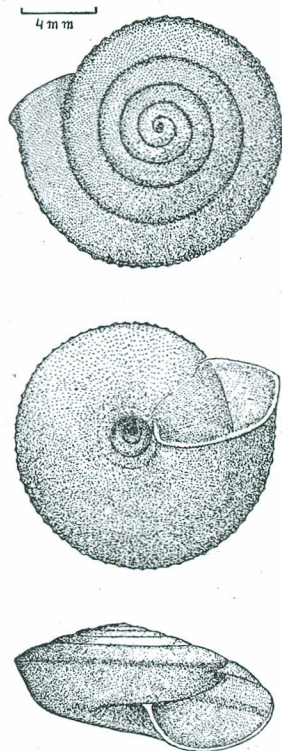


Fig. 83. *Landouria cilio-cincta* (MLLDF). Shell from top, base and side. LENSVELT del.

- 1887 TRYON, Man. of Conch. (2) 3, p. 184, pl. 40, fig. 44-46 (*Helix smiruensis*).
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 233, pl. 10, fig. 9-11 (*Plectotropis tenggerica*).
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 236 (*Plectotropis smiruensis* and *Pl. tenggerica*).
 1915 SCHEPMAN, Bijdr. t. d. Dierk. Afl. 20, p. 19 (*Plectotropis* sp.).
 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 93-94 (*smiruensis*).
 1934 RENSCH, Trop. Binnengew. 4, p. 754 and 758 (*tenggerica*).

Shell low conical, unicolorous yellowish-brown to greyish-brown. Thin, fragile, somewhat transparent and with a dull lustre. In adult shells the periphery is rounded, in immature ones angular, although not acute.

Whorls $5\frac{1}{4}$ - $5\frac{3}{4}$, the first $1\frac{1}{2}$ smooth or finely punctate, the following ones striated according to the growth lines. Covered by a thin epidermis bearing numerous short soft hairs. When the hairs are rubbed off

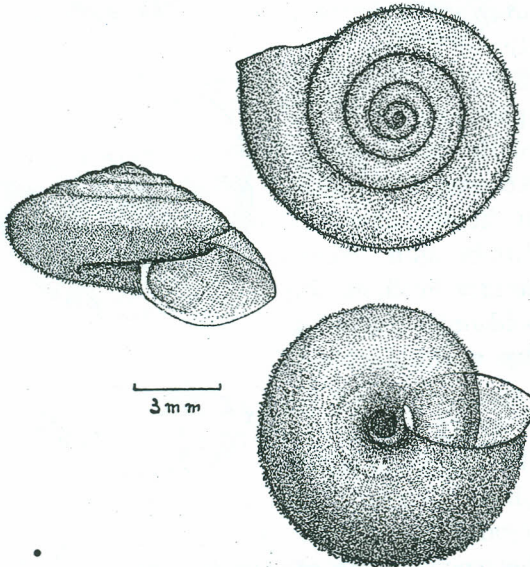


Fig. 84. *Landouria smironensis* (MOUSS.). Shell from side, top and base. LENSVELT del.

their cicatrices are still visible, even on old weathered shells without epidermis. There are no strong bristles along the periphery like in *Landouria winteriana*, *rotatoria* or *ciliocincta*. The radial striation is crossed by delicate spiral lines, especially visible in adequate light on the base of the shell. In the beginning the whorls compose a relatively steep cone, the later whorls are growing more in lateral direction. Therefore the shell is rather broad with a more or less mammillate spire. Suture moderately well impressed.

Last whorl descending a little just before the aperture. Base rounded, without angle round the umbilicus, except in young shells. Umbilicus rather narrow, occupying about $\frac{1}{5}$ of the greatest diameter.

Aperture oblique, broadly lunar, columellar side almost vertical. Peristome but little thickened, white, sharp or a little reflected, only slightly overshadowing the umbilicus.

Dimensions: height $6\frac{1}{2}$ -8, breadth 10- $11\frac{1}{2}$, height of aperture 4- $4\frac{1}{2}$ mm.

Distribution: Java, Lombok.

Habitat in Java: living amongst herbage, in woodland and uncultivated places, generally on the ground, but climbing more actively on

trees and shrubs during wet weather. Occurring between 500 and 3200 m altitude.

Central Java: Dieng plateau, 2000 m (RENSCH, 1934).

East Java: Kali Djumok, Mt. Lawu, 1787 m (RENSCH, 1934); Mt. Lawu, 2400 m (RENSCH, 1934); Tjemorosewu, Mt. Lawu, 3265 m (RENSCH, 1934); Nongkodjadjar, near waterfall, near spring and near Vetshoogte, Tengger Mts, 1200-1400 m; Malang, 500 m; Tosari, Tengger Mts, 6000 feet; Mt. Smeru, 4000 feet (MOUSSON, 1849); nature reserve Mt. Jang, on leaf of *Elatostemma*, 2100 m; road to Jang plateau, 6000 feet; Mt. Raung, 1200 m.

The shells are rather variable in the height: breadth ratio. Especially young shells are relatively high, because the spire is more conical, the last whorl more laterally expanded.

The shells from Nongkodjadjar and vicinity reach a somewhat larger breadth than has been mentioned in MOUSSON's description of the species (MOUSSON, 1849) or in later publications (MARTENS, 1867; RENSCH, 1932).

According to the actual interpretation of the Rules of Zoological Nomenclature the procedure of MARTENS of changing MOUSSON's emendated specific name *smironensis* into *smiruensis* is not allowed. Therefore we have to employ *smironensis* MOUSSON, 1849.

***Landouria monticola* n.sp. (fig. 85).**

Shell somewhat more elevated than the other Javanese *Landouria*-species, yet on the whole low conical. Unicolorous yellowish-brown to greenish-brown. Thin, fragile, somewhat transparent. Epidermis thin, fibrous. In adult shells there are no traces of hairs, or even their cicatrices, but it is not impossible that in fresh or immature shells such hairs can occur.

Whorls $4\frac{3}{4}$ — $5\frac{1}{4}$, the first two smooth, the following ones finely striated radially, crossed by much finer, undulating spiral lines. Whorls regularly increasing in size, moderately curved, suture distinct. Periphery keeled, the keel becoming obsolete towards the aperture. Base rounded. Umbilicus narrow for the genus.

Aperture oblique, broad sickle-shaped. Peristome not continuous, sharp, not reflected, except for a little distance in the columellar region where it hides part of the umbilicus.

Dimensions: height 6, breadth 8.8-9.4, height of aperture $3\frac{1}{2}$ mm.

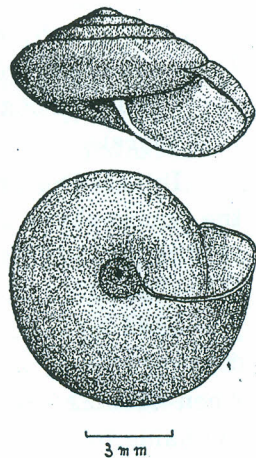


Fig. 85. *Landouria monticola* n.sp. Type. Shell from side and base. LENSVELT del.

	type	paratypes				
		Mt. Tjikorai	Mt. Tjikorai	Java		
Height	6	6	5.6	6	6	} mm
breadth	9.4	9.4	8	9.2	8.8	
height of aperture	3	3	3	3.5	3	

The type, and the paratypes from Central and East Java, are preserved in the Amsterdam Zoological Museum; the paratypes from Mt. Tjikorai and from Java (without further locality) are in the Senckenberg Museum at Francfort on the Main.

Distribution: Java.

Habitat in Java: living on the ground, hiding in grass, decaying vegetation, under logs and on mossy trees. All records of vertical distribution refer to localities lying over 2000 m.

West Java: Mt. Tjikorai, 2500-2800 m.

Central Java: near origin of the Seraju river, Dieng Plateau, 2000 m; near Telaga Dringu, Dieng Plateau, 2100 m; Tegal Pangonan, Dieng Plateau, 2200 m.

East Java: Mt. Kawi, 2500 m.

Landouria monticola has been lying in museum collections under the name of *Plectotropis schepmani* BOETTGER ms. This name, however, was never published, but MOELLENDORFF (Nachr. Blatt, 29, 1897, p. 68) described a *Plectotropis schepmani* which is quite a different species. Of the latter I could examine the holotype (Mus. Senckenberg, no. 8877) and two other shells (Mus. Senckenberg no. 8878), all from Bungbulan, 1500 feet, collected by H. FRUHSTORFER in 1892. They proved to be a form of *Landouria winteriana* (PFEIFFER). Hence the name *Plectotropis schepmani* MOELLENDORFF is now included into *Landouria winteriana* (PFR) (see there).

In the Amsterdam Zoological Museum (SCHEPMAN Collection) and in the Senckenberg Museum at Francfort on the Main there are specimens of *Plectotropis schepmani* BOETTGER ms from Mt. Tjikorai, 2500 and 2800 m, collected by H. FRUHSTORFER in 1892 which belong to a hitherto unpublished species. Obviously BOETTGER distributed of his material to his correspondents, but he never described or figured it. Some years later when MOELLENDORFF published his *Plectotropis schepmani* he attached the name to another shell from a different locality.

From the foregoing lines it is evident that the ms name *Plectotropis schepmani* has to be substituted and the unnamed species has to be described all over as a new species: *Landouria monticola*.

Dubious species of *Landouria*

Landouria huttoni (PFEIFFER, 1842) (syn. *L. orbicula* (HUTTON), 1838 non ORBIGNY, 1835) was mentioned from Java by MARTENS (1867, p. 267) on the evidence of 3 shells in the MOUSSON collection. This record was afterwards quoted by TENISON WOODS (1888, p. 1032), by LESCHKE (1914, p. 235) and by myself (1929, p. 80). It has already been pointed out by GODWIN AUSTEN (Rec. Ind. Mus. 8, 1918, p. 606) that this identification is probably erroneous.

Genus *Chloritis* BECK, 1837

Shell more or less distinctly umbilicate, with low spire. In most species with a hairy epidermis. Below this cuticle the shell itself shows minute scales or pits were the hairs are implanted.

Aperture semilunar, or broad sickle-shaped, oblique. Peristome not continuous, thickened and reflected.

The animals are hermaphroditic. Dart sac and dart are absent.

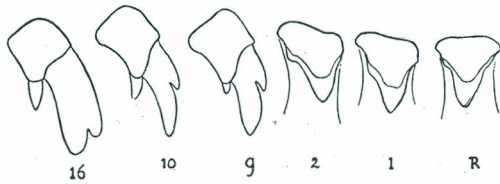


Fig. 86. *Chloritis crassula* (PHIL.). Radula elements. Author del.

Radula $\infty.1.\infty$ (fig. 86). Mandibula strong and ribbed (fig. 87).

Distribution: India, Japan, China, Indo-China, Burma, Siam, Malay Peninsula, Malay Archipelago, Philippines, various Papuan islands, North Australia.

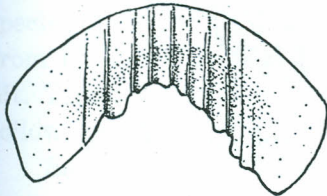


Fig. 87. *Chloritis crassula* (PHIL.). Mandibula: After PILSBRY.

In Java there are 4 species:

1. Shell sharply keeled at the periphery ... **helicinoides**
- Shell not, or only feebly keeled in young specimens ... 2
2. Umbilicus wide, spire flat .. **fruhstorferi**
- Umbilicus narrow, spire a little elevated ... 3
3. Whorls increasing in width slowly, diameter about twice the height of the shell ... **crassula**
- Whorls increasing in width rapidly, diameter of shell more than two times its height ... **transversalis**

Chloritis crassula (PHILIPPI, 1844) (fig. 86, 87, 88).

1844 PHILIPPI, Abb. Conch. 1, p. 152 (*Helix*).
 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix*).
 1849 MOUSSON, Land & Süßw. Moll. Java, p. 20, pl. 2, fig. 3, pl. 20, fig. 3 (*Helix*).
 1867 MARTENS, Ostas. I.andschn. p. 276 (*Helix*).
 1887 TRYON, Man. of Conch. (2) 3, p. 211, pl. 48, fig. 90-92 (*Helix*).

- 1888 TENISON WOODS, Proc. Linn. Soc. N. S. Wales (2) 3, p. 1032 (*Helix*).
 1890 BOETTGER, Ber. Senckenb. p. 145, pl. 5, fig. 7, 7a, 7b [*Helix (Chloritis)*].
 1891 BOETTGER, Ber. Senckenb. p. 244 [*Helix (Chloritis)*].
 1892 MARTENS, Erg. Weber, 2, p. 238 [*Helix (Chloritis)*].
 1892 PILSBRY, Man. of Conch. (2) 8, p. 271, pl. 51, fig. 31-33.
 1897 MOELLENDORFF, Nachr. Blatt, 29, p. 68 (*tetragyra*).
 1906 GUDE, Proc. Malac. Soc. London, 7, p. 116 (*crassula* and *tetragyra*).
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 233.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 210 and p. 231 (*Trichochloritis crassula* and *tetragyra*).
 1935 PARAVICINI, Arch. Moll. K. 67, p. 172.
 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 312.

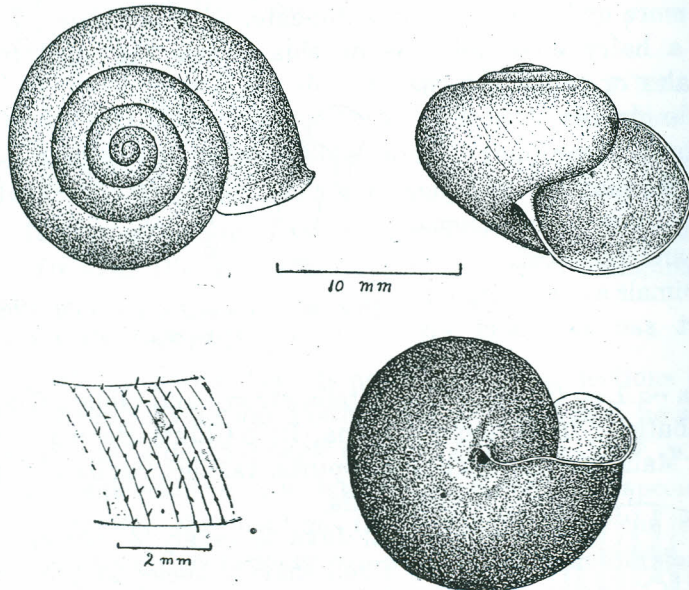


Fig. 88. *Chloritis crassula* (PHIL.). Shell from top, side and base and detail of sculpture, enlarged. LENSVELT del.

Shell broader than high, with little elevated spire. Brown, now and then with a vague light zone along the suture. Thin, but hardly transparent and not glossy. First $1\frac{1}{2}$ whorls granular, the subsequent ones irregularly striated with rather coarse growth lines. No spiral striation. Epidermis brown, velvet-like, provided with numerous small, brown, stiff hairs, placed in oblique rows. On the periphery of the last whorl there are 2-3 hairs per mm, in the umbilicus 5-6 ones. Occasionally shells with more closely placed hairs occur.

Whorls $4\frac{1}{2}$ -5, regularly increasing in diameter. Rounded, separated by a well-impressed suture. Last whorl only little descending towards the aperture, obtusely angular round the umbilicus. The umbilicus is moderately narrow, partly concealed by the reflected peristome.

Aperture broad sickle-shaped, oblique. Peristome white, not continuous, thickened, reflected. Behind the peristome the shell is generally abruptly constricted.

Dimensions: height 10-12, breadth 15-17, height of aperture 7-8 mm.

Distribution: Sumatra, Palau Berhala, Nias, Java, Nusa Kambangan.

Habitat in Java: living on the ground, among vegetable debris, under moss, stones etc. Occurring between sealevel and 2000 m altitude.

West Java: Mt. Karang, near kampong Tjinjurup, 700 m; Mt. Tjibodas, estate of Tjampea, near Buitenzorg, 300 m; Mt. Salak (BOETTGER, 1890); Mt. Salak above Tjigombong, 1000 m (PARAVICINI, 1935); Palau-buan, sea level; wood near Tjisolak, 200 m; Tjiliwong estate, near Puntjak pass, 1200 m; Mt. Gedeh, 5000-6000 feet; Tjibodas, Mt. Gedeh, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; near waterfalls of Tjibeureum, Mt. Gedeh, 1700 m; Sukanegara, Djampang, 500 m (PARAVICINI, 1935); limestone hill near Sukanegara, Djampang, 1000 m; Mt. Pawon, near Padalarang, 700 m; limestone hills near Padalarang, under overhanging rock, 500 m; Bandung, 700 m; Mt. Patuha, 1550 m; Mt. Papandajan, 5000 feet; Tjibitung, above Pengalengan, 2000 m; Mt. Tjikorai.

East Java: Djaboong estate, near Wlingi, 800 m; Glen Falloch estate, near Kalibaru, district of Banjuwangi, 1200 feet; Wonosari (MARTENS, 1867).

LESCHKE (1914, p. 210) already suggested that *Chloritis tetragyra* MOELLENDORFF is a synonym of *Chl. crassula* (PHIL.). In his diagnosis of *Chl. tetragyra* MOELLENDORFF does not mention in which respect his new species differs from allied species, in the first place *Chl. crassula*. Judging from his description and from a comparison of the type specimen from Mt. Tjikorai, West Java (Mus. Senckenberg no. 8549), I am inclined to follow LESCHKE's classification:

Samples from Mt. Gedeh, Tjibodas, Tjibeureum, and Pantjoran Mas have, as a rule, a somewhat narrower umbilicus than the typical shells. For the rest they are similar to those from other localities.

Chloritis fruhstorferi MOELLENDORFF, 1897 (fig. 89).

1897 MOELLENDORFF, Nachr. Blatt, 29, p. 68.

1906 GUDE, Proc. Malac. Soc. London, 7, p. 116.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 231 (*Tricho-chloritis*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 312.

Shell broader than high, spire not, or very little, elevated. Light-brown, with a broad, almost white band along the suture, the two zones sometimes separated by a fine, dark-brown spiral line. Somewhat more solid than the preceding species. Not transparent, not glossy. First 1½ whorls granular, the subsequent ones irregularly striated with rather

coarse growth lines. No spiral striation. Epidermis light-brown, velvety, provided with small, stiff, brown hairs, placed in oblique rows. On the periphery of the last whorl there are about 5-6 hairs per mm, in the umbilicus 10-12 ones.

Whorls $4\frac{1}{2}$ -5, regularly increasing in diameter, rounded, separated by a distinct suture. Last whorl only very little descending towards the aperture, obtusely angular round the umbilicus. The umbilicus is wide, the reflected peristome hiding a small corner.

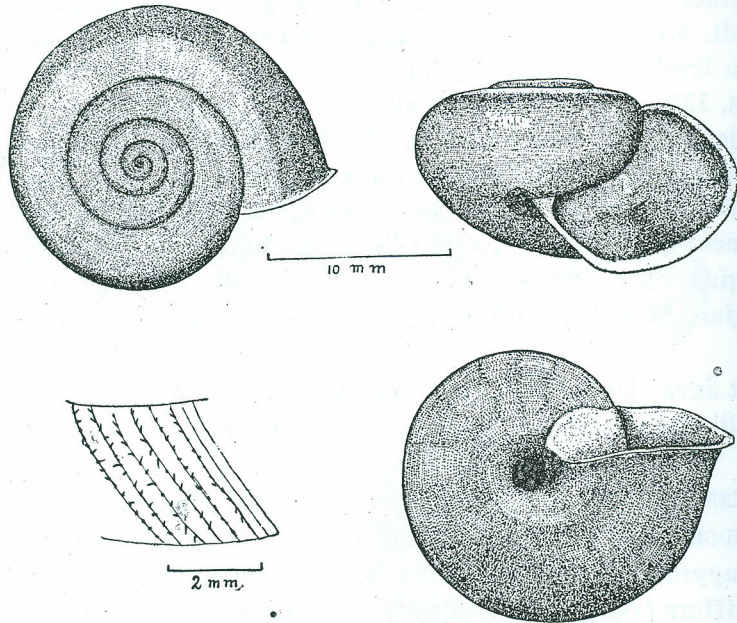


Fig. 89. *Chloritis fruhstorferi* MLLDFF. Shell from top, side and base and detail of sculpture, enlarged. LENSVELT del.

• Aperture broad sickle-shaped, oblique. Peristome white, not continuous, thickened; reflected. Behind the peristome the shell is generally somewhat constricted.

Dimensions: height $10\frac{1}{2}$ -12, breadth 18-20, height of aperture $7\frac{1}{2}$ -9 mm. The type specimen from the Tengger Mountains (Mus. Senckenberg no. 8547) is high 11 and broad 19 mm, with an aperture of 8 mm height.

Distribution: Java, Nusa Kambangan.

Habitat in Java: living on the ground, amongst earth, fallen leaves, decaying wood, moss and other low vegetation, in hilly and mountainous country. The locality Surabaya is quite unusual for the species.

West Java: Mt. Gedeh; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; Mt. Guntur, 1500 m;

East Java: Surabaya; Tengger Mts, 4000-5000 feet.

Chloritis helicinoides (MOUSSON, 1848) (fig. 90).

- 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix*).
 1849 MOUSSON, Land & Süßw. Moll. Java, p. 23, pl. 2, fig. 6 (*Helix*).
 1867 MARTENS, Ostas. Landschn. p.270 (*Helix*).
 1887 PILSBRY, Man. of Conch. (2) 3, p. 211, pl. 48, fig. 87-88 (*Helix cryptopila* var. *helicinoides*).
 1888 TENISON WOODS, Proc. Linn. Soc. N. S. Wales (2) 3; p. 1031 (*Helix cryptopila*).
 1906 GUDE, Proc. Malac.Soc. London, 7, p. 116.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p.231 (*Trichochloritis*).
 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 312.

Shell broader than high, with keeled periphery and moderately elevated spire. Light-brown or straw colour. Thin, transparent, glossy.

Whorls obliquely striated according to the growth lines. With advancing age this striation becomes coarser. On the last whorl the growth lines are often minutely granular with small oval beads. This sculpture is crossed by a much finer spiral stration. Epidermis thin, fibrous, scaly. In fresh specimens the closely implanted scales are projecting like little hairs, generally only visible in the umbilicus.

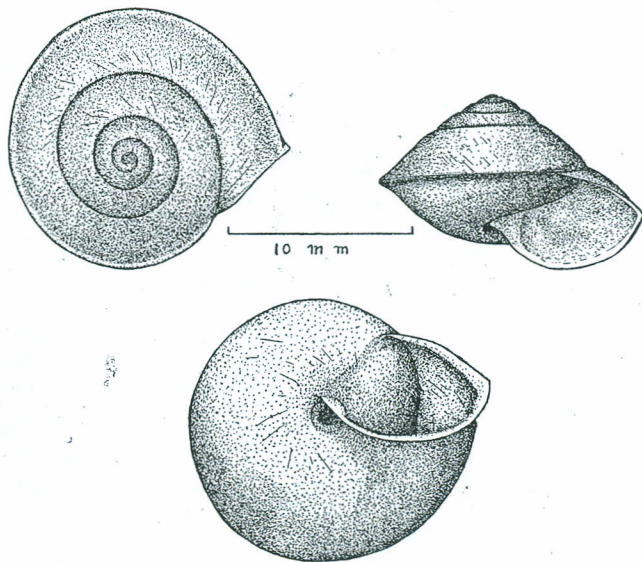


Fig. 90. *Chloritis helicinoides* (MOUSS.). Shell from top, side and base. LENSVELT del.

Whorls $4\frac{1}{2}$ -5, regularly increasing in diameter, keeled at the periphery, separated by a shallow suture. Last whorl not, or very little descending towards the aperture. Umbilicus moderately narrow, partly concealed by the reflected peristome.

Aperture very oblique, broad sickle-shaped, angular at the outer corner. Peristome white, not continuous, thickened and reflected.

Dimensions: height 7-8, breadth 12-13, height of aperture $5\frac{1}{2}$ -6 mm.

Distribution: Java and several satellite islands.

Habitat in Java: living on the ground, in earth, among dead leaves, decaying wood and low vegetation.

West Java: Anjer (MARTENS, 1867); Tjiringin (MOUSSON, 1849).

***Chloritis transversalis* (MOUSSON, 1857) (fig. 91).**1857 MOUSSON, Journ. de Conch. 6, p. 158, pl. 6, fig. 5 (*Helix*).1859 Zollinger, Natuurk. Tijdschr. Ned. Indië, 18, p. 424 (*Helix transovalis*).1867 MARTENS, Ostas. Landschn. p. 273 (*Helix*).1887 PILSBRY, Man. of Conch. (2) 3, p. 210, pl. 48, fig. 80-81 (*Helix*).

1906 GUDE, Proc. Malac. Soc. London, 7, p. 116.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 231 (*Trichochloritis*) and p. 235 (*Eulota*).

1941 VAN BENTHEM JUTTING, Arch., néerl. Zool. 5, p. 313.

Shell broader than high, with moderately elevated spire. Light-brown, or straw-colour, in some individuals with a narrow spiral brown band above the periphery. Thin, somewhat transparent, glossy. First $1\frac{1}{2}$ whorls smooth, or minutely punctate, the following ones striated according to the growth lines. On the last and penultimate whorls this striation

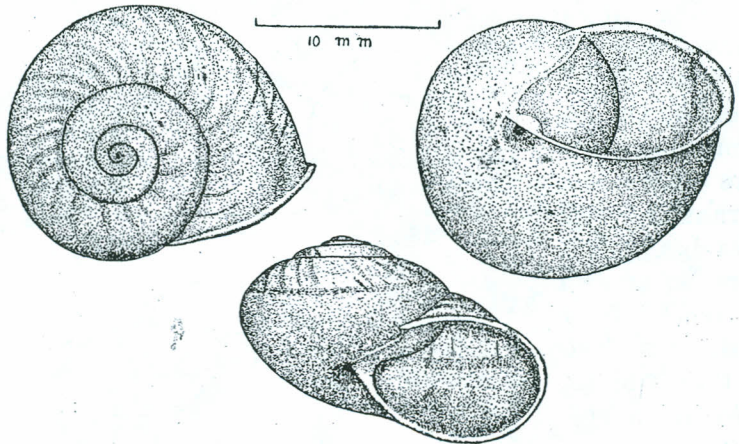


Fig. 91. *Chloritis transversalis* (MOUSS.). Shell from top, base and side. LENSVELT del.

is more or less regularly arranged in radiating ribs, only visible on the upper part of the whorl. There is no spiral striation. Epidermis very thin, granular-scaly in fresh specimens. The closely placed scales project like little hairs, generally only visible in the umbilicus.

Whorls $4\frac{1}{2}$ -5, rapidly increasing in diameter, the last about twice as broad as the preceding one, distinctly descending towards the aperture. Suture not deep. Umbilicus moderately narrow, partly concealed by the reflected peristome.

Aperture broad, sickle-shaped, very oblique. Peristome white, not continuous, thickened, reflected. The two ends of the peristome approach each other more closely than in any of the other Javanese members of the genus.

Dimensions: height 11, breadth 17-18, height of aperture 6-7 mm.
Distribution: Java, Madura, Bali.

Habitat in Java: little is known of the natural habitat of the species. It is probably a ground dweller, living in the soil fauna.

The only exact locality in Java where *Chloritis transversalis* has been found is Banjuwangi, in the extreme east of the island.

One shell was found as a fossil in the so-called "bone layers" of the Trinil deposits, Middle Pleistocene, East Java (VAN BENTHEM JUTTING, Zool. Meded. 20, 1937, p. 94).

Doubtful species of *Chloritis*

According to C. F. ANCEY (Journ. de Conch. 54, 1906, p. 128) *Chloritis malangensis* BULLEN, 1905 (Proc. Malac. Soc. London, 6, p. 192, pl. 11, fig. 2) described from Malang, East Java, is not a new species, but *Chloritis eucharista* PILSBRY (syn. *Chl. oshimana* GUDE) from Japan. One is only wondering how a species could be accidentally introduced at such a distance from its native country.

Chloritis unguilina (LINNÉ) and *Chl. unguicula* (FÉRUSAC) which are lying in various old collections with a label "Java" (MOUSSON, Zeitschr. f. Malak. 6, 1849, p. 178), are certainly not from Java. The species occur in Ceram and Buru Id. respectively.

Genus *Amphidromus* ALBERS, 1850

Shell dextral or sinistral, high conical to turreted, polished and often with porcellaneous lustre. In most species the shell is vividly coloured: yellow, red, orange, green, with elegant patterns of bands or flames in a contrasting colour. Generally finely striated in vertical and spiral direction. In some species there are irregular vertical folds or ribs. The shells are not, or only little transparent.

Whorls regularly increasing in size, the last one large and spacious. Profile of the whorls of the spire little curved, the last whorl, however, distinctly rounded. Young shells angular, or even carinate at the periphery. In adult shells this angulation becomes obsolete. Suture mostly shallow.

Apex pointed, but not sharp, base rounded. Umbilicus closed, or only visible as a narrow slit, for the greater part, covered by the peristome.

Aperture oblique, irregularly oval or lunar. In some species with a longitudinal fold on the columellar side. Peristome thickened and reflected. Not continuous, but in most species there is a white, polished callus connecting the two ends.

Radula ∞.1.∞. The teeth have broad bases. Rhachis and adjoining laterals with ectocones. Marginals multicuspid. Mandibula horseshoe- or sickle-shaped, with a number of flat ribs (fig. 92).

Distribution: India, Burma, Malay Peninsula, Malay Archipelago to New Guinea, Philippines.

The causes of the amphidromous coiling of the members of this genus are not at all understood. Anatomically the dextral and sinistral specimens of one species are inversely built. But we have no information as to the percentage of right and lefthanded individuals in a population, or in one cluster of eggs. It is not known either whether differently coiled partners (a dextral and a sinistral) can conjugate, but it seems highly improbable.

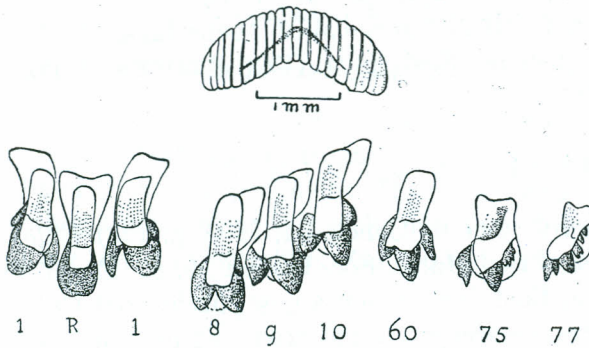


Fig. 92. *Amphidromus porcellanus* (MOUSS.). Mandibula and radula elements. After WIEGMANN.

In Java there are 9 species:

1. Shell large and broad, dextral or sinistral, usually with markings of previous growth-arrest as an oblique pigment stripe 2
- Shell smaller and more slender, always sinistral and usually without markings of previous growth-arrest 7
2. Shell smooth, polished. Umbilicus entirely closed or nearly so 3
- Shell more coarsely striated, uniformly yellow or pale tawny and often with additional colour patterns. Umbilicus perforate 4
3. Shell rather slender for the group. Uniformly yellow. Markings of growth-arrest usually absent. No dark band along the peristome exteriorly. Peristome thickened, but little reflected *alticola*
- Shell broad, uniformly yellow, or yellow with chestnut colour-markings in one or more spiral bands and vertical zigzag fleckings or flames. Markings of growth-arrest usually present. Peristome bordered exteriorly by a narrow dark band. Peristome thickened and reflected *perversus*
4. Shell ruggedly striated or wrinkled. Peristome broadly expanded *winteri*
- Shell surface coarsely striate, but not wrinkled. Peristome thickened, but not broadly expanded 5
5. Shell large, up to 65 mm height, high conical, vertically streaked with dark and light brown mottled stripes *javanicus*
- Shell not exceeding 60 mm height and usually smaller. Variously coloured or uniformly yellowish or greenish 6
6. Shell generally unicolorous yellow or greenish. In some cases light pink with a narrow dark spiral zone along, or somewhat below the

- periphery. Last whorl less than half the total length of the shell. Top angle narrower than in *heerianus* **palaceus**
- Shell yellow or greenish, or with various colour markings. Last whorl about half the total length of the shell. Top angle broader than in *palaceus* **heerianus**
7. Suture of ultimate and penultimate whorls bordered by a narrow pink zone. Vertical colour-markings forked at their top. **furcillatus**
- Suture of ultimate and penultimate whorls bordered by a white, yellow or lightbrown zone. Vertical colourmarkings not forked at their top 8
8. Colour pattern of brown vertical streaks and flames on a yellow or greenish-yellow background **porcellanus**
- Colour pattern of brown spiral zones on a yellowish background, or of light spiral zones on a brown background. The brown stripes can be broken into spots and blotches, suggesting a vertical pattern **filozonatus**

Amphidromus palaceus (MOUSSON, 1848) (fig. 93).

1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus*).

1849 MOUSSON, Land & Süsw. Moll. Java, p. 28, 108, pl. 3, fig. 1 (*Bulimus*).

1849 MOUSSON, Zeitschr. f. Malak. 6, p. 178 (*Bulimus*).

1849 PFEIFFER, Zeitschr. f. Malak. 6, p. 136 (*Bulimus*).

1867 MARTENS, Ostas. Landschn. p. 352 (*Bulimus*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1048 (*Bulimus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 72.

1900 PILSBRY, Man. of Conch. (2) 13, p. 134, pl. 47, fig. 1, 2, 4, 5, 6.

1912 SCHEPMAN, Proc. Malac. Soc., London, 10, p. 234.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 233.

1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 151.

1924 SCHEIBENER, Trop. Natuur, 13, p. 108, fig. 6.

1935 PARAVICINI, Arch. Moll. K. 67, p. 173.

1939 ADAM & LELOUP, Mém. Mus. Roy. Hist. Nat. Belg. (Hors Série) 2, fasc. 20, p. 32.

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 315.

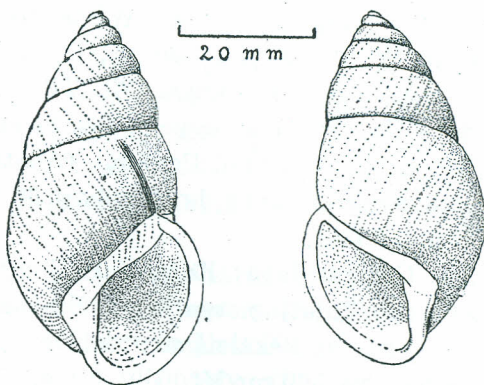


Fig. 93. *Amphidromus palaceus* (MOUSS.). Dextral and sinistral shell. ABDULKADIR del.

Shell dextral or sinistral, ovate-conical to high-conical. Uniformly yellow, sometimes buff-tawny or with a greenish lustre. Growth striae distinct, occasionally even coarse. Often of different strength on the different parts of the shell: fine on the spire and coarse on the ultimate whorl, or the reverse. Spiral sculpture very weak. Rather thick, somewhat transparent, with soft lustre.

Whorls 6 $\frac{1}{2}$ -7, regularly increasing in size, the last one somewhat ventricose, occupying less than one half of the total length of the shell. Profile of the whorls little convex. Suture shallow, bordered by a narrow white or rufous zone. Top white, smooth and shining. Base evenly rounded, in immature shells somewhat angular. Umbilicus narrowly open, partly concealed by the reflexed peristome. No lighter zone round the umbilicus.

Aperture oblique, oval. Peristome white, not continuous, the two ends connected by a white, polished, parietal callus. The outer rim is thickened and reflexed. Columellar wall thick, vertical.

Dimensions: height 55-60, breadth 30-35, height of aperture 25-28 mm.

Distribution: Sumatra, Java, Madura, Nusa Kambangan.

Habitat in Java: living in banana trees, bambu bushes, on tree-trunks etc.

West Java: Pardana and Tjikoya (MOUSSON, 1849, p. 28); border of Lake Danau, near kampong Gunungsarie, 150 m; Pasir Waringin, near Serang; Djasinga, near Buitenzorg, 300 m; Mt. Salak; estate of Tjikopo, near Buitenzorg, 700 m; Mt. Gedeh, 4000-6000 feet; Tjibodas, Mt. Gedeh, 1400 m; Pantjoran Mas, near Rarahan, Mt. Gedeh, 1400 m; wood near Situ Gunung, Mt. Gedeh, 1000 m; Sukabumi, 700 m; Djampang; Bantar Gadung; Palabuan, near Wijnkoopsbay, sea level; wood near Tjisolak, near Wijnkoopsbay, 200 m; Tjiandjur; Mt. Pawon, near Padalarang, 700 m; Tandjak Nangsi, Mt. Tilu; Mt. Guntur, 1500 m; Tjilaut estate, S. of Garut; Pameungpeuk, sea level; kampong Sindangkerta, 4 km from S. coast; environs of Pendjalu (ADAM & LELOUP, 1939); Kaliputjang, near Pangandaran, Dirk de Vriesbay, 50 m; Palimanan, near Cheribon (PARAVICINI, 1935).

Central Java: Karang Putjong, between Bandjar and Purwokerto, 300 m; Tjilatjap, sea level; Babakan, sea level; teakwood near Subah, residency of Pekalongan; teakwood near Bodja, nature reserve S. W. of Semarang, 500 m; Mt. Gilipetung, residency of Kedu, in secondary forest, 1200 m; government rubber estate Balong, N. E. Japara (OOSTINGH, 1923).

One specimen was found as a fossil in the so-called "bone-layers" of the Trinil deposits, Middle Pleistocene, East Java (VAN BENTHEM JUTTING, Zool. Meded. 20, 1937, p. 93).

The shell which MARTENS (1867, p. 348, pl. 20, fig. 11) described and figured as *Amphidromus leucoxanthus* is either *A. palaceus* or *A. perversus*.

Amphidromus palaceus is rather variable in shape and colour. Four of the more important and apparently constant varieties will be treated here.

Amphidromus palaceus var. appressa (MARTENS, 1867).

- 1867 MARTENS, Ostas. Landschn. p. 353 (*Bulimus appressus*).
 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1048 (*Bulimus appressus*).
 1890 BOETTGER, Ber. Senckenb. p. 145, pl. 5, fig. 8 (*Amphidromus appressus*).
 1894 MARTENS, Jenaische Denkschr. 8, p. 83 (*Amphidromus appressus*).
 1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 72.
 1900 PILSBRY, Man. of Conch. (2) 13, p. 136, pl. 47, fig. 7, pl. 46, fig. 15.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 213 and 233.

It differs from the main form in its conic elongate shape, pale yellow tint, and in having the suture appressed and distinctly margined.

West Java: Mt. Salak (BOETTGER, 1890); Mt. Gedeh, 2000 feet; Tjibodas, Mt. Gedeh (BOETTGER, 1890; MARTENS, 1894); Tjitjurug, S. of Buitenzorg; Bungbulan, South Djampang; Bantar Gadung.

Amphidromus palaceus var. pura (MOUSSON, 1848).

- 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus purus*).
 1849 MOUSSON, Land & Süsww. Moll. Java, p. 29 and p. 108, pl. 3, fig. 2 (*Bulimus purus*).
 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1048 (*Bulimus purus*).
 1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 73.
 1900 PILSBRY, Man. of Conch. (2) 13, p. 135, pl. 47, fig. 3.
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 233.
 1921 PARAVICINI, Arch. Moll. K. 53, p. 113-116, pl. 2 (*Amphidromus purus*).

The variety has a white, pink or yellow shell and a well developed peristome. This broad peristome made MOUSSON (Zeitschr. f. Malak. 6, 1849, p. 178) classify his *Bulimus purus* as a form of *Amphidromus winteri* and MARTENS 1867, p. 354 followed him in this opinion.

West Java: Pardana (MARTENS, 1867); Mt. Gedeh; Sukabumi, 700 m; Palabuan, S. coast; Tjiandjur; Mt. Tjikorai; Palimanan, near Cheribon (PARAVICINI, 1921).

MOUSSON mentioned also the locality Hakka, district of Probolinggo. It is not clear what he meant by this place. It is very improbable that *Amphidromus palaceus* var. *pura* should occur in East Java.

PARAVICINI (1921) had the opportunity to observe the nest-building and spawning processes of this variety in the vicinity of Palimanan, near Cheribon. The main points of his notes (translated by me, V.B.J.) are quoted here:

"Native collectors brought me two nests of this snail Oct. 18, 1920. This date is approximately the beginning of the wet monsoon in this region. Apparently many Javanese landsnails start spawning at that time; the newborn young reach maturity in the following year at the beginning of the next rainy season.

"One of the two nests is figured in pl. 2 (PARAVICINI, 1921). The snail had folded together the exterior leaves of a young bambu shoot and gummed them to a pointed cornet. By its weight the shoot hung vertical-

ly downwards with the narrow end of the cornet pointing upwards and the wide opening below. At the moment when I received the nest the animal was hiding in the interior of the sac with the body folded in such a manner that the caudal end of the foot reached beyond the head. The greyish-yellow body with its ochreous longitudinal stripes, the pink shell, the white eggs and the green leaves formed together a most beautiful colour picture. At the base of the egg sac the apex of the shell was protruding; the upper part of the sac was already entirely filled with eggs. The animal had started spawning in the narrowest part of the nest and descended gradually, rotating slowly round its longitudinal axis. In this way it filled the whole cavity with eggs. At those spots where the tips of the bambu leaves were not sufficiently gummed together a few eggs passed through the fissures to the exterior of the nest and desiccated there rapidly. Finally the nest was closed at the base by pulling the tips of the leaves and pasting them together with mucus. On Oct. 22 the animal had ceased spawning and dropped to the ground. A short while before the snail defecated on the nest. The spawning could be observed during 4 days, but the total duration of the process must have been at least twice as long, because the nest was already half filled with eggs when I received it.

"The second nest consisted of two mangga-leaves stuck together. The leaves were gummed on their interior surfaces with mucus so that only a small, flat cavity remained. In this space the eggs had been deposited as a flat, aggregated mass. Few hours after the animal had arrived it stopped spawning and dropped to the ground. I opened this nest and examined the eggs. There were 234 eggs, each globular, white and with 3 mm diameter. Their membrane was so very weak, that the eggs shrunk rapidly when exposed to air. Yet the envelope contained a small amount of lime, because it foamed when treated with hydrochloric acid. In both nests the whole egg-mass occupied a much larger space than the body-volume of any of the parent-snails. This might be explained by admitting that new eggs are still formed in the ovary when spawning of ripe eggs has already started. If this surmise is right it involves that the sperm must remain viable during the whole duration of the spawning act, in order to be able to fertilise the eggs before their deposition."

***Amphidromus palaceus* var. *subaurantia* (MARTENS, 1867).**

1876 MARTENS, Ostas. Landschn. p. 352 (*Bulimus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 72.

The variety has a pinkish or dilute orange shell, ornated with a redbrown peripheral band. Occasionally there is a sutural band of the same colour too.

West Java: Mt. Salak.

***Amphidromus palaceus* var. *tenera* (MARTENS),**

1867 MARTENS, *Ostas. Landschn.* p. 350 (*Bulimus perversus tenera*).

1896 FULTON, *Ann. Mag. Nat. Hist.* (6) 17, p. 67 (*Amphidromus perversus* var. *tenera*).

1900 PILSBRY, *Mann. of Conch.* (2) 13, p. 136, pl. 46, fig. 16-18.

1914 LESCHKE, *Mitt. naturhist. Mus. Hamburg*, 31, p. 233.

Whether the variety *tenera* has to be associated with *Amphidromus palaceus*, as PILSBRY did, or with *A. perversus*, as MARTENS and FULTON supposed is still dubious. It is a large thin form and, as far as I can judge from the scanty material I have seen, I should prefer its classification in the *palaceus* relationship.

West Java: Mt. Gedeh; near Tjiliwong estate, near Puntjak pass, 1200 m; Mt. Tjempaka, near Tjibeber, 500 m.

East Java: Tengger Mountains.

***Amphidromus heerianus* (PFEIFFER, 1871) (fig. 94).**

1871 PFEIFFER, *Novit. Conch.* 4, p. 31, pl. 116, fig. 1 (*Bulimus*).

1896 FULTON, *Ann. Mag. Nat. Hist.* (6) 17, p. 73.

1900 PILSBRY, *Man. of Conch.* (2) 13, p. 138, pl. 48, fig. 10-12.

1914 LESCHKE, *Mitt. naturhist. Mus. Hamburg*, 31, p. 232.

1939 ADAM & LÉLOUP, *Mém. Mus. Roy. Hist. Nat. Belg.* (Hors Série) 2, fasc. 20, p. 32.

Shell dextral or sinistral, broad conical to turreted. Ground-colour yellowish-white to yellowish-green, pale salmon, or rufous. Sometimes unicolorous, sometimes ornated with dark spiral bands, or with irregular brown or purplish vertical streaks and blotches. Somewhat glossy, little transparent. Vertical striae coarse, although not as coarse as in *Amph. winteri*. Spiral striation very fine.

Whorls 6-7, regularly increasing in size. The last one generally somewhat ventricose, occupying one half of the total length of the shell. Whorls little rounded, suture shallow. A light zone, bordering the suture can be present. In immature shells the periphery is obtusely angular; in adult ones the last whorl descends evenly towards the base. Top white or yellow. Umbilicus open, though not wide; in coloured specimens encircled by a white zone.

Aperture oblique, oval. Peristome not continuous, the two ends connected by a white, polished callus against the penultimate whorl. Columellar side thickened, vertical. Exterior peristome white, thickened and reflected, although not as much as in *Amph. winteri*.

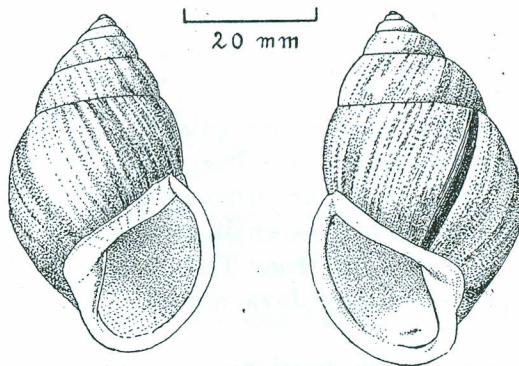


Fig. 94. *Amphidromus heerianus* (PFR). Dextral and sinistral shell. ABDULKADIR del.

Dimensions: height 52-55, breadth 30-32, height of aperture 26-27 mm.

Distribution: Java, Meeuwen Island.

Habitat in Java: living in trees, teakwood, fruit-trees, bananas, etc. The species is suspected of drinking latex from the tap-cuts of Hevea-trees.

West Java: Buitenzorg, 250 m; Ujung Genteng, near Sandbay, South Djampang, sea level; Kamodjan, Mt. Guntur, road to English Plain, 1550 m; estate of Buni Sarie, S. of Garut; Tjilaut estate, S. of Garut; environs of Pendjalu (ADAM & LÉLOUP); Pangandaran.

Central Java: Tjilatjap, sea level; teakwood near Balapulung, residency of Pekalongan, 100 m.

East Java: Ponorogo, residency of Madiun, 300 m.

The species is rather variable in form and still more so in colour. In a population from Tjilaut estate, S. of Garut, there occur pell mell plain yellow shells, yellow shells with brown spiral bands and rufous shells with a light peripheral band. The rufous coloration is never uniform, but irregularly streaked with darker and lighter vertical striae. In this same population the umbilicus of the shells which is usually well visible in *Amph. heerianus*, is almost closed by the overlapping peristome.

***Amphidromus heerianus* var. *poecila* PILSBRY, 1900.**

1900 PILSBRY, Man. of Conch. (2) 13, p. 138-139, pl. 46, fig. 19, 20.

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 314.

Ornated with irregular stripes and blotches of a pink or purplish tint, now and then mixed with shades of olive.

This peculiar ornamentation lead to the native name of tengèk polèng (tengèk = snail, polèng = checkered) for this species.

West Java: near Tjidamar, S. of Bandúng, 500 m; Sindangbarang, S. coast of West Java, sea level, Tjilauteureun, S. coast, sea level.

***Amphidromus heerianus* var. *robusta* FULTON, 1896.**

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 73 (*Amphidromus robustus*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 139, pl. 46, fig. 21.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 232.

1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 152 (*Amphidromus winteri* fa. *robusta*).

It is somewhat larger than the main form (height 55-60, breadth 32-34, height of aperture 26-29 mm). In its typical form it is whitish or ochreous with 4 brown spiral bands: 2 above and 2 below the periphery. Occasionally, however, there occur shells with fewer bands, or without any colour markings at all.

West Java: wood on N.W. slope of Mt. Malabar (OOSTINGH, 1923); Bandjar, 150 m; teakwood near Bandjar, 150 m; Kaliputjang, near Pan-

gandaran, Dirk de Vriesbay, sea level; Pangandaran, Penandjung bay, sea level.

***Amphidromus winteri* (PFEIFFER, 1849) (fig. 95).**

- 1849 PFEIFFER, Zeitschr. f. Malak. 6, p. 135 (*Bulimus*).
- 1867 MARTENS, Oostas. Landschn. p. 353, pl. 20, fig. 4, 10, pl. 21, fig. 12 (*Bulimus*).
- 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1048 (*Bulimus*).
- 1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 74.
- 1900 PILSBRY, Man. of Conch. (2) 13, p. 137, pl. 48, fig. 13-15.
- 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 234.
- 1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 152.
- 1935 PARAVICINI, Arch. Moll. K. 67, p. 173.
- 1939 ADAM & RELOPP, Mém. Mus. Roy. Hist. Nat. Belg. (Hors Serie) 2, fasc. 20, p. 32.

Shell dextral or sinistral, rather slender. White, yellow, greenish-yellow or pale rufous. Usually unicolorous, but occasionally with dark vertical or spiral streaks. There is a light zone bordering the suture. Shell rather thick, little transparent, with a soft lustre. Ruggedly striated and irregularly wrinkled by wave-like folds in vertical direction. The spiral sculpturè is very weak.

Whorls 6½-7, regularly increasing in size, the last one about one half of the total length of the shell. Profile of the whorls moderately convex. Suture well impressed and somewhat crenulated. Apex white, smooth and shining. Base evenly curved to the aperture. Immature shells angular at the periphery. Umbilicus open, though not wide, partly concealed by the peristome. In rufous specimens there is a more or less conspicuous light zone round the umbilicus.

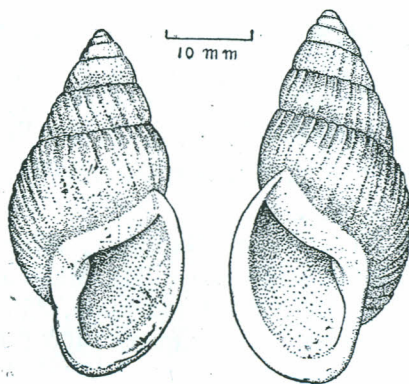


Fig. 95. *Amphidromus winteri* (PFR). Dextral and sinistral shell. Author del.

Aperture oblique, oval. Peristome not continuous, the two ends united by a white parietal callus. The outer rim is thickened, white and broadly expanded. Columellar side vertical.

Dimensions: height 50-57, breadth 24-29, height of aperture 22-25 mm.

Distribution: Java.

Habitat in Java: living in trees, tea and coffee trees, cotton trees, bananas etc.

West Java: Tjikoya and Pardana, residency of Bantam (MARTENS, 1867); near Wijnkoopsbay, sea level (PARAVICINI, 1935); near Tjiliwung estate, near Puntjak pass, 1200 m; Tandjak Nangsi, Mt. Tilu; cinchona estate Arga Sarie, near kampong Tjipendjen, E. slope of Mt. Malabar,

3000-5000 feet; Garut, 800 m; Tjilaut estate, S. of Garut; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; Pengalengan, Mt. Malabar, 1500 m (PARAVICINI, 1935); Mt. Tjikorai, 4000-6000 feet; Pamegattan, 1300 m; estate of Bandjarwangi, near Tjikadjang, 1500 m; environs of Lake of Pendjalu (PARAVICINI, 1935; ADAM & LÉLOUP, 1939); Bandjar (MARTENS, 1867).

Central Java: teakwood near Bandarredjo, residency of Rembang (OOSTINGH, 1923); Gundih, S. of Purwodadi (OOSTINGH, 1923).

East Java: Kedewan, N.W. of Bodjonegoro; Bekingking, Asaldari and Gedangan; Southern Mountains, 1500 feet; mountains near Malang, 750 m; Hakke, Probolinggo district.

Occasionally there occur shells with a broad and flatly expanded peristome. Its broadest part is generally at the base, rendering to the lowest extremity a nozzle-shaped appearance. This modification was proposed as var. *inauris* FULTON, 1896, but PILSBRY (1900) considered it to be a subspecies.

***Amphidromus winteri* var. *inauris* FULTON, 1896.**

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 74, pl. 6, fig. 12, 12a.

1900 PILSBRY, Man. of Conch. (2) 13, p. 138, pl. 48, fig. 16-18 (*winteri* subsp. *inauris*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 234.

The variety differs from the main form in the extreme expansion of the peristome.

West Java: Bandung, 700 m; Pengalengan, Mt. Malabar, 1700 m; estate of Arga Sarie, Mt. Malabar; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; Tjisurupan, 3500 feet; Mt. Tjikorai; wood near Kawah Kamodjan, Mt. Guntur, 1400-1500 m.

***Amphidromus javanicus* (SOWERBY, 1841) (fig. 96).**

1841 SOWERBY, Conch. Ill. *Bulinus*, p. 6, pl. 31, fig. 35, 35*.

1854 PFEIFFER, Proc. Zool. Soc. London, p. 293 (*Bulinus loricatus*).

1867 MARTENS, Ostas. Landschn. p. 339, pl. 22, fig. 2, (*Bulinus loricatus*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1046 (*Bulinus loricatus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 73.

1900 PILSBRY, Man. of Conch. (2) 13, p. 140, pl. 61, fig. 50, 51.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 233.

1935 PARAVICINI, Arch. Moll. K. 67, p. 173.

1940 VAN BENTHEM JUTTING, Treubia, 17, p. 332.

Shell dextral or sinistral. High conical. Ground-colour white or pale yellow, ornated with irregular vertical streaks of cinnamon or reddish-brown. Occasionally the streaks are broken into a mottled pattern. There is a light zone bordering the suture, but no such one round the umbilicus. Coarsely striated, sometimes even wrinkled in vertical direction. The spiral sculpture is very feeble. Thick, little or not transparent, with a soft lustre.

Whorls 7, regularly increasing in size. The last somewhat ventricose, occupying a little less than one half of the entire shell-length. Profile of the whorls slightly convex. Suture shallow, in wrinkled specimens somewhat crenulated. Apex white, smooth and shining. Base evenly curved towards the aperture. Immature shells obtusely angular at the periphery. Umbilicus generally closed by the thickened peristome. Not surrounded by a white zone.

Aperture oblique, oval. Peristome not continuous, the two ends, however, united by a white parietal callus. Thickened, white and somewhat expanded. Columellar side thick, vertical.

Dimensions: height 65-67, breadth 30-33, height of aperture 24-26 mm.

Distribution: Java.

Habitat in Java: living in trees and high shrubs, mangga, cotton and other trees.

West Java: Depok, N. of Buitenzorg, 150 m; Sukabumi, 700 m; estate of Ganesa, near Tjibadak, 1000 m; Tjikasintu estate, near Sukabumi; Palabuan, near Wijnkoopsbay, sea level; forest between Tjisolak and hot springs, 200 m; mountains above Palabuan, 1000 m; Djampang; Kedung Djati, near Cheribon (PARAVICINI, 1935).

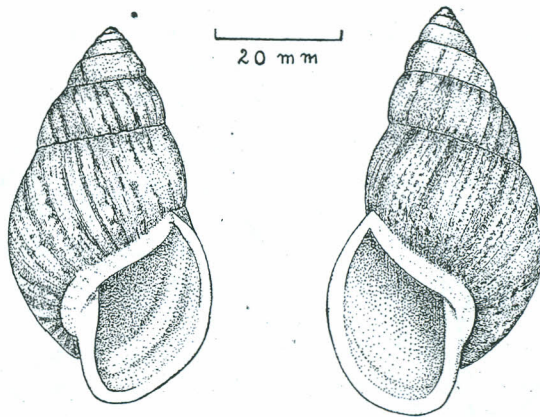


Fig. 96. *Amphidromus javanicus* (Sow.). Dextral and sinistral shell. Author del.

***Amphidromus perversus perversus* (LINNÉ, 1758) (fig. 97).**

1758 LINNÉ, Syst. Nat. Ed. X, p. 772 (*Helix perversus*).

1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus perversus*).

1849 MOUSSON, Land & Süßw. Moll. Java, p. 28 and 108, pl. 20, fig. 5 (*Bulimus perversus*).

1867 MARTENS, Ostas. Landschn. p. 349 (*Bulimus perversus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 67 (*Amphidromus perversus*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 147, pl. 51, fig. 47-52 (*Amphidromus perversus*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 233 (*Amphidromus perversus*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 101 (*Amphidromus perversus* inclus. *A. interruptus*).

1935 PARAVICINI, Arch. Moll. K. 67, p. 173 (*Amphidromus perversus*).

1941 VAN BENTHEM JUTTING, Arch. neerl. Zool. 5, p. 316 (*Amphidromus perversus* inclus. *A. interruptus*).

Shell dextral or sinistral. Ovate conical. Uniformly yellow or whitish-yellow, with one or more black-brown variceal stripes and a narrow band

of the same colour behind the peristome and parallel with it. Rather thick, little transparent, polished. Finely striated in vertical direction and still finer in spiral sense.

Whorls 6-7, regularly increasing in size, the last one somewhat ventricose, occupying about two-fifths of the total length of the shell. Profile of the whorls moderately convex. Suture well impressed, bordered by a narrow whitish or brownish zone. Immature shells are angular at the periphery. Apex white, smooth and shining. Base evenly curved towards the aperture. Umbilicus closed by the broadened peristome.

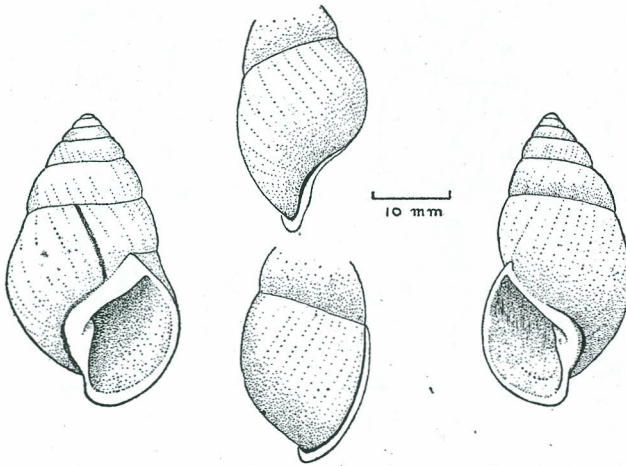


Fig. 97. *Amphidromus perversus perversus* (L.). Dextral and sinistral shell, and details of umbilical region and peristome. Author del.

Aperture oblique, oval. Peristome white, not continuous, the two ends united by a white parietal callus. Outer margin thickened and reflected. Generally bordered exteriorly by a dark brown or black band. Columella thick, vertical.

Dimensions: height 55-60, breadth 26-28, height of aperture 18-19 mm.

Distribution: Sumatra, Borneo, Java,

Celebes, all with their satellite islands, and various islands of the Lesser Sunda group.

Habitat in Java: living in trees, bananas, cotton-trees, tree-ferns, etc. In Java *Amphidromus perversus perversus* and its subspecies and varieties chiefly inhabit East Java. Some findings, however, are recorded from Central and West Java. They must be regarded with a certain amount of reserve.

West Java: cinchona estate Arga Saŕie, Mt. Malabar, 5000 feet; Sukabumi; (PARAVICINI, 1935); Tjibodas (PARAVICINI, 1935); Kebon Djati, near Cheribon (PARAVICINI, 1935).

East Java: Grissee, near Surabaya, 50 m.

The dark border along the peristome may fall out. It is not figured in MOUSSON'S plate 20, fig. 5.

The species is very variable in form and colour. Consequently many names have been introduced and it is often far from easy to bring a certain local form to one of the existing varieties or subspecies. Some of the most important ones will be mentioned here.

***Amphidromus perversus perversus* var. *nivea* SAR. & SAR.**

1899 P. & F. SARASIN, Landmoll. Celebes, p. 209, pl. 26, fig. 262 (*Amphidromus perversus niveus*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 149, pl. 51, fig. 47 (*Amphidromus perversus* var. *niveus*).

It is a form without any trace of colour, even the markings of growth-arrest and the dark border of the peristome occasionally fall out.

West Java: Mt. Gedeh (PILSBRY, 1900).

BOETTGER (1890, p. 146 and 1891, p. 244) mentioned a variety *aurea* MARTENS, 1867 (Ostas. Landschn. p. 349, pl. 20, fig. 13) of *Amphidromus perversus* from Mt. Gedeh. PILSBRY (1900, p. 148) followed him in this nomenclature. From the fact that the shells are described as perforate, with an appressed suture distinctly crenulated by growth striae one might conclude that they belong to another species, perhaps *Amph. palaceus*. Moreover the occurrence in West Java is a little dubious.

For *Amphidromus perversus aureus* MARTENS (1867, l.c.) made the following remark: "Native country not positively known, perhaps Java, because a specimen in the Leyden Museum, sent by REINWARDT from Java, seems to belong here". Recent inquiries in the Leyden Museum could not bring the shell to light. Therefore its classification remains uncertain.

The shell which MARTENS (1867, pl. 20, fig. 11) figured and described (p. 248-249) as *Bulimus leucoxanthus* is either a *A. perversus* or a *A. palaceus*.

***Amphidromus perversus interruptus* (MÜLLER, 1774).**

1774 MÜLLER, Hist. Verm. 2, p. 94 (*Helix interrupta*).

1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus interruptus*).

1949 MOUSSON, Land & Süsw. Moll. Java, p. 30, pl. 4, fig. 1, 2, pl. 20, fig. 4 (*Bulimus interruptus*).

1849 MOUSSON, Zeitschr. f. Malak. 6, p. 179 (*Bulimus interruptus*).

1860 ZOLLINGER, Natuurk. Tijdschr. Ned. Indië, 21, p. 321 (*Bulimus interruptus*).

1867 MARTENS, Ostas. Landschn. p. 344, pl. 20, fig. 1, 2, 3, 5, 6, 8, 9 (*Bulimus interruptus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 68 (*Amphidromus perversus* var. *interrupta*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 150, pl. 52, fig. 53-56 (*Amphidromus interruptus*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 232 (*Amphidromus interruptus*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 101 (*Amphidromus perversus* inclus. *A. interruptus*).

1935 PARAVICINI, Arch. Moll. K. 67, p. 173 (*Amphidromus interruptus*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 316 (*Amphidromus perversus* inclus. *A. interruptus*).

Amphidromus perversus interruptus, regarded by older authors as a separate species, *Amphidromus interruptus*, occurs with the main form in the same islands. In general habitus the two are similar; only the

colour pattern is different. This has induced other authors (RENSCH, 1932) to unite the two, bringing *A. interruptus* as a synonym under *A. perversus*.

In my opinion it seems more reasonable to classify *A. interruptus* as a subspecies of *A. perversus*, herewith confirming that they are genetically related, although being sufficiently distinct to be regarded as separate subspecies. Unfortunately I have no information whether the two subspecies live in the same or in different habitats, or in separate populations.

Amphidromus perversus interruptus differs from *A. perversus perversus* in being ornated with red-brown vertical bands or flames, especially on the last whorl. Towards the base these flames are coalescent in a continuous dark spiral band below the periphery. In other shells only this dark basal spiral band is left, the flames and streaks having become obsolete, or disappeared entirely. Around the umbilicus there is a more or less conspicuous light zone. Along the periphery a narrow light spiral zone is often interrupting the brown flames. On the spire the dark markings become obsolete towards the apex.

Dimensions, distribution and habitat are the same as in *A. perversus perversus*.

West Java: Pardana, Bantam (MARTENS, 1867); Depok, N. of Buitenzorg, 150 m; Central Java: Surakarta (PARAVICINI, 1935).

East Java: Surabaya, sea level; Surabaya, on kapok trees (*Ceiba pentandra*); Grisee, near Surabaya, in bushes of bambu duri (*Bambusa spinosa*); Situbondo; Rogodjampi (MARTENS, 1867).

The spawning has been observed by ZOLLINGER (1860, p. 322). When the snail lays its eggs, it starts rolling a leaf, or pasting it together like a little pointed cornet. In this sac the animal deposits its eggs which are transparent whitish, of the size of a pepper-corn, somewhat compressed on one side.

The subspecies is extremely variable in coloration, in Java as well as in the neighbouring islands.

The principal colour-varieties in Java which are distinct enough to receive a special name are:

***Amphidromus perversus interruptus* var. *emaciata* (MARTENS, 1867).**

1867 MARTENS, Ostas. Landschn. p. 347, pl. 20, fig. 7 (*Bulimus emaciatus*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1048 (*Bulimus emaciatus*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 153, pl. 53, fig. 77-78 (*Amphidromus interruptus* subsp. *emaciatus*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 232 (*Amphidromus interruptus* subsp. *emaciatus*).

The general form of the shell is narrower, the whorls little convex. Its colour is pale yellow or white with chestnut flames, confluent on the base. There is no light spiral band along the periphery.

Central Java: teakwood forest along road from Purwodadi to Wiro-sari; Tjepu, S. E. of Blora.

East Java: Kedewan, N.W. of Bodjonegoro; Grissee, near Surabaya; Gedangan, S. of Surabaya.

The locality Donerang, mentioned by PILSBRY (1900) is unintelligible to me.

***Amphidromus perversus interruptus* var. *sultana* (LAMARCK 1822).**

1822 LAMARCK, Anim. s. Vert. 6, part 2, p. 119 (*Bulimus sultanus*).

1849 MOUSSON, Land & Süßw. Moll. Java, p. 31 and p. 109 (*Bulimus interruptus* var. *sultanus*).

1867 MARTENS, Ostas. Landschn. p. 342, pl. 22, fig. 1, 3, 4 (*Bulimus sultanus*).

1900 PILSBRY, Man. of Conch. (2) 13, p. 154, pl. 53, fig. 66-74 (*Amphidromus interruptus* subsp. *sultanus*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 232 (*Amphidromus interruptus* subsp. *sultana*).

The shell is large, broad and highly polished. It is ornated with numerous flames and zigzag markings of reddish-brown on a yellow or pinkish background. Along the periphery there is usually a light spiral band.

West Java: Sukabumi.

East Java: Kediri; Grissee, near Surabaya; Sutji, near Grissee; Pu-ger, S. of Djember, sea level; wood near Batu Ulo, S. coast, sea level; Rogodjampi (MARTENS, 1867); Banjuwangi, sea level.

***Amphidromus alticola* FULTON, 1896 (fig. 98).**

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 70, pl. 6, fig. 5, 5a.

1900 PILSBRY, Man. of Conch. (2) 13, p. 147, pl. 53, fig. 75, 76.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 231.

1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 153.

Shell dextral or sinistral, rather slender. Uniformly sulphur-yellow or greenish-yellow. In the shells which I have seen there is no dark mark of previous periods of growth-arrest. Rather thin and transparent, smooth and polished. Vertical striae weak, spiral striation so fine that it is only visible under a magnification of 10 times or more.

Whorls 6, regularly increasing in size. The last one large: about one half of the total shell length. Profile of the whorls only little convex. Suture shallow, often margined by a narrow, white, sub-sutural zone. Apex whitish, smooth and shining. Base evenly curved to the aperture. Umbilicus generally closed by the overlapping peristome, or visible as a narrow slit only.

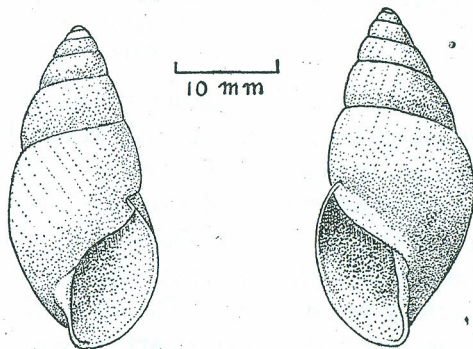


Fig. 98. *Amphidromus alticola* FULTON.
Dextral and sinistral shell. Author del.

Aperture somewhat oblique, oval. Peristome not continuous, white, thickened and only little reflexed. Columellar side almost straight.

Dimensions: height 33-39, breadth 17-20, height of aperture 16-19 mm.

Distribution: Java.

Habitat in Java: little is known of the natural habitat of this species. All records mention jungle stations in the mountains of West Java.

West Java: Mt. Gedeh; wood near Telega Warna, near Puntjak pass, 1400 m; environs of Bandung; Mt. Patuha, 1550 m; Pengalengan, Mt. Malabar, 1600 m; Tjibitung, near Pengalengan, Mt. Malabar, 2000 m; forest N.W. slope of Mt. Malabar (OOSTINGH, 1923); Mt. Puntang, N. of Mt. Malabar, 2000 m; Mt. Tjikorai.

Amphidromus porcellanus (MOUSSON, 1848) (fig. 92, 99).

1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus*).

1849 MOUSSON, Land & Süßw. Moll. Java, p. 33 and p. 110, pl. 3, fig. 4 (*Bulimus*).

1867 MARTENS, Ostas. Landschn. p. 365 (*Bulimus*).

1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1049 (*Bulimus*).

1890 BOETTGER, Ber. Senckenb. p. 146.

1892 MARTENS, Erg. Weber, 2, p. 241.

1893 WIEGMANN, Erg. Weber, 3, p. 204, pl. 15, fig. 2-11.

1894 MARTENS, Jenaische Denkschr. 8, p. 83.

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 79.

1897 WIEGMANN, Abh. Senckenb. 24, p. 519.

1900 PILSBRY, Man. of Coch. (2) 13, p. 201, pl. 64, fig. 5-7.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 213 and p. 233.

1923 OOSTINGH, Meded. Landb. Hoogeschool, 26, p. 154.

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 96 (*Amphidromus contrarius porcellanus*).

1934 RENSCH, Trop. Binnengew. 4, p. 754 (*Amphidromus contrarius porcellanus*).

1935 PARAVICINI, Arch. Moll. K. 67, p. 173.

1939 ADAM & LELOUP, Mém. Mus. Roy. Hist. Nat. Belg. (hors série) 2, fasc. 20, p. 31, pl. 1, fig. 2.

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 319.

Shell sinistral, slender. Ground-colour creamy or straw-yellow. Ornated with vertical brown streaks or flames, in some shells close to each other (about 18 on the last whorl), in others at a greater distance (about 10 on the last whorl). Occasionally the flames are indistinctly bifurcate at their tops, in other shells they are vaguely anastomosing. Generally there is a light spiral zone along the upper part of each whorl, about half way between the suture and the periphery, dividing the brown streaks in an upper and a lower part. Now and then the upper part of the flames, above the just-mentioned light spiral zone, is absent. Below the periphery of each whorl there are two spiral brown bands,

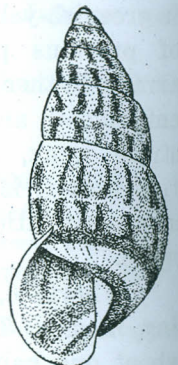


Fig. 99. *Amphidromus porcellanus* (Mouss.). Front view of shell. Author del.

leaving a light area bordering the umbilicus. There is generally a narrow yellow margin along the suture. Rather thin and transparent, smooth. Finely striated in vertical and in spiral direction.

Whorls 7, regularly increasing in size, the last about two fifths of the total length of the shell. Profile of the whorls little convex. Suture shallow, in the uppermost whorls bordered by a white, in the later ones by a yellow zone. Apex dark-brown to black, smooth and shining. Base evenly curved to the aperture. Immature shells angular at the periphery. Umbilicus generally closed by the overlapping peristome, or appearing as a narrow slit only.

Aperture oblique, oval, the brown colour-pattern shining through. Peristome not continuous, white, thickened and only little reflexed. Columellar side almost vertical.

Dimensions: height 28-34, breadth 15-16, height of aperture 11-13 mm.

Distribution: Java, Krakatau, Sebesi. The occurrence in Deli, N.E. Sumatra (MARTENS, 1892) needs further confirmation.

Habitat in Java: living in trees and shrubs, bananas, fruit-trees, palms, tree-ferns, etc.

West Java: Warong Kapangdangan (MARTENS, 1867); Buitenzorg, Botanical Garden, 250 m; Botanical Garden, Buitenzorg, near churchyard, 250 m; Djampang; Mt. Pawon, near Padalarang, 700 m; forest N.W. slope of Mt. Malabar (OOSTINGH, 1923); Cheribon; Kedung Djati, near Cheribon (PARAVICINI).

An animal which was taken in the Botanical Garden, Buitenzorg, deposited a cluster of eggs in the Buitenzorg Zoological Museum; from these eggs the first young hatched after 10 days.

Amphidromus porcellanus was one of the two first landsnails observed in Krakatau after the great eruption of 1883 [JACOBSON, Jaarversl. Topogr. Dienst, 1908 (1909), list].

***Amphidromus furcillatus* (MOUSSON, 1849) (fig. 100).**

- 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus elegans*, non *elegans* PFEIFFER, 1848).
- 1849 MOUSSON, Land & Süsw. Moll. Java, p. 115, pl. 3, fig. 3 (*Bulimus*) and p. 32 and p. 110 (*Bulimus elegans*, non *elegans* PFEIFFER, 1848).
- 1849 MOUSSON, Zeitschr. f. Malak. 6, p. 179 (*Bulimus*).
- 1860 ZOLLINGER, Naturk. Tijdschr. Ned. Indië, 21, p. 321, (*Bulimus*).
- 1867 MARTENS, Oostas. Landschn. p. 357, (*Bulimus*).
- 1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 76.
- 1900 PILSBRY, Man. of Conch. (2) 13, p. 216, pl. 66, fig. 38-40.
- 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 234.
- 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 232.
- 1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 154.
- 1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 96 (*furcillatus furcillatus*).
- 1934 RENSCH, Trop. Binnengew. 4, p. 755 (*furcillatus furcillatus*).

Shell sinistral, slender. Ground-colour whitish on the spire, yellowish or greenish on the penultimate and ultimate whorls. Ornated with vertical brownish streaks or flames, each of which becomes bifurcate or trifurcate at their upper ends. The "stalk" and the "teeth" of these forks are often separated by a light spiral zone running along the whorls about halfway between the periphery and the suture. Below the periphery of each whorl there are two spiral brownish bands, generally only visible on the last whorl. Shell rather thin and transparent, smooth. Finely striated in vertical and spiral direction.

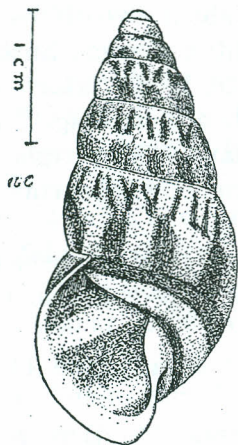


Fig. 100. *Amphidromus furcillatus* (MOUSS.). Front view of shell. Author del.

Whorls 7, regularly increasing in size; the last one about $\frac{2}{5}$ of the total length of the shell. Profile of the whorls little convex. Suture shallow, in the upper whorls margined by a white, in the later whorls by a pink zone. Apex dark-brown to black, smooth and shining. Base evenly curved towards the aperture. In immature shells the periphery is angular. Umbilicus generally closed by the

reflexed peristome, or appearing as a narrow slit only.

Aperture oblique, oval, the brown colour pattern shining through. Peristome not continuous, white, thickened and only little reflexed. Columellar side almost straight.

Dimensions: height 31-36, breadth 16-20, height of aperture 12-15 mm.

Distribution: Java, Bali.

Habitat in Java: living in trees, teak wood, coffee trees, rubber trees and various not cultivated trees.

• West Java: Tjiandjur, 2000 feet; Djampang.

Central Java: Gundih, S. of Purwodadi (OOSTINGH, 1923); teakwood at Penawangan (OOSTINGH, 1923); Telawah, 200 m; Mantingan; Blungun, S. of Rembang, 500 m.

East Java: Kedewan, W. of Bodjonegoro; Surabaya, sea level; Gedangan, S. of Surabaya, 50 m; Malang, 500 m; coffee estate Negredjo, Mt. Kawi; estate of Sumber Djeror, near Malang, 2500 feet; coffee plantations near Pangang Lele (MOUSSON, 1849); near spring, Nongkodjadar, 1200 m; Southern Mountains, 1500 feet; Ranu Klakah, 300, m (RENSCH, 1934); Ranu Bedali, 100 m (RENSCH, 1934); Mt. Lamongan (MARTENS, 1867); Djember, 200 m; kampong Balong, near Djember, on djarak pagger (*Jatropha curcas*); rubber estate Sumber Tengah, near Kalisat, Djember district, 1500 feet; Durdjo estate, near Djember, 600 m; Kali Mrawan, near Kalisat, Djember district, 1500 feet; rubber estate near Dampar; Litjin and Rogodjampi, Banjuwangi district (MARTENS, 1867).

***Amphidromus furcillatus* var. *virescens* (MARTENS, 1867).**

1867 MARTENS, Ostas. Landschn. p. 358, pl. 21, fig. 3 (*Bulimus*).

1899 MARTENS, Arch. f. Naturgesch. 65, p. 28.

1900 PILSBRY, Man. of Conch. (2) 13, p. 217.

1923 OOSTINGH, Meded. Landb. Hooges. 26, p. 155 (*Amph. furcillatus* "another shell").

The variety occurs together with the main form in the same localities. It is readily distinguished by the vertical striae of a peculiar grass green colour on the last whorl, substituting the brown flames and spiral bands of typical *furcillatus*. A combination of both patterns may, however, occur: the forked flames on a yellowish background occupying the upper part of the last whorl, the green lines the lower part.

West Java: Sukabumi.

Central Java: teakwood at Penawangan (OOSTINGH, 1923); Tuntang, near Rawah Pening, 300 m.

East Java: Mt. Kawi (MARTENS, 1899); Tengger Mts, 4000-5000 feet; Tumpang, Tengger Mts; Wlingi; Kali Mrawan, near Djember, 1500 feet; Djaboong estate, near Wlingi, 800 m, on rubber trees; Breml, Jang Mts, 1200 m.

***Amphidromus filozonatus* (MARTENS, 1867) (fig. 101).**

1867 MARTENS, Ostas, Landschn. p. 358, pl. 21, fig. 4 (*Bulimus*).

1896 FULTON, Ann. Mag. Nat. Hist. (6) 17, p. 78.

1900 PILSBRY, Man. of Conch. (2) 13, p. 202, pl. 64, fig. 4.

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 231.

1932 VAN BENTHEM JUTTING, Treubia, 14, p. 103.

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 96 (*Amphidromus contrarius filozonatus*).

1941 VAN BENTHEM JUTTING, Arch. neerl. Zool. 5, p. 314.

Shell sinistral, slender. Ground-colour light to dark-brown, darker towards the base. Ornated with light spiral bands and blotches, or, rarely, light yellow all over with only faint traces of cinnamon. There is a light zone bordering the suture, either continuously of one colour, or with alternating dark and light spots. Rather thin and transparent, smooth. Finely striated in vertical and in spiral direction.

Whorls 6, regularly increasing in size, the last about 2/5 of the entire length of the shell. Profile of the whorls little convex. Suture shallow. Apex dark-brown to black, smooth and shining. Base evenly curved to the aperture. Immature shell angular at the periphery. Umbilicus closed by the overlapping peristome, or only visible as a narrow slit.

Aperture oblique, oval; the exterior colour-pattern shining through. Peristome not continuous, white, thickened and only little reflexed. Columellar side almost vertical.

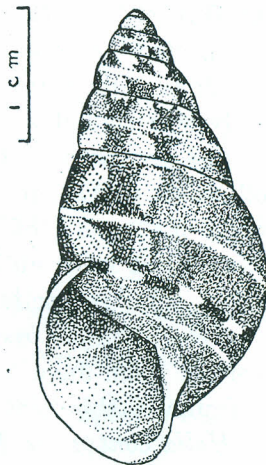


Fig. 101. *Amphidromus filozonatus* (MARTENS).
Front view of shell.
Author del.

Dimensions: height 33-36, breadth 16-18, height of aperture 14-15 mm.

Distribution: Java, Madura, Bawean.

Habitat in Java: living in bushes and trees, bananas, bambu, cotton trees etc.

Central Java: Kedingding, W. of Bodjonegoro.

East Java: Sampung Cave, near Ponorogo; Kedewan, N. W. of Bodjonegoro; Grisee, near Surabaya, sea level, in bushes of Bambu duri (*Bambusa spinosa*); Sutji, near Grisee, 50 m.

Amongst the population of shells with the characteristic colour-pattern there occur occasionally paler ones of a dirty orange or isabel-line ground-colour on which the dark markings are not, or only vaguely, developed.

Doubtful species of *Amphidromus*

Amphidromus inversus (MÜLLER, 1774) which is now and then recorded from Java (MARTENS, 1867, p. 338) is not known in authentic material from precise localities. Originally it is a Bornean species, but advanced colonies have already reached some of the satellite islands North of Java (VAN BENTHEM JUTTING, 1941, p. 314).

Amphidromus sumatranus (MARTENS, 1864) mentioned as doubtful from Java (MARTENS, 1867, p. 366) is not an inhabitant of this island, but lives in Sumatra.

The occurrence of *Bulimus rusticus* MOUSSON, 1849 (Land & Süßw. Moll. Java, p. 115, pl. 22, fig. 1) in East Java is certainly an erroneous record. MARTENS (1867, p. 393-394) classed it with the spurious species of Java, but later authors (TENISON WOODS, 1888, p. 1044 and PILSBRY, 1891, p. 187) resuscitated it again.

Amphidromus laevus (MÜLLER, 1774) which has now and then been recorded from Java with an interrogation mark, is not a component of the fauna of this island, but lives in the Moluccas.

Helix contrarius MÜLLER, 1774 (now *Amphidromus contrarius*) is repeatedly recorded from Java. It is, however, an inhabitant of South Celebès and various Lesser Sunda Islands where the species has developed numerous geographical races. RENSCH (1932 and 1934) included even the Javanese species *Amphidromus porcellanus* and *A. filozonatus* in this "Rassenkreis", but I am afraid I cannot follow him in this respect.

Another problematic species belonging to *Amphidromus* is *Bulimus Bataviae* GRATELOUP, 1840 (Actes Soc. Linn. Bordeaux, 11, p. 165), later on called *Partula Bataviae* by the same author (Actes Soc. Linn. Bordeaux, 11, 1840, pl. 2, fig. 12) recorded from Batavia, Java. Various authors have attempted a more adequate classification, but so far none of these seems

admissible. PFEIFFER (Zeitschr. Malak. 6, 1849, p. 128) referred it to *Amphidromus inversus*, although in 1848 (Monogr. Helic. 2, p. 40) he observed: "Might be assigned to a variety of *Bulimus perversus*". MOUSSON (1849, Land & Süßsw. Moll. Java, p. 30) suggested the relationship to *Amphidromus interruptus*. MARTENS (Ostas. Landschn. 1867, p. 398) did not admit it as a Javanese species at all. FULTON (1896, Ann. Mag. Nat. Hist. (6) 17, p. 79) united the dubious species with *Amphidromus filozonatus*. The question will remain unsettled until the type specimen in the GRATELOUP collection can be examined.

Genus *Pseudopartula* PFEIFFER, 1855

Shell sinistral, high conical. White or cream-colour, somewhat transparent. Whorls regularly increasing in size, the last one much larger than the previous one. Last whorl feebly or sharply angular at the periphery. Profile of the whorls flat, suture shallow. First whorl smooth and shining, the subsequent ones finely striated spirally and radially. Umbilicus narrow or closed. Aperture very oblique, with thickened and reflected peristome.

The anatomy is similar to that of *Amphidromus*. In the radula of *Pseudopartula galericulum* RENSCH observed (1930, Zool. Anz. 92, p. 183 and 185) that the central tooth and the 9-11 adjacent laterals lack the outer denticle which is present in *Amphidromus*. The marginals agree with the *Amphidromus* type (fig. 102).

Distribution: Sumatra, Java, Nusa Kambangan, Madura. The occurrence in Borneo, based on the existence of *Helix nasuta* METCALFE, 1851, has proved to be erroneous. This species belongs to the family *Zonitidae* (PILSBRY, Nautilus, 20, 1906, p. 47).

In Java there is only one species:

Pseudopartula galericulum galericulum (MOUSSON, 1848).

- 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Bulimus galericulum*).
- 1849 MOUSSON, Land & Süßsw. Moll. Java, p. 34, pl. 3, fig. 5 (*Bulimus galericulum*).
- 1867 MARTENS, Ostas. Landschn. p. 324 (*Helix galericulum*).
- 1888 TENISON WOODS, Proc. Linn. Soc. N.S. Wales (2) 3, p. 1043 [*Helix (Bulimus) galericulum*].
- 1897 PILSBRY, Nautilus, 10, p. 110 (*Pseudopartula galericulum*).
- 1898 ANCEY, Ann. Mus. Hist. Nat. Marseille (2) Bull. 1, p. 147 (*Pseudopartula galericulum*).

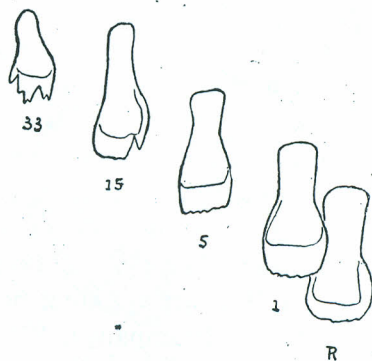


Fig. 102. *Pseudopartula galericulum* (MOUSS.). Radula elements. After RENSCH.

- 1901 PILSBRY, Man. of Conch. (2) 14, p. 10, pl. 2, fig. 31-33 [*Amphidromus (Pseudopartula) galericulum*].
 1912 SCHEPMAN, Proc. Malac. Soc. London, 10, p. 234 (*Pseudopartula galericulum*).
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 234 (*Pseudopartula galericulum*).
 1930 RENSCH, Zool. Anz. 92, p. 183, fig. 2, p. 185, fig. 3 (*Pseudopartula galericulum*).
 1935 PARAVICINI, Arch. Moll. K. 67, p. 173 (*Pseudopartula galericulum*).
 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 319 (*Pseudopartula galericulum*).

Shell sinistral, with a high conical cap or helmet-shaped spire on an oblique aperture: White, in the typical form with a dark apex and a dark band in the aperture parallel with the peristome. Fresh shells somewhat shining and transparent, dead ones opaque, chalky.

Whorls 6, regularly increasing in size; the last one indistinctly angular at the periphery. Profile of the whorls almost flat, suture shallow and oblique, margined with a narrow white zone. First whorl smooth and shining, the apex black or dark-brown. The subsequent whorls delicately striated in vertical and spiral direction. Umbilicus very narrow, for the greater part hidden by the reflected peristome.

Aperture very oblique, irregularly oval. Peristome not continuous, flatly expanded, white, bordered interiorly by a blackish-brown band.

In the living animal the green mantle shines through the shell.

Dimensions: height 16-20, breadth 10-11, height of aperture 6-8 mm.

Distribution: Java, Madura, Nusa Kambangan. The subspecies *Ps. gal. gedeana* lives in Java and Sumatra.

Habitat in Java: living in trees, on the leaves and on the bark.

West Java: near Wijnkoopsbay; Tjisolak, near Wijnkoopsbay, 200 m; Pardana (MOUSSON, 1849); Mt. Gedeh, 3000 feet; Sukabumi, 700 m; estate of Dajeuhmanggung near Garut, virgin forest, 1200 m; Pameungpeuk, South Djampang, 350 m.

East Java: Tengger Mountains.

The species seems to be rare in Java; we seldom get large series for checking local variation. The two following colour varieties and the subspecies *gedeana* PILSBRY, 1897 are based on limited material only. Hence it is not yet possible to form a definite opinion on the basic value of this classification.

Forma *impunctata* ANCEY, 1898 has the same general form as the type, but is quite immaculate.

West Java: Mt. Gedeh, 4000 feet; Djampang, 2000 feet.

East Java: Southern Mountains, 1500 feet.

Forma *fasciata* ANCEY, 1898 is not only provided with a dark apex and a dark band lining the aperture, but in addition possesses a dark spiral band along the suture and another along the periphery of the last whorl.

West Java: Mt. Salak; Sukabumi.

Pseudopartula galericulum.gedeana PILSBRY, 1897 (fig. 103).

1897 PILSBRY, Nautilus, 10, p. 110.

1890 BOETTGER, Ber. Senckenb. p. 146 [*Amphidromus (Beddomea) galericulum*].

1901 PILSBRY, Man. of Conch. (2) 14, p. 11, pl. 2, fig. 29 [*Amphidromus (Pseudopartula) galericulum* var. *gedeanus*].

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 234 (*Pseudopartula galericulum* var. *gedeana*).

The subspecies is somewhat more elongate than the typical form, especially on account of the last whorl which — at the base — is hanging out more sack-like. It has no peripheral angle. Dark markings are usually absent, but a narrow spiral band has been observed in one shell. Umbilicus narrow and covered by the peristome as in the typical form. The perforation is a little more elongate.

Dimensions: height 20-21, breadth 11, height of aperture 7-8 mm.

Distribution: West Java and South Sumatra.

Habitat in Java: there are no special communications on the mode of living of this subspecies. It is, however, probable that it follows the main form in this respect.

West Java: Mt. Salak (BOETTGER, 1890); Mt. Gedeh; Djampang, 2000 feet.

Pseudopartula galericulum gedeana PILSBRY has also been collected at Mount Tanggamus, Lampong Districts, S. Sumatra, 600-700 m, Dec. 1934, by M. A. LIEFTINCK. It is the first record for Sumatra.

Doubtful species of *Pleurodontidae* from Java

The record of *Papuina (Crystallopsis) coelaxis* (PILSBRY, 1891) [Man. of Conch. (2) 7, p. 114, pl. 27 (not 26), fig. 6, 7 and 8 and as *Cochlostyla (Corasia)*], in Java is very problematic, the more so as since PILSBRY's publication no further animals have been collected in this island. Information in the Museum of the Academy of Natural Sciences, Philadelphia, where the type specimen is preserved, has revealed that the shell is from quite dubious origin. It reached this Institute in the previous century with the collection of A. D. BROWN, an amateur conchologist who,

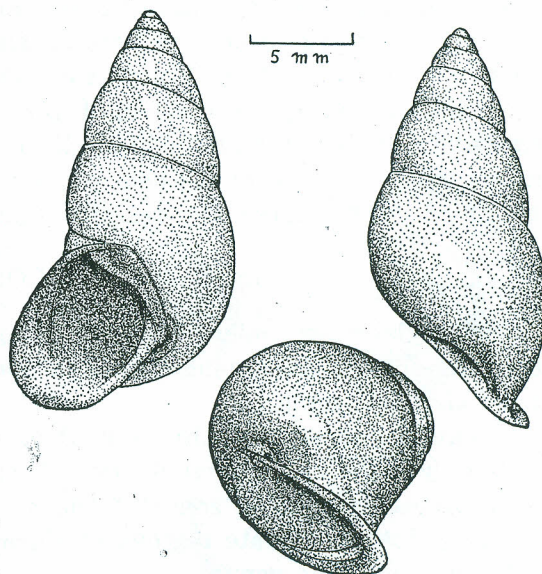


Fig. 103. *Pseudopartula galericulum gedeana* PILSBRY. Front, back and base or shell. LENSVELT del.

through purchase and exchange, built up a large collection. Judging from the original label BROWN apparently obtained the shell from DAMON's stock, a dealer in London. All this occurred in a time when even eminent conchologists were not always strictly scrupulous about localities. Hence it is most likely that some confusion has taken place: shells brought by travellers sailing from Java in a homebound vessel often being located as "Java", although the real origin of the objects might be totally different. Therefore we can conclude that any connection between *Papuina* (*Crystallopsis*) *coelaxis* and the island of Java seems inconsistent.

In a paper on displaced mollusks PARAVICINI (Arch. Moll. K. 58, p. 184-189, 1926) mentioned four species introduced accidentally in Java: *Helix aspersa* MÜLLER, *Euhadra nipponensis* KOBELT, *Bradybaena similaris* (FÉRUSAC) and *Opeas gracile* (HUTTON). The first two have never taken permanent possession of their new area. The two others are permanent settlers since so many years (long before 1926!) that they cannot be separated from the original inhabitants of Java nowadays. *Bradybaena similaris* will be treated in the next paragraph; *Opeas gracile* will follow in the third part of these "Systematic Studies".

Familia FRUTICICOLIDAE

Shell high or low conical. Unicolorous or ornated with vertical flames or spiral bands. In some genera smooth and polished, in others covered with a hairy epidermis.

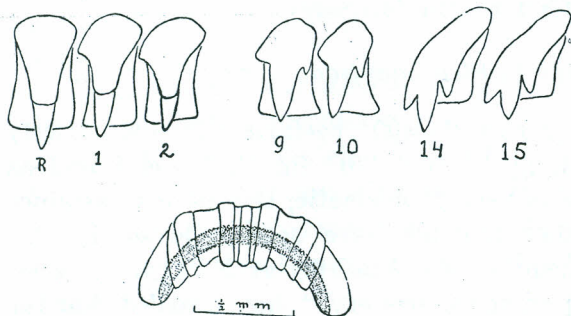
The animals are hermaphroditic. Dart sac and dart are usually present. Radula $\infty.1.\infty$. Mandibula ribbed with strong ribs.

Distribution: tropical zones of Old and New World. A few genera penetrating into temperate regions of Europe and East Asia.

In Java only one genus:

Genus *Bradybaena* BECK, 1837

Shell low-conical, almost globular, perforate. Brown, or yellowish-brown, some species unicolorous, others banded. Aperture broad sickle-shaped, oblique. Peristome not continuous, thickened, reflected.



In the central and lateral teeth of the radula the ectocones are small or obsolete. Marginals with the principal cusp bifid, the other cusps undivided or bifid.

Fig. 104. *Bradybaena similis* (FÉR.). Radula elements and mandibula. Author del.

(fig. 104).

The animals are hermaphroditic. Of the general biology next to nothing is known.

Distribution: Japan, China, S.E. Asia, Malay Archipelago, Philippines. Introduced in tropical and temperate America, the Antillean Islands, South Africa.

In Java only one species:

***Bradybaena similaris* (FÉRUSSAC, 1821) (fig. 104, 105).**

- 1821 FÉRUSSAC, Tabl. Syst. Limaçons, p. 47 (*Helix*).
 1821 FÉRUSSAC, Hist. Nat. partic. génér. Moll. 1, p. 171, pl. 25 B, fig. 1-4, pl. 27 A, fig. 1-5 (*Helix*).
 1848 MOUSSON, Mitt. naturf. Ges. Zürich, 1, p. 266 (*Helix*).
 1849 MOUSSON, Land & Süsw. Moll. Java, 6. 21, pl. 2, fig. 4, 5 (*Helix*).
 1867 MARTENS, Oostas. Landschn. p. 270 (*Helix*).
 1887 TRYON, Man. of Conch. (2) 3, p. 205, pl. 46, fig. 27-30, pl. 47, fig. 33-37 (*Helix*).
 1890 BÖETTGER, Ber. Senckenb. p. 144 [*Helix (Dorcasia) similaris* var. *subsimilaris*].
 1892 MARTENS, Erg. Weber, 2, p. 236 [*Helix (Eulotella)*].
 1894 MARTENS, Jenaische Denkschr. 8, p. 83 (*Helix similaris* var. *subdepressa*).
 1894 PILSBRY, Man. of Conch. (2) 9, p. 203 and 205, pl. 55, fig. 19, pl. 65, fig. 3-4, pl. 66, fig. 20 [*Eulota (Eulotella)*].
 1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 210-211 and p. 234-235 (*Eulota*).
 1921 PARAVICINI, Trop. Natuur, 10, p. 151, fig. 6 (*Eulotella*).
 1922 PARAVICINI, Teysmannia, 33, p. 25, fig. 2 (*Eulotella*).
 1926 PARAVICINI, Arch. Moll. K. 58, p. 187 (*Eulotella*).
 1929 DAMMERMAN, Agric. Zool. Mal. Archip. p. 119 (*Eulota*).
 1934 RENSCH, Trop. Binnengew. 4, p. 755.
 1935 PARAVICINI, Arch. Moll. K. 67, p. 173.
 1939 ADAM & LELOUP, Mém. Mus. Roy. Hist. Nat. Belg. (hors série) 2, fasc. 20, p. 36.
 1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 320.

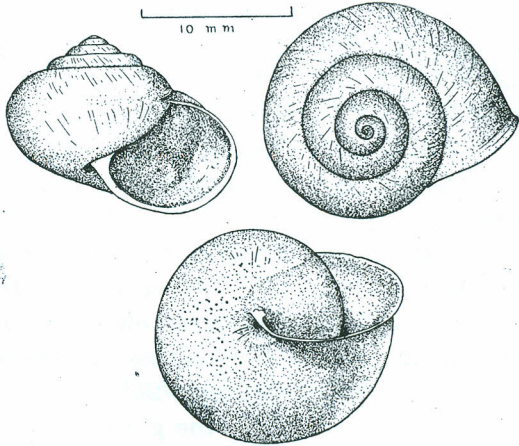


Fig. 105. *Bradybaena similaris* (Fér.). Front, top and base of shell. LENSVELT del.

Shell globular, with moderately elevated spire. Plain reddish-brown or straw colour, some individuals with a dark brown peripheral band. Somewhat transparent and with a soft lustre. First 1½ whorls smooth, others irregularly striated with rather coarse growth lines, crossed by very fine, wavy spiral lines. Epidermis very thin, fibrous.

Whorls 5-6, regularly increasing in size, rounded below and above. In young specimens keeled at the periphery, a feature which occasionally can persist in the adult stage. Umbilicus open, partly concealed by the reflected peristome.

Aperture broad sickle-shaped, somewhat oblique. Peristome not continuous, thickened, reflected. The ends of the peristome are connected by a thin parietal callus.

Dimensions: height 10-12, breadth 14-18, height of aperture 7-9 mm.

Distribution: beyond Java the species has been recorded in the Malay Archipelago from Sumatra, Banka, Billiton, Noordwachter Id., Klein Kombuis, Id., Nusa Kambangan, Timor, Kei Ids., S. Celebes.

Bradybaena similaris is a circumtropical species. It has been found in Cuba, Puerto Rico, Jamaica, Bermuda, Brazil, Madagascar, Rodriguez, Seychelles, Mauritius, Reunion, Japan, China, Indo-China, Philippines, India, Ceylon, Singapore, Sandwich Ids., Admiralty Ids., S. Africa, Ascension, Argentine.

What the native country of the species has been is difficult to ascertain at the present date. In Java the species occurs in a perfectly "wild" state, not only in the vicinity of human settlements, as would be the case with introduced species.

Habitat in Java: living under stones, among grass sods, low shrubs. Sometimes climbing on tree trunks. According to PILSBRY (1887) the species normally "inhabits the coffee tree, and commerce has spread it all over the world where coffee is cultivated".

Occasionally the animals become a real pest in vegetable and flower gardens in the higher districts of Java (PARAVICINI, 1922, p. 25, DAMMERMAN, 1929, p. 120).

West Java: Tjikoya (MOUSSON, 1849); Tjiringin (MARTENS, 1867); Batavia, sea level; Weltevreden, 50 m; in Zoological Garden, Weltevreden, under stones; Weltevreden, on trees; Depok, S. of Batavia, 150 m, in churchyard, under flower pots; estate of Tjiomas, near Buitenzorg, 258 m; Buitenzorg, in gardens, 250 m; Tjiliwong estate, near Puntjak pass, 1200 m, on cabbages in the garden; Sindanglaja (MARTENS, 1867); Tjibodas, Mt. Gedeh, 1400-1600 m; Mt. Gegerbintang, near Tjibodas, 1800 m; Tjigombong, Mt. Salak, 700 m (PARAVICINI, 1926); Tjibadak, near Sukabumi, 400 m (PARAVICINI, 1926); Djampang, near Sukabumi, 2000 feet; limestone hills near Padalarang, under dead wood, 700 m; verges along Grote Postweg in kampong Padalarang, 600 m; Tjimahi, along railroad near Military Hospital, 750 m; environs of Bandung; Bandung, lawns near Geological Institute, under stones and wood, 700 m; Bandung, along Huygensroad, in grass, 700 m; Dago, near Bandung, in garden, 800 m; Dago, along left bank of the Tjikapundung, near first waterfall, soil fauna, 1000 m; Maribaja, along stream, 1100 m; road to Lembang near Maribaja, 1100 m; Lembang, lane near hotel, 1200 m; north of triangulation point, KQ 13 near Bandung, 1250 m; Tjigombong estate, near Bandung, 3500 feet; Mt. Tangkuban Prah, 700-1000 m; Tjiwidej, S.W. of Bandung, 1100 m; Mt. Patuha, 1550 m; Mt. Tilu, 1450 m; Mt. Malabar, near wireless station, in garden on mangga stumps, 1300 m; Pengalengan, Mt.

Malabar, 1400 m; Tjinjiruan, near Pengalengan, 1800 m; Tjibitung, near Pengalengan, 1400-2000 m; cinchona estate Kertamanah, near Pengalengan, 1600 m; cinchona estate Argasarie, Mt. Malabar, 5000 feet; tea estate Negla, near Pengalengan, 1500 m; Tjibulu, near Tjisurupan, Mt. Papandajan, 1300 m; Tjibulu, near Tjikadjang, Mt. Papandajan, 1500 m; environs of Garut, 700 m; Mt. Guntur, 1500 m; Kawah Kamodjan, road to English Plains, 1500 m, on hedges of Sambucus; Mt. Tjikorai.

East Java: Tedja, Kediri residency; Idjen Plateau, 1100 m.

The shell is rather variable in size and colour; high and low shells, brown, yellow or, rarely, banded ones occur in mixed populations. Therefore the varieties which have been described are of little importance and will not further be considered here. Especially in samples obtained beyond the Malay Archipelago I have frequently seen shells with the brown peripheral band. In Java this colour form is not common.

A scalariform shell, probably caused by injury in the juvenile state, was found among normal ones at Mt. Gegerbintang, near Tjibodas, West Java, 1800 m, June 1926.

The eggs are spherical, about 1.5-2 mm diameter, with a calcareous shell. They are laid in clusters of 20-25 under stones, among leaves and grass roots.

Familia STREPTAXIDAE

Shell low conical to turreted, smooth or ribbed. Generally white or hyaline, in some species brown and little or not transparent. Several species have an elaborate mechanism of teeth and lamellae in the aperture.

The animals are hermaphroditic. Radula with or without a central tooth. Lateral teeth numerous, dagger-shaped, arranged in V-form. Mandibula absent.

Distribution: tropical zones of the Old and New World.

In Java there is only one genus:

Genus *Gulella* PFEIFFER, 1856

Shell ovate to cylindrical, smooth or ribbed. Some species are curiously obliquely deformed; in others the last whorl is not adnate to the penultimate whorl, but free. Aperture generally provided with teeth. Peristome thickened, in some species greatly expanded and callous.

Radula ∞ .1. ∞ , with acute, dagger-shaped teeth. The rhachis is small. On each side of the central tooth there are 9 latero-marginals (fig. 106). For a more detailed description of the radula of *Gulella bicolor* see below. Mandibula is absent.



Fig. 106. *Gulella bicolor* (HUTTON). Radula elements. After RENSCH.

Distribution: Africa, South and East Asia, West Indies. *Gulella bicolor* has been introduced into various tropical regions, so that it is a tropical cosmopolite now.

In Java there is only one species:

***Gulella (Huttonella) bicolor* (HUTTON, 1834) (fig. 106, 107).**

1834 HUTTON, Journ. As. Soc. Bengal, 3, p. 86 (*Pupa*).

1867 MARTENS, Ostas. Landschn. p. 384 (*Pupa*).

1885 TRYON, Man. of Conch. (2) 1, p. 104, pl. 19, fig. 14, 17, 18 and pl. 20, fig. 24 (*Ennea*).

1914 LESCHKE, Mitt. naturhist. Mus. Hamburg, 31, p. 223 (*Ennea*).

1932 RENSCH, Zool. Jahrb. (Syst.) 63, p. 4, fig. 1 [*Gulella (Indoennea)*].

1935 PARAVICINI, Arch. Moll. K. 67, p. 171 (*Ennea*).

1941 VAN BENTHEM JUTTING, Arch. néerl. Zool. 5, p. 320 [*Gulella (Indoennea)*].

Shell turreted to cylindrical, with blunt apex and rounded base. Hyaline, cream colour, the orange or brick-red body of the animal is shining through. Shell finely striated according to the growth lines. On the greater part of each whorl, however, this sculpture becomes obsolete. Only in the suture and on the entire surface of the last whorl the striae are visible as delicate ribs.

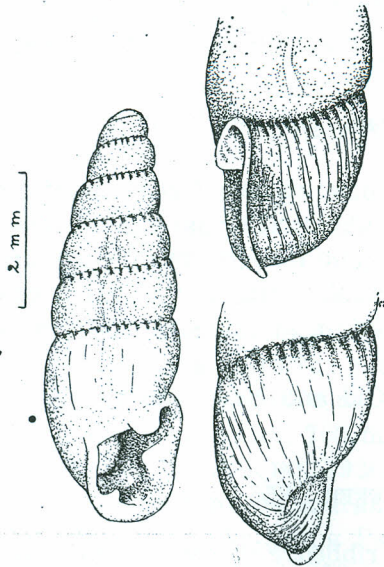


Fig. 107. *Gulella bicolor* (HUTTON). Entire shell and details of side and back of last whorl. LENSVELT del.

Whorls 7-8½, little convex, the first two entirely smooth, the subsequent ones striated. The last whorl slightly ascending towards the aperture. About a quarter of a whorl's distance from the aperture the ultimate whorl is somewhat inflated, after that constricted, forming two shallow pits just behind the peristome. Umbilicus closed.

Aperture almost quadrate, with rounded base. Only very little oblique. Interiorly narrowed by 4 teeth, one lamella on the parietal wall close to the peristome, one lamella in the corner between parietal and columellar sides and winding round the columella in the interior of the shell, and two folds on the peristome. Peristome not continuous, white, thickened, reflected. With a broad triangular tooth on the palatal wall and a small pointed tooth on the basal side.

Dimensions: height 5¾-6¾, breadth 1¾-2, height of aperture 1½-1¾ mm.

Distribution: *Gulella bicolor* is a circumtropical species. In the Malaysian region it has been recorded from Malaya, Philippines and several

islands of the Malay Archipelago: Java, Madura, Edam Id., Noordwacher Id., Bali, Timor, Amboina.

Habitat in Java: living on the ground, amongst dead leaves, decaying wood, in grass, moss and other low vegetation. It prefers damp places.

West Java: Batavia, sea level; Weltevreden, in Zoological Garden, under stones, 50 m; Depok, S. of Batavia, in verge along road near churchyard, 150 m; Tjiteureup, near Buitenzorg, among grass, leaves and tree bark; Tjiandjur, under stone in grass near hospital, 470 m.

Central Java: Borobudur, near Djokja.

East Java: Surabaya, botanical garden of the Netherlands Indonesian Medical School, sea level.

There is some variation in the height-breadth ratio of the shells, long and slender, short and broad specimens occurring. MARTENS (1867) created a var. *abbreviata* for shells which are high $6\frac{1}{2}$ and broad 2 mm, with an aperture of $1\frac{1}{2}$ mm height and breadth.

Although the species is often found alive there are only few observations on the life history of the animal. I copy here the description by STOLICZKA (Journ. As. Soc. Bengal, 40 II, 1871, p. 169-170): "The animal has a long body, laterally strongly compressed, posteriorly shortened ... more or less distinctly yellowish; on the head reddish; pedicles long, slightly thickened at the end, their external skin is yellow, but the internal eyebearing peduncles are vermilion, eyes very small; tentacles small, pale reddish; mantle deep-red, and so is also the whole of the internal lining of the shell which exhibits the same deeper, or brighter red colour as soon as the animal moves about. When retracted only the median whorls appear as deep red ... The lateral line of the foot is rather distinct. The mantle is only slightly swollen on either side of the pulmonary opening, rarely produced into a distinct lobe ... No jaw has been observed. The radula is very long, the sides curved up like the sheath of a bambu leaf. There are between 80 and 90 transverse series of teeth, arranged in a moderate curve. The centre tooth is short, sharply pointed with a rapidly widened base. The adjoining and following teeth are longer, slightly curved, sharply pointed and with a blunt knob near their bases; their size gradually decreases as they proceed outward. There are only 19 teeth in each transverse series (9-1-9). The animal of *Huttonella bicolor* lives generally hidden under old wood, stones, and between damp gravel, particularly near the edges of tanks. Its movements are rather rapid."

ANNANDALE & PRASHAD (Rec. Ind. Mus. 19, p. 193, 1920) observed *Gulella bicolor* preying upon *Opeas gracile* and SEMPER (Reisen Arch. Philipp. 3, 1874, p. 137-138) described a similar case where *Gulella bicolor* was attacking *Opeas panayense*.



Photograph Aug. 1947

Will