
Part XVII: The Freshwater Gastropods of Ceylon

by

FERDINAND STARMÜHLNER*

(WITH 15 PLATES—PLATES II—XVI)

(1) Introduction

Sri Lanka (Ceylon), situated between the 6° and 9° N latitude and the 79° and 82° E longitude, is a detached part of the continental Deccan plateau of ancient crystalline rocks. The Central Highlands, at a general elevation of 1400m and 1800m, is surrounded by two plains, the lowland from the coast to 100m to 150m altitude and the upland from 150m to 500/700m altitude. The upland and highland are composed of crystalline Precambrian rocks. The greater part of the lowland is composed of very strongly metamorphic palaeozoic rocks (Vijayan series). In western Ceylon are also found the Tablowa and Andigama basins with sedimentary rocks of Upper Jurassic age which form a part of the Gondwana system. In the northwest area of Jaffna is a thick belt of limestone from the Lower Miocene age. Lastly along the river valleys and along the coast there are Quaternary deposits (Cooray, 1967; Moermann & Panabokke, 1961; Brink, Andersson, 4 Cederholm, 1970/71; Weninger, 1972).

The climate of Ceylon shows only slight seasonal variations in temperature, air humidity and day length. In the highland the mean average temperature is about 15°C, in the upland about 24°C and in the lowland about 27°C. The yearly amplitudes of the air-temperatures vary between 10°C along the coast, 2°C in the upland and 24°C in the highland. These narrow amplitudes are a result of the influence of the sea and of the cloudiness. The rainfall in the southwest of the island the "wet zone" is very high (between 2000 mm and 7000 mm in average), while in the "dry zone" there occurs a dry season lasting several months. Costa & Starmühlner, 1972 and Weninger, 1972 have already given reports about the physical and chemical conditions in the inland waters, specially the running waters in the upland and highland areas.

Due to their short courses, the brooks, torrents and the rivers of the upland and highland have steep falls, on the average it is 15 p.m., but in the higher regions the falls rises to 50 p.m. These remarkable falls cause high current velocities in the upland and highland between 1m to 2m/sec. In the grove-like pools between the cascades and in the lower parts of the streams in the upland and lowland however: the current reaches only a maximum of 30-50cm/sec.

The formation of the bottom in the running waters is a consequence of the velocity of the current. In the waterfalls and torrents of the highland and upland the bottom is formed of standing, smooth granitic rocks, interrupted by regions with larger and smaller boulders. On the banks and in the pools the bottom is covered by gravel and sand like in the rivers of the lower upland and lowland. In the lower regions of the rivers and streams the bottom is very frequently muddy.

The water temperatures in the running waters of Ceylon increased from the springs and torrents in the highland (between 1800m and 2000m altitude) from 15°C to 22°C and 25°C in the upland and between 25°C and 28°C in the lowland to the coast. The variation between highland waters and the streams near the coast is approx. 13°C. The amplitudes of water temperature changes between day and night is from 4°C-5°C in the highland to 3°C-4°C in the upland

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* 1st Zoological Institute of the University of Vienna, Austria. Section of Malacology.
and only 1°C-2°C in the lowland and the coast. In the crystalline highland and upland the waters are extremely poor in electrolytes, specially poor is the content of CaO and MgO. The total hardness vary in the crystalline zone from 0'08* dH* to 2'35* dH. Otherwise in the regions of limestone of the Lower Miocene and the sediments of the Upper Jurassic the hardness of the waters shows values between 7* dH to 12'9* dH. Exact analysis of the investigated streams are given by Weningger, 1972.

The exploration of the non-marine molluscs of Ceylon was begun a long time back. The collection of shells was at all times very easy and pleasant for the collectors. But till the 20th century in most cases only the shells have been described by the conchologists. However, the shells of freshwater molluscs are very variable, depending on the ecological features of the local aquatic environment. The consequence of this was the description of numerous species of freshwater molluscs from Ceylon only from the shape of the shells, sometimes only from one shell. With the study of the shells of large populations and the anatomy of the soft body parts it was necessary to unite many "species". Descriptions and figures of shells of freshwater gastropods from Ceylon have been made by Reeve, 1848-1878, Deshayes 1854, Dohrn, 1857 and 1858. Very important are the summaries of land- and freshwater shells by Hanley & Theobald, 1876 and Godwin-Austin, 1882-1920. Many descriptions and figures of shells are also to be found in several volumes of the "Conchylie-N-Cabinet" edited by Martini & Chemnitz, for example by Kiiater, 1862; Brots 1874, 1880; Clessin, 1886 and Kobelt 1909 and 1915. A list of the freshwater molluscs of British India, including Ceylon was published by Preston, 1915. Other contributions to the Malacology of Ceylon have been made by Collett 1897 and 1898. Recent studies of shells from Ceylon have been made by Satyamurthi, 1960. Sivalingam, 1949 studied the correlation of some freshwater snails of Ceylon to human schistomiasis. Hubendick, 1951 in his important study about the recent Lymnaeidae gave a revision of the Ceylonese species of Lymnaea. The same author u. 1955 in his investigation about the phylogeny of the Planorbidae gave anatomical comments on Indoplanorbis crassus, occurring also in Ceylon. The special literature concerning freshwater gastropods found in Ceylon is cited in the systematical part describing the different species.

In the following study are described the specimens collected by (1) Austrian Ceylonese Hydrobiological Mission 1970 (Costa & Starmühlner, 1972, Weningger, 1972), (2) Prof. Dr. H. H. Costa and students from the Vidyalankara Campus of the University of Ceylon, Department of Zoology, Kelaniya during 1971 and (3) Swedish Lund University of Ceylon Expedition in 1962, conducted by P. Brinck, H. Anderson and L. Cederholm (Report No. 35 of the Lund University Expedition to Ceylon, 1962)

(2) Material and Methods

The specimens of freshwater snails from the Austrian Ceylonese Mission 1970 were collected by the author qualitatively and quantitatively. The collections of Costa et. al., 1971 and from the Lund University Ceylon Expedition 1962 were taken only qualitatively. The quantitative samples were taken mostly from 1/16m² sometimes from 1/4m². However when the density of the population was very small the collection was counted on 1 m²—and more. The animals were preserved in alcohol 75% for anatomical studies and in Bouin's liquid for subsequent histological studies. The dissections of the snails were executed with a binocular Wild M5 and a drawing tube. For microanatomical and histological studies the snails were sectioned in paraffin and stained with Haemalaun-Eosin. The photographs of the shells were made by Kine-Exakta and the micro-photographs with Reichart Zetopan with KAM ES.

The freshwater gastropods in this study were collected from 100 different localities, mostly running waters, but some were also collected from stagnant waters like pools, irrigated paddy fields, swamps and water reservoirs (tanks). Listed from these localities are 31 species (and subspecies) 28 species are Streptoneura (= Prosobranchia), 3 species are Euthyneura-Pulmonata-Basommatophora. The freshwater bivalves from the cited collections were studied by G. Hadl (Zool. Inst. Univ. Vienna) and will be published elsewhere in this Journal.

* dH : German hardness degree.
**STREPTONEURA (PROSOBRANCHIA)**

Archaeogastropoda

Neritacea

Neritidae

(1) *Neritina (Neripteron) auriculata* LAMARCK, 1816
(2) *Septaria lineata* (LAMARCK, 1816)

Mesogastropoda

Cyclophoracea

Viviparidae

(3) *Bellamya dissimillis* (O.F. MÜLLER, 1774) var. ceylanica (DOHRN, 1857)

Ampullariidae

(4) *Pila globosa* (SWAINSON, 1822)

Rissoacea

Hydrobiidae

Lithoglyphiniae

(5) *Tricula montana* (BENSON, 1842)

Stenothyridae

(6) *Gangetia burmanica* (PRASHAD, 1921)

Bulliminidae (=Bithyniidae)

(7) *Bulimus (=Bithynia) inconspicua* (DOHRN, 1857)
(8) *Bulimus (=Bithynia) stenothyroides* (DOHRN, 1857)
(9) *Mysorella costigera* (KÜSTER, 1852)

Synceridae (=Assimineidae)

(10) *Syncera (=Assiminea) cf. hidalgoi* (GASSIES, 1869)
(11) *Syncera (=Assiminea) cf. woodmasoniana* (NEVILL, 1880)

Cerithiacea

Thiaridae (=Melaniidae)

Melanospinae

(12) *Faunus ater* (LINNÉ, 1758)

Paludominae

(13) *Paludomus (Paludomus) chilinoides* (REEVE, 1847)
(14) *Paludomus (Paludomus) inflatus* (BROT, 1880)
(15) *Paludomus (Paludomus) palustris* (LAYARD, 1854)
(16) *Paludomus (Paludomus) tanzehaureicus* (Gmelin, 1791)
(17) *Paludomus (Philopotamis) tanzehaureicus* (Gmelin, 1791) subspec. *nasutus* (DOHRN, 1857)
(18) *Paludomus (Philopotamis) bicinctus* REEVE, 1852
(19) *Paludomus (Philopotamis) decussatus* REEVE, 1852
(20) *Paludomus (Philopotamis) nigricans* REEVE, 1847
(21) *Paludomus (Philopotamis) regalis* Layard, 1854
(22) *Paludomus (Philopotamis) sulcatus* Reeve, 1847
(23) *Paludomus (Tanalia) loricatus* Reeve, 1847
(24) *Paludomus (Tanalia) neritoides* Reeve, 1847
(25) *Paludomus (Tanalia) solidus* Dohrn, 1857

Thiarinae

Thiareae

(26) *Thiara (Plotia) scabra* (Müller, 1774)
(27) *Melanoides (Melanoides) tuberculata* (Müller, 1774)
(28) *Melanoides (Stenomelania) torulosa* (Bruguère, 1789)

EUTHYNEURA

Basommatophora

Lymnaeacea

Lymnaeidae

Lymnaeinae

(29) *Radix (Cerasina) luteola* (Lamarck, 1822) var. pinguis (Dohrn, 1858)

Planorbidae

Bulininae

(30) *Indoplanorbis exustus* (Deshayes, 1834)

Planorbeinae

Planorbeae

(31) *Gyraulus (Gyraulus) convexicusulus* (Hutton, 1849)

(3) List and Descriptions of the Stations

In this study are described the specimens of freshwater Gastropods collected in 1970 by the Austrian-Ceylonese Hydrobiological Mission, specimens collected by Prof. Dr. H.H. Costa et al. in 1971 and the specimens collected by the Swedish Lund University Expedition to Ceylon in 1962.

The stations of the collections are listed after the Provinces of Ceylon and are also listed by continuous numbers*. These numbers are also to be found in the systematical and anatomical part of this study. (Fig. 1).

3.1 SOUTHERN PROVINCE

Collection Austrian-Ceylonese Hydrobiological Mission 1970

No. 1. FC 7/g/12.11.1970 : Thanipita Dola, a tributary of the Nilwala Ganga, near Deniyaya; torrent running through forest and tea plantations, partially with shadow. Alt. : 600m.; Br.: 3-5m.; D.: 5-20cm.; Curr.: 50cm/sec. (on cascades 1m./sec.), Gr.: pebbles, gravel, sand, some parts with boulders; Te.: 9°: 25.1°C, 12°: 27.3°C; Che.: pH: 6, El 20: 35 U. Siemens, Tot. H.: 1°dH, CaO: 4 mg./l. Species found: *Paludomus (T.) loricatus*, *Thiara (Pl.) scabra*, *Melanoides (M.) tuberculata*.

No. 2.—FC 8/c/13.11.1970 : Nagahaketa Dola, a tributary of the Nilwala Ganga, near Deniyaya; torrent running through forest and plantations, partially with shadow. Alt.: 500m.; Br.: 8-10m.; D.: 5-10cm. (some pools: 30-50cm); Curr.: 50cm-1m/sec., (in pools: 5-10 cm./sec.); Gr.: granitic boulders; pebbles, gravel and sand; Te.: 9°: 24°/2°C 10°: 25°; Che.: pH: 5.8, El 20: 35—U Siemens, Tot. H.: 1°dH, CaO: 2mg./l. species found: *Paludomus (Ph., sulcatus, Paludomus (T.) loricatus, Pludomus (T.) neritoides.*

Fig. 1. Map of Sri Lanka (Ceylon), Indicating Provinces and Main Towns.

Collection COSTA et al., 1971

No. 3: Ambalangoda; Species found: Neritina (Neripteron) auriculata, Septaria lineata, Faunus ater, Paludomus (T.) loricatus.

No. 4. Hakmana; Species found: Bellamya dissirilis v. ceylanica, Pila globosa, Thiara (Pl.) scabra, Melanoides (M.) tuberculata, Indoplanorbis exustus.

No. 5. Matara; Species found: Thiara (Pl.) scabra, Melanoides (M.) tuberculata.

Collection Lund University Expedition 1962,

No. 6. Loc. 24/26.1.1962: Gilcroft, 7.5 mls. SE of Ambalangoda; Alt.: 10m, shallow cultivated valley (paddy fields) with central areas swampy, transversed by a muddy stream, surroundings cultivated, plantations. Species found: Bulimus inconspicua, Melanoides (M.) tuberculata, Redix (C.) luteola v. pinguis, Indoplanorbis exustus, Gyraulus convexiusculus.

No. 7. Loc. 33: 1/29.1.1962: Haycock Mountain, 21 mls. NNE of Galle; Alt.: 325m; ravine with fast-running stony stream; dense indigenous forest with a layer of leaves on the ground and soil rich in humus. Species found: Paludomus (Ph.) regalis.

No. 8. Loc. 169/22.3.1962: Yoda Wewa at Tissamaharama; Alt.: 20m; large water reservoir with much aquatic vegetation. Species found: Bulimus inconspicua, Gyraulus convexiusculus.

3.2 WESTERN PROVINCE

Collection COSTA et al., 1971

No. 10. Kegala; Species found: Neritina (Neritina) auriculata, Bellamyza dissemilis var. ceylanica, Pila globosa, Bulimus inconspicua, Mysorella costigera, Radix (C.) luteola var. pinguis, Indoplanorbis exustus.

No. 11. Horana, Species found: Septaria lineata, Neritina (Neritina) auriculata, Melanoides (Stenomelania) torulosa, Radix (C.) luteola var. pinguis, Indoplanorbis exustus.

No. 12. Tholangamuwa near Warakapala; Species found: Neritina (Neritina) auriculata, Septaria lineata.

No. 13. Agalawatte; Species found: Bellamyza dissemilis var. ceylanica, Thalara (Pl.) scabra, Melanoides (M.) tuberculata.

No. 14. Bertiwala; Species found: Pila globosa, Indoplanorbis exustus, Gyraulus convexusculus.

No. 15. Moratuwa; Species found: Paludomus (T.) loricatus.

No. 16. Minuwangoda; Species found: Melanoides (M.) tuberculata, Radix (C.) luteola var. pinguis, Indoplanorbis exustus.

No. 17. Attanagalla: Bellamyza dissemilis var. ceylanica, Pila globosa, Paludomus (P.) chilinoides, Melanoides (M.) tuberculata, Indoplanorbis exustus.

No. 18. Ratmalana: Pila globosa.


Collection Lund University Expedition 1962 :

No. 20. Loc. 7/11.1.1962: Stream Ja-Ela, 10 mls. NNE of Colombo; Alt.: 1-5m. in the stream Azolla; surrounding cultivated area with paddy fields and coconuts. Species found: Pila globosa, Indoplanorbis exustus.


No. 23. Loc. 17: IV/21.1.1962: Labugama, 24 mls. ESE of Colombo; Alt.: 100-150m. stony stream sheltered by dense forest, outflow from Kalutawawa Reservoir; Species found: Paludomus (T.) neritoides.

3.3 SABARAGAMUWA PROVINCE

Collection Austrian-Ceylonese Hydrobiological Mission 1970

No. 24. FC9/17.11.1970: Bodathpita Ela near Ratnapura, torrent coming from the Bodathpita Ela falls; cascades change with sectors of slight current in pools, surrounding forest and plantations, nearly no shadow at the borders. Alt.: 500m.; Br.: 5-30cm.; D.: 10-50cm. (in pools to 1m. and more); Curr.: cascades: 75cm/sec. to more than 1m/sec; pools: 0-30 cm/sec; Gr.: granitic rocks, boulders, pebbles and sand (on banks and in pools); Te.: 29°: 25 C, 13° 27°C; Che.: pH: 6, Elph: 35 u Siemens, Tot. H.: 1,1°dH, CaO: 2 mg/l. Species found: Paludomus (T.) loricatus, Paludomus (T.) sulcatus, Thalara scabra.

No. 25. FC 10/18.11.1970: Katugas Ela near Ratnapura, torrent with waterfalls in a narrow ravine, forest very shady. Alt.: 450m.; Br.: 1-10cm.; D.: in cascades: 1 cm, in pools: 50cm-1m.; Curr.: in cascades: more than 1m/sec, pools: 30-50cm/sec; Gr.: granitic rocks, boulders, in pools: gravel with sand; Te.: 29°: 25°C, 12°: 25°C; Che.: pH: 5-8, Elph: 29 u Siemens, Tot. H.: 0-6°dH, CaO: 2mg/l. Species found: Paludomus (T.) neritoides.

No. 27. FC 12/120.11.1970: Kalu Ganga before the town of Ratnapura, deep valley, running between forests and plantations. Alt: 60m; Br: 20-30m.; D.: up to 3m in the middle of the stream; Curr.: in cascades more than 1m/sec, on the banks: 0-30cm/sec; Gr.: granitic boulders, gravel and on the banks with muddy sand; Te.: 10°: 28°C; Che.: pH: 7.2; Elg: 46 μSiemens, Tot. H.: 12m, CaO: 6mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 28. FC 13/12/21.11.1970: Upper reaches of Kalu Ganga near Malwala (in the region of Ratnapura), running through plantations, no shade on the shores. Alt: 80m; Br.: 15-20m; D.: 30-50cm; Curr.: 50-75cm/sec, in pools 5-10cm/sec; Gr.: granitic rocks, boulders, gravel, on the stones attached long water-plants floating in the current, banks, and pools with sand and mud; Te.: 13°: 26°C; Che.: pH: 7.2; Elg: 41 μSiemens, Tot. H.: 15°dH, CaO: 6.38mg/l, MgO: 3.6mg/l, SiO₂: 9.7mg/l, Cl: 1.94 mg/l, NO₃: 0.094mg/l, NH₄: 0.16mg/l, PO₄: 0.12mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 29. FC 14/12/22.11.1970: Upper reaches of the Kalu Ganga on the south flank of the Adam's Peak, near Carney Estate (region of Ratnapura), deep ravine, sheltered by dense primary forest, very shady. Alt: 300m; Br.: 2-10m; D.: in cascades: 1-3m, in pools: 30-50cm; Curr.: in cascades: 75cm/sec, and more than 1m/sec in pools 15-20cm/sec; Gr.: granitic rocks and boulders of 1-3m in diameter, gravel, sand; Te.: 9°: 18°C; 12°: 20°C; Che.: pH: 6.7; Elg: 25 μSiemens, Tot. H.: 5°dH, CaO: 2.35 mg/l, MgO: 1.9mg/l, SiO₂: 4.4mg/l, Cl: 1.6mg/l, NO₃: 0.101mg/l, NH₄: 0.08mg/l, PO₄: 0. Species found: *Paludomus (T.) loricatus.*

No. 30. FC 15/12/23.11.1970: Ira Handaha Pana Dola, torrent and a tributary of Kalu Ganga (region of Ratnapura), running through plantations, no shade. Alt: 100m; Br.: 2-4; D.: 10-20cm, in pools: 50cm-1m; Curr.: in cascades: more than 1m/sec, in pools 30-50cm/sec, Gr.: granitic boulders from 50cm to 2m in diameter, gravel, sand, Te.: 9°: 18°C; 12°: 21°C; 17°: 24°C; Che.: pH: 6.6; Elg: 23 μSiemens, Tot. H.: 5°dH, CaO: 2.3mg/l, MgO: 2.3mg/l, SiO₂: 9mg/l, Cl: 1.42 mg/l, NO₃: 0.123 mg/l, NH₄: 0.03mg/l, PO₄: 0.17mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 31. FC 24/12/7.12.1970: Bellihul Oya near the Bellihul Oya Rest-House. A tributary of the Wallawage Ganga, surrounded by forest, on the shores no shade. Alt: 650m; Br.: 5-6m; D.: 50-30cm, in pools: 50cm-1m; Curr.: in cascades: more than 1m/sec, in pools 30-50cm/sec, Gr.: granitic rocks, gravel, sand; Te.: 15°: 21°C; 17°: 24°C; Che.: pH: 7.1; Elg: 34 μSiemens, Tot. H.: 1°dH, CaO: 4.7mg/l, MgO: 3.8mg/l, SiO₂: 11mg/l, Cl: 4.2mg/l, NO₃: 0.071mg/l, NH₄: 0.03mg/l, PO₄: 0.14mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 32. FC 25/8/12.12.1970: Kirikatu Oya, torrent coming from the Horton Plains at World’s End, near Belihuloya, no shade. Alt: 700m; Br.: 5.8m; D.: 20cm.1m; Curr.: 40-50cm/sec, in cascades: more than 1m/sec in pools: 0-20cm/sec, Gr.: granitic rocks, boulders (1-3m in diameter), gravel sand; Te.: 9°: 18°C; 12°: 19°C; Che.: pH: 7.1; Elg: 34 μSiemens, Tot. H.: 1°dH, CaO: 4.7mg/l, MgO: 3.8mg/l, SiO₂: 11mg/l, Cl: 4.2mg/l, NO₃: 0.071mg/l, NH₄: 0.03mg/l, PO₄: 0.14mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 33. FC 30/9/10.12.1970: We Ganga, a tributary of the Kalu Ganga, near Balangoda, running through a deep ravine, surrounded by forests and paddy fields, on the border pools with reeds, muddy and sandy bottom. Alt.: 0°: 9m; Br.: 5-10m; D.: in cascades: more than 1m/sec, pools: 0-30cm/sec; Gr.: granitic rocks, boulders, gravel, on the banks and shores: muddy sand, reeds and rushes; Te.: 9°: 24°C; 12°: 25°C; Che.: pH: 7.2; Elg: 89 μSiemens, Tot. H.: 2.35°dH, CaO: 15°mg/l, MgO: 5°mg/l, SiO₂: 24°mg/l, Cl: 14.82mg/l, NO₃: 0.05mg/l, NH₄: 0.04mg/l, PO₄: 0.17mg/l. Species found: *Bullimus stenothyreoides, Paludomus (P.) tanschauricus* subsp. *nasutus, Paludomus (T.) neritoides, Thliara (PL) scabra, Melanoides (M.) tuberculata.*

No. 34.—FC34/a/26.12.1970: Bibi Oya. a tributary of the Kelani Ganga near Kitulga, surrounded by forests, partially shady. Alt.: 80m; Br.: 6-10m; D.: 10-50cm, in pools:1m; Curr.: 50cm-1m/sec; Gr.: granitic boulders (30cm to 2 m in diameter) gravel sand and on submerged rocks floating water-plants. Te.: 14°: 25°d 16°: 25°8°c; Che.: pH: 6.6; Elg: 33 μSiemens, Tot. H.: 0.71°dH, CaO: 4.48mg/l, MgO: 1.84mg/l, SiO₂: 6.5mg/l, Cl: 2.41mg/l, NO₃: 0.128mg/l, NH₄: 0.08mg/l, PO₄: 0.18mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*

No. 35. FC 37/d/28.12.1970: Kelani Ganga near the Rest House of Kitulga no shade on the borders of the stream, surrounding: forest and plantations, influence of pollution from the Kitulga town. Alt.: 60m; Br.: 30-40m; D.: 30-50cm; Curr.: 50cm-1m/sec; Gr.: granitic rocks gravel sand floating water-plants; Te.: 7°: 24°3°: 94°: 24°3°; 11°: 25°8°; 18°: 2°: 4°c; Che.: pH: 6.6; Elg: 33 μSiemens, Tot. H.: 0.71°dH, CaO: 4.48mg/l, MgO: 1.84mg/l, SiO₂: 6.5mg/l, Cl: 2.41mg/l, NO₃: 0.128mg/l, NH₄: 0.08mg/l, PO₄: 0.18mg/l. Species found: *Paludomus (T.) loricatus, Paludomus (T.) neritoides.*
Collection COSTA et al., 1971

No. 36. Kegalla: Species found: Bellamya dissimilis var. ceylanica, Pila globosa, Paludomus (P.) chilinoides, Thiara seabra, Melanoideas (M.) tuberculata, Indoplanorbis exustus.

No. 37. Ratnapura: Species found: Pila globosa, Melanoideas (M.) tuberculata.

No. 38. Rakawana: Species found: Paludomus (T.) loricatus.

Collection Lund University Expedition 1962.


No. 40. Loc. 93/20.2.1962 : Gilimale; 6 mls NE of Ratnapura. Alt.: 90m, stony stream in hillside cultivated area tea and rubber plantations Species found: Paludomus (T.) loricatus.

No. 41. Loc. 94/20.2.1962 : Carney; 8 mls NE of Ratnapura. Alt.: 300m, foot hills of Adam's peak, above Carney primeval forest torrential, mountain river (see also No. 2601). Species found: Paludomus (T.) neritoides.

No. 42. Loc. 96/22.1.1962 : 5 mls NW of Balangoda. A.t.: 725 m, mountain ravine upper parts with virgin forest, wet and dense; fast-running stream, surroundings: tea estate. Species found: Paludomus (T.) neritoides.

No. 43. Loc. 106/1.3.1962 : Kahawatta; 15 mls SE of Ratnapura. Alt.: 150m, shallow valley, surrounded by tea plantations; Species found: Paludomus (T.) loricatus, Paludomus (T.) neritoides.

No. 44. Loc. 110/3.3.1962 : Karagal Oya; 3 mls ENE of Belihul Oya. Alt.: 600m; stream from Ellamana Mountain (950m) passing a wet ravine with primary vegetation. Species found: Paludomus (T.) neritoides.

No. 45. Loc. 152/7.3.1962 : Kitulgal; 21 mls N of Ratnapura. Alt.:60-150m, valley of the river Kelani Ganga; banks gravel and sand, small stream at 150m. Species found: Paludomus (T.) neritoides.

3.4. CENTRAL PROVINCE

Collection Austrian-Ceylonese Hydrobiological Mission 1970

No. 46. FC 21/c/2.12.1970: Hakagula Dola, a small torrent in the Hakagula Gardens, near Nuwara Eliya, surroundings dense cultivated park-forest, very shady. Alt.: 170m; Br.: 1m; D.: 1-5cm, in pools: 20-100cm; Curr.: 50cm. 1m/sec, in pools 0-10cm/sec; Gr.: gravel and sand, artificial cascades; Te.: 11; 14°9°C, 13; 15 2°C, Che.: pH: 6°9, E; 26; 5 Siemens, Tr.H.: 0°65° dH, CaO: 2°6mg/l, MgO: 27 mg/l, SiO; 133 mg/l, Cl: 2°55mg/l, NO; 0°067 mg/l, NH; 0'2 mg/l P; 0°2mg/l. Species found: Paludomus (Ph.) nigricans.

No. 47. FC 35/c/27.12.1970: Hal Oya near Ginigathena (region of Kitulgal) a tributary of the Kelani Ganga, no shadow at the borders. Alt.: 650m, Br.: 1-5m; D.: 10-50cm in pools: to 1m Curr.: 30-50 cm/sec (Cascades: more than 1m/sec) in pools: 0-20 cm/sec; Gr.: granitic boulders (1-2m in diameter), gravel sand; Te.: 9; 22°5°C, 11; 23°1°C Che.: pH: 6°8, E; 36; 36 Siemens, Tr.H.: 0°82° dH, CaO: 5°15 mg/l, MgO: 2°16 mg/l, SiO; 12°3 mg/l, Cl: 1°99 mg/l, NO; 0°04 mg/l, NH; 0°03 mg/l, P; 0°16 mg/l. Species found: Paludomus (T.) neritoides.

No. 48. FC 36/c/27.12.1970: Rambukoth Oya near Pitawela, a tributary of the Kelani Ganga in a deep ravine, no shadow at the borders. Alt.: 625m; Br.: 5-8m; D.: 5-30cm, in pools: 50cm; Curr.: 30-75 cm/sec, in cascades: more than 1m/sec.; granitic boulders (1-3m in diameter), gravel, sand. Te.: 13; 25°1°C; Che.: pH: 6°7, E; 18°7; 18° Siemens, Tr.H.: 0°36° dH, CaO: 0°89 mg/l, MgO: 1°95 mg/l, SiO; 11°2 mg/l, Cl: 1°7 mg/l, NO; 0°037 mg/l, NH; 0°03 mg/l, P; 0°18 mg/l. Species found: Paludomus (T.) neritoides.

Collection COSTA et al. 1971

No. 49. Kandy; Species found: Bellamya dissimilis var. ceylanica, Pila globosa, Paludomus (P.) chilinoides, Melanoideas tuberculata, Radix (C) luteola var. pinguis, Indoplanorbis exustus.

No. 50. Peradeniya-River, near Kandy; Species found: Paludomus (P.) chilinoides, Thiara (P1) seabra.

Collection Lund University Expedition 1962.

No. 51. Loc. 9/12.1.1962: Kandy. Alt. 600m, sanctuary with indigenous vegetation muddy water reservoir. Species found :Bellamya dissimilis var. ceylanica, Bulimus inconspicuus Melanoideas (M.) tuberculata, Indoplanorbis exustus.
No. 52. Loc. 128/11.3.1962 : Udagala ; 8 mls E of Kandy, Alt.: 450m, exposed slow-flowing stream, a place forming pools, surroundings cultivated area. Species found : Bulimus inconspicua, Paludomus (P.) chilinoides.

No. 53. Loc. 134/12.3.1962 : Stream 2 mls E of Madugoda, 18 mls E of Kandy. Alt.: 800m, small stream in shallow ravine in forest-clad mountain side. Species found : Tricula montana, Bulimus inconspicua, Paludomus (Ph.) nigricans.

No. 54. Loc. 135/12.3.1962 : Stream 20 mls E of Kandy. Alt.: 250m; fairly fast-running is in bush and thin secondary forest. Species found : Paludomus (P.) chilinoides, Paludomus (Ph.) bicinctus, Thiara (Pl.) scabra, Indoplanorbis exustus.

No. 55. Loc. 148/16.3.1962 : 3 mls NW of Hanguranketa, 10 mls E of Kandy. Alt.: 575m; shallow ravine with slow-flowing stream in a coconut plantation. Species found : Paludomus (P.) chilinoides, Thiara (Pl.) scabra.

No. 56. Loc. 135/18.3.1962 : Rambukpoth Oya, 10 mls NW of Hatton. Alt.: 250m; stream in steep ravine with bush and some indigenous vegetation (see also No. 471). Species found : Paludomus (T.) neritoides.

No. 57. Loc. 161/19.3.1962 : Diyagama East, 9 mls SSE of Nuwara Eliya. Alt.: 1800m; small stony stream in a recently cleared ravine at upper border of tea plantation. Species found : Paludomus (Ph.) nigricans.

No. 58. Loc. 162/19-20.3.1962 : Horton Plains; 11 mls SSE of Nuwara Eliya. Alt.: 2000m; stream at edge of remaining forest, bush and meadows. Species found : Paludomus (Ph.) nigricans.

3.5 UVA Province

Collection Austrian-Ceylonese Hydrobiological Mission 1970 :

No. 59. FC 26/8.12.1970 : Veli Oya, a tributary of the Walawe Ganga in the E of Belihul Oya, borders without shadow. Alt.: 700m; Br. : 10-15m ; D. : 20cm-1m; Curr. : 50cm-1m/sec, in cascades : more than 1m/sec, in pools : 0-20cm/sec ; Gr. : granitic boulders (1-3m in diameter), gravel and sand ; Te. : 16°C, 21°C, 20°C ; Chc. : pH : 7, Els : 45 μSiemens, Tot. H. : 13°dH, CaO : 6'5mg/l, MgO : 4'4mg/l, Si02 : 13mg/l, Cl : 1'84mg/l, NO3 : 0'01mg/l, NH4 : 0, PO4 : 0'1mg/l. Species found : Paludomus (T.) neritoides, Thiara (Pl.) scabra, Melanoides (M.) tuberculata.

No. 60. FC 27/9.12.1970 : Kuda Oya, a tributary of the Menik Ganga, near Buttala, surroundings forest, very shady. Alt.: 150m; Br. : 10-15m ; D. : 20cm-1m; Curr. : 30-50cm/sec, in cascades : 1m/sec; Gr. : Gravel, sand and rarely rocks ; Te. : 10°C, 16°C, 25°C ; Chc. : pH : 7, Els : 295 μSiemens, Tot. H. : 9°dH, CaO : 52mg/l, MgO : 28'9mg/l, Si02 : 28'8mg/l, Cl : 7'1 mg/l, NO3 : 0'108mg/l, NH4 : 0'02mg/l, PO4 : 0'11mg/l. Species found : Bulimus inconspicua, Paludomus (P.) chilinoides, Thiara (Pl.) scabra.

No. 61. FC 28/11.1970 : Watakei Ella, an affluent of the Kirindi Ganga, near Wellawaya, a small torrent with calcareous sitters on the stones and rocks, surroundings dense forest, very shady. Alt.: 200m, Br. : 1-2m ; D. : 5-20cm, in pools : to 1m ; Curr. : 30-50cm/sec, in cascades : 1m/sec; Gr. : calcareous rocks, gravel, sand ; Te. : 14°C, 23°C ; Chc. : pH : 8'2, Els : 360 μSiemens, Tot. H. : 11°dH, CaO : 59'4mg/l, MgO : 40'8mg/l, Si02 : 54'8mg/l, Cl : 2'5mg/l, NO3 : 0'101mg/l, NH4 : 0'08mg/l, PO4 : 0. Species found : Paludomus (P.) tanschauriciis subsp. nasutus, Paludomus (T.) solitus.

No. 62. FC 29/9.12.1970 : Dijaluma-falls, coming from the Horton Plains at World's end and fall about 150m, a tributary of the Kirindi Ganga. Alt.: 500m; Br. : 10m ; D. : 1-3cm, in pools : to 50cm; Curr. : more than 1m/sec ; Gr. : granitic rocks, boulders ; Te. : 17°C, 20°C ; Chc. : pH : 6'7, Els : 34 μSiemens, Tot. H. : 0'8°dH, Si02 : 24'8mg/l, Cl : 2'4mg/l, NO3 : 0'35mg/l, NH4 : 0'05mg/l, PO4 : 0'06mg/l. Species found : Paludomus (P.) tanschauriciis subsp. nasutus, Paludomus (T.) neritoides.

Collection COSTA et al., 1971 :

No. 63. Badulla ; Species found : Paludomus (P.) chilinoides, Thiara (Pl.) scabra, Melanoides (M.) tuberculata, Indoplanorbis exustus.

Collection Lund University Expedition 1962 :


No. 65. Loc. 121/7.3.1962 : Monaragala Mountain, 25mls E of Badulla. Alt.: 150m; slow-flowing stream with gravel bottom, surroundings by gardens and paddy fields. Species found : Paludomus (P.) chilinoides.

No. 66. Loc. 140/13.3.1962 : Yalakumbura ; 5 mls SSW of Bibile, Alt.: 450m; fast-running stream in fairly wet ravine, sheltered by bushes and trees, thick layer of debris. Species found : Paludomus (P.) bicinctus, Paludomus (Ph.) decentissatus.
No. 67. Loc. 141/11.3.1962: Adawatte, 7 mls S of Bibile. Alt.: 600 m; a small stream cascading down mountain slope with remains of forest, surrounding tea estate. Species found: Paludomus (Ph.) bicinctus.

No. 68. Loc. 143/14.3.1962: Ury Estate; 6 mls SE of Badulla. Alt.: 1200 m; exposed stream in a shallow ravine with primary forest. Species found: Paludomus (P.) tanschauricus subsp. nasutus, Paludomus (Ph.) bicinctus.

No. 69. Loc. 166/21.3.1962: Diyatalawa, 3 mls N of Hatapatale. Alt.: 1200 m; in a shallow depression of grassland, small streams and marshes. Species found: Melanoides (M.) tuberculata, Radix (C.) luteola var. pinguis, Indoplanorbis exustus.

No. 70. Loc. 167/21.3.1962: Wellawaya, 18 mls S of Badulla. Alt.: 175–200 m; Radapola Oya, a large stream in dry area, sheltered by dense vegetation of bush and plants, shaded by scattered trees. Species found: Paludomus (T.) solidus.

3.6 EASTERN PROVINCE

Collection Lund University Expedition 1962.

No. 71. Loc. 125/8.3.1962: Rambukkan Oya; 25 mls NE of Bibile, Alt.: 25 m; a shallow river with sandy bottom and banks, partly open, partly covered by sedges. Species found: Paludomus (P.) inflatus.

No. 72. Loc. 139/13.3.1962: Kukagala Mountain; 20 mls N of Bibile. Alt.: about 50 m; sandy area, stream sheltered by bush and scattered trees. Species found: Paludomus (P.) chilinoides.

3.7 NORTH-CENTRAL PROVINCE

Collection Austrian-Ceylonese Hydrobiological Mission 1970:

No. 73. FC 31/15.12.1970: Small canal near the temple of Isurumuniya, Anuradhapura; water colour yellowish-brown, polluted, open. Alt.: 80 m; Br.: 50 cm; Curr.: 30 cm/sec.; D.: 50 cm; Gr.: walls of concrete; Temp.: 11°C; Che.: pH: 7; Tot. H.: 7° dH. Species found: Paludomus (P.) tanschauricus.

No. 74. FC 32/15.12.1970: Small stream in a forest, crossed by the road between Habarane and Dambulla, W of Polonnaruwa, very shady. Alt.: 100 m; Br.: 1.5–3 m; D.: 10–50 cm; Curr.: 30 cm/sec.; Gr.: sandy, on the borders are roots hanging and floating in the current; Temp.: 18°C; Che.: pH: 7.75, El: 605 µSiemens, Tot. H.: 12°dH, CaO: 50.9 mg/l, MgO: 15 mg/l, SiO₂: 15 mg/l, Cl: 145.6 mg/l, NO₃: 0.081 mg/l, NH₄: 0.08 mg/l, P₂O₅: 0.18 mg/l. Species found: Paludomus (P.) chilinoides.

No. 75. FC 33/17.12.1970: Border of the Parakrama Tank near the Rest House at Polonnaruwa. Empty shells of Bellamya dissimilis var. ceylanica, Thiaru (Pl.) scabra, Melanoides (M.) tuberculata.

Collection COSTA et al., 1971:

No. 76. Wilpattu: Species found: Bellamya dissimilis var. ceylanica, Bulimus stenothyrodes, Gyraulus convexiusculus var. compressus.

No. 77. Kala Oya; Species found: Thiaru (Pl.) scabra.

Collection Lund University Expedition 1962:

No. 78. Loc. 47/2.2.1962: Wilpattu National Park, intermediate zone, 29 mls NE of Puttalam. Alt.: 75 m; temporary stream in dry secondary scrubland, collected during rainy season. Species found: Paludomus (P.) tanschauricus, Indoplanorbis exustus.

No. 79. Loc. 48/2.2.1962: Maradan Maduwa, Wilpattu National Park; 23 mls W of Anuradhapura. Alt.: 80 m; water reservoir with dense aquatic vegetation in a dry dense secondary forest. Species found: Bulimus inconspicuus, Mysorella costigera, Indoplanorbis exustus, Gyraulus convexiusculus var. compressus.

No. 80. Loc. 50/4.2.1962: Maha Bulankulama; 7 mls SW of Anuradhapura. Alt.: 80 m; large stream (Talawa Oya) in open cultivated area (paddy fields, coconut and banana plantation), in pools with aquatic vegetation. Species found: Bulimus inconspicuus, Mysorella costigera, Melanoides (M.) tuberculata, Gyraulus convexiusculus.

No. 81. Loc. 56/1/8.2.1962: Ritigala, Natural Reserve; 8 mls NW Habarana. Alt.: 500 m; fast-running small stream which emerged as a rhee and came down in cascades under a canopy (isolated mountain, alt. 760 m). Species found: Paludomus (P.) chilinoides, Paludomus (P.) tanschauricus.

No. 82. Loc. 67/11.12.1962: 3 mls S Minneriya. Alt.: 100 m; ravine with small stream sheltered by bush and trees; surroundings secondary, dense, fairly dry forest (Giritale Forest Reserve). Species found: Paludomus (P.) chilinoides, Paludomus (P.) tanschauricus.
No. 83. Loc. 99/11.2.1962: 5 mls E of Habarana. Alt.: 110m; shallow ravine in dense secondary forest, fairly dry; stream (Talkote Oya) with sandy banks; surroundings secondary dry forest. Species found: *Paludomus (P.) chilinoides*.

3.8 NORTH-WESTERN PROVINCE

Collection COSTA et al., 1971:

No. 84. Kurunegala; Species found: *Bellamyia distimills* var. ceylanica, *Pila globosa, Paludomus (P.) chilinoides, Indoplanorbis exustus, Gyraulus convexiusculus*.

No. 85. Narramala; Species found: *Pila globosa, Paludomus (P.) chilinoides, Melanoides (M.) tuberculata*.

No. 86. Batalagoda; Species found: *Bellamyia distimills* var. ceylanica, *Bulimus inconspicua, Melanoides (M.) tuberculata, Radix (C.) luteola var. pinguis, Gyraulus convexiusculus*.

Collection Lund University Expedition 1962:

No. 87. Loc. 36/31.1.1962: Kadainparu; 15 mls N of Negombo. Alt.: 1-5m; estuarine lagoon. Species found: *Faunus ater*.

No. 88. Loc. 37/31.1.1962: Madampa; 20 m N of Negombo. Alt.: 5m; old water reservoir with dense aquatic vegetation. Species found: *Bulimus inconspicua Radix (C.) luteola var. pinguis Indoplanorbis exustus*.

No. 89. Loc. 40/1.2.1962: Mundel Lake; 16 mls N of Chillaw. Alt.: 5m; brackish lagoon with exposed grazed shore. Species found: *Pila globosa. Bulimus inconspicua, Melanoides (M.) tuberculata, Indoplanorbis exustus*.

No. 90. Loc. 42/1.2.1962: 5 mls NNE of Puttalam; Alt. 2-5m; marsh with dense vegetation, at places flooded by river. Species found: *Bulimus inconspicua*.

No. 91. Loc. 45/2.2.1962: 10 mls E of Puttalam. Alt.: 20m; marsh flooded by river after rain surroundings: secondary dry scrub forest. Species found: *Radix (C.) luteola var. pinguis, Gyraulus convexiusculus var. compressus*.

No. 92. Loc. 52/7.2.1962: Deduru Oya; 5 mls NE of Kurunegala. Alt.: 120m; river in open shallow bed, bordered by scattered old trees, bottom and shores sandy, at places rock; surroundings cultivated with coconut and paddy fields. Species found: *Thiara (P.) scabra*.

No. 93. Loc. 53/8.2.1962: Andapolakanda; 3 mls NE of Melsiripura. Alt.: 225m; small fast-running stream in ravine sheltered by old trees and a dense layer of species of Aracea; Umbuwewa Hills with remains of dense indigenous forest. Species found: *Melanoides (M.) tuberculata*.

3.9. NORTHERN PROVINCE

Collection Lund University Expedition 1962:

No. 94. Loc. 73/13.2.1962: Paranthan; 32 mls SE of Jaffna. Alt.: 10m; temporary streams and pools at rainy season, surroundings: open low scrubland. Species found: *Paludomus (P.) tanschauricus*.

No. 95. Loc. 75/14.2.1962: 2 mls E of Mankulam. Alt.: 30m; shallow ravine with small stream, sheltered by dense bush and indigenous secondary dry forest at rainy season. Species found: *Paludomus (P.) tanschauricus*.

No. 96. Loc. 76/14.2.1962: 7 mls E of Mankulam. Alt.: 31m; flooded swampy water reservoir (tank); surroundings: grazes and thin secondary dry forest. Species found: *Bulimus inconspicua, Mysorella costigera*.

No. 97. Loc. 79/14.2.1962: Nanthi Kadal lagoon; 3 mls S of Mullaitivu. Alt.: 5m; brackish, marsh and pools with freshwater inshore: paddy fields. Species found: *Bulimus inconspicua, Indoplanorbis exustus*.

No. 98. Loc. 82/15.2.1962: 2 mls E of Paraiyanalanukulam, 20 mls W of Vavanaya. Alt.: 20m; small stream with sandy banks; surroundings, dense secondary dry forest at places glades with grass and plants. Species found: *Paludomus (P.) tanschauricus*.

No. 99. Loc. 86/15.2.1962: Nay Aru at Pallamadu; 10 mls E of Mannar. Alt.: 5m; flooded river in open grass land, mainly salt meadow. Species found: *Gangetia burmanica, Syncera (= Assiminea) hidalgoi, Syncera (= Assiminea) of woodmasoniana, Gyraulus convexiusculus var. compressus*.

3.10. Collection from COSTA et al., without locality (1971)

No. 100. Ceylon; Species found: *Paludomus (P.) palustris*. 
4 SYSTEMATIC-ANATOMICAL PART
STREPTONEURA (=PROSOBRANCHIA)
Archaeagastropoda
Neritacea
Neritidae

(1) *Neritina (Neripteron) auriculata* LAMARCK, 1826


**Localities.** Southern Province: No.3 (10 ind.); Western Province: No. 10 (12 ind.), No.11 (6 ind.) No.12 (1 ind.).

**Shell.** All individuals of the subgenus *Neripteron* in the samples belong to *Neritina (Neripteron) auriculata*. After a letter of Mr. Henk H. MIENIS (Dept. of Zoology, Section Mollusca, the Hebrew University of Jerusalem, Israel), recognized specialist of Neritidae, all Ceylonese specimens of *auriculata* have generally been referred to the subspecies or infraspecies *layardi*, REEV,1856. But in the opinion of Mr. MIENIS there is hardly any difference from *N. auriculata* s. str. from the Indo-Malayan Archipelago.

The semi-globar shell is with a flat base; 1-1 1/2 whorls with growth striae in semi-circles, crossed by finer spiral lines. Colour brownish to olivaceous with darker brown or violet reticulations or flames, mostly on the oldest part; aperture large, half-moon shaped; the broad peristome ends in two "wings" or "auricles" at the upper and lower columellar sides; margin of columella a little arcuate in the middle and minutely toothed (20-23); yellowish-white. The individuals of No.10 (Kelaniya) correspond to the var. *rostrata* REEV, 1856 (Conch. Icon. : f. 151, figured also by TRYON, 1888 on pl.21, fs.61,62): the shell is smaller than by *auriculata* s. str. and var. *layardi*. Juvenile shells with well developed "wings"; adult shells have only small "wings" (corrosion?).

<table>
<thead>
<tr>
<th>No. 10 Kelaniya</th>
<th>Adult shells (Fig. 2, Plate II)</th>
<th>Juvenile shells; (Fig. 2, Plate II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes (in mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length :</td>
<td>17'8</td>
<td>15'6 15'4</td>
</tr>
<tr>
<td>Diameter :</td>
<td>11'2</td>
<td>10'4 10'3</td>
</tr>
<tr>
<td>Height :</td>
<td>8'1</td>
<td>7'6 6'8</td>
</tr>
<tr>
<td>Index L : D :</td>
<td>62'8% 66'6%</td>
<td>66'8% 83'3%</td>
</tr>
<tr>
<td>Index L : H :</td>
<td>45'5% 48'7%</td>
<td>44'1% 44'1%</td>
</tr>
</tbody>
</table>
The indices of Length: Diameter decreases from juvenile to adult shells. It shows that the “wings” are smaller-in-relation—by adult shells than by juvenile shells. This variation in form and size depends on the surface of stones, where the snails are fixed.

No. 3 (Ambalangoda; Fig. 3, Plate II)

Sizes (in mm):

<table>
<thead>
<tr>
<th></th>
<th>13</th>
<th>12'5</th>
<th>12</th>
<th>10'3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>10</td>
<td>9'3</td>
<td>9'1</td>
<td>3'2</td>
</tr>
<tr>
<td>Height</td>
<td>5'2</td>
<td>5'5</td>
<td>5</td>
<td>4'6</td>
</tr>
<tr>
<td>Index L : D</td>
<td>76'9%</td>
<td>74'4%</td>
<td>75'8%</td>
<td>79'6%</td>
</tr>
<tr>
<td>Index L : H</td>
<td>40%</td>
<td>44%</td>
<td>41'6%</td>
<td>44'6%</td>
</tr>
</tbody>
</table>

The specimens from No. 3 (Ambalangoda), No. 11 (Horana) and No. 12 (Tholangamuwa, near Warakapola) belong to the var. layardi REEVE, 1856 (Conch. Icon.: f. 104, 105, also figured by TRYON, 1883 on pl. 21, f. 63). These shells are much more broader like the juvenile shells of var. rostrata in consequence of the well developed “wings”.

No. 11 (Horana; Fig. 4, Plate II)

Sizes (in mm):

<table>
<thead>
<tr>
<th></th>
<th>12</th>
<th>10'3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>10'2</td>
<td>8'1</td>
</tr>
<tr>
<td>Height</td>
<td>4'5</td>
<td>4'2</td>
</tr>
<tr>
<td>Index L : D</td>
<td>85%</td>
<td>78'6%</td>
</tr>
<tr>
<td>Index L : H</td>
<td>37'5%</td>
<td>40'7%</td>
</tr>
</tbody>
</table>

The sizes given are from the biggest specimens in the samples.
Operculum. Semilunar with a sinuous columellar side and with right hand nucleus; along the exterior edge is a narrow brown-horny margin. On the back side are two apophyses; the lower one is conical with a rounded top and the upper one is sharp, sickle shaped and with an acute free top (sizes from an individual of No. 10: 7.2 mm x 4.16 mm; Fig. 5).

Anatomical remarks. Descriptions of the anatomy of Neritina (Neripteron) auriculata (including var. lecontei, REEVE, 1855/56) are given by STAR MUHLNER 1969 and 1970. The radula of the specimens from No. 11 (Horana) shows a central-tooth more elongated than broad with a small cutting edge and without denticles. The first lateral tooth is very long and narrow, with two cusps on the outside, the 4th lateral tooth in the shape of a triangle with a broad cutting edge forming 8–10 denticles. The marginal-teeth are with 5–8 small denticles (Fig. 6).

Neritina (Neripteron) auriculata; Fig. 5: operculum; Fig. 6: radula teeth; Fig. 7: female reproductive system and spermatophore; ag: albumen gland, bcp: bursa copulatrix, csa: crystal sac, cp: capsule gland, od: oviduct, r: rectum, rcs: receptaculum seminis, sp: spermatophore, vag: vagina; Fig. 8: tentacle, penis and penis sheath of male.

The female reproductive organs possess a big bursa copulatrix, filled with small, rolled up spermatophores (Fig. 7). The male shows a very twisted vas deferens conducting in a broad ductus ejaculatorious surrounded by the prostate gland. It opens into a small penis covered by the penis sheath on the left side of the right tentacle (Fig. 8).
Ecological-biological remarks: Neritina (Neripteron) auriculata settles in the lower parts of streams below the stones near the borders in a current between 20-50cm/sec. The snails tolerate slight brackish water in the mouths of the streams during high-tide. The eggs are found under stones, sometimes also on the shells of other water-snails. Their food consists of algae, growing on the stones.

Distribution: Coastal areas of the Indo-Pacific Islands: from Madagascar, Ceylon to the Malayan and Philippines Islands and most of the Pacific Islands.

(2) Septaria lineata (LAMARCK, 1816)


Localities. Southern Province: No. 3 (33 ind.); Western Province: No. 11 (7 ind.), No. 12 (2 ind.).

Shell. All shells found belong to Septaria lineata (LAMARCK, 1816). After the opinion of Henk H. MIENIS who also examined the specimens, it is apparent that those from No. 3 and No. 11 are very close to a form of lineata, which was described by LAMARCK in 1816 as tessellata. They are somewhat broader than the "typical" lineata. As this is probably due to ecological factors (form of settling area?) it is not necessary to give them an intraspecific name. The same is found in the case with the animals from No. 11. These shells are however more slender than "typical", lineata this is due to the fact they are living on small waterplants. Such shells were described under several names like entrecasteauxi RECLUIZ, livesay DOHRN, picturata GARRETT, but BENSON'S name compressa is the oldest! However it is the opinion of MIENIS that it is not necessary to give an intraspecific name to these specimens.

The shells are symmetrical cap-like with the apex at the posterior side. Posterior margin straight, anterior rounded. The ground colour is yellowish-green, with longitudinal dark lines, near the border the lines dissolve to a reticulate pattern of flames or zigzag lines. The aperture is very large with a rather narrow, little concave septum.
No. 3 (Ambalangoda; var. tessellaria; Fig. 9, 10, Plate III)

Sizes (in mm.):

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Diameter</th>
<th>Height</th>
<th>Index L : D</th>
<th>Index L : H</th>
</tr>
</thead>
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<tr>
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<tr>
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<td>62.5%</td>
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<tr>
<td></td>
<td>10.7</td>
<td>6.4</td>
<td>2.7</td>
<td>60%</td>
<td>25%</td>
</tr>
</tbody>
</table>

No. 11 (Horana; var. tessellaria, Fig. 11, 12, Plate II)

Sizes (in mm.)

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Diameter</th>
<th>Height</th>
<th>Index L : D</th>
<th>Index L : H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.1</td>
<td>10.1</td>
<td>3.7</td>
<td>65.8%</td>
<td>24.5%</td>
</tr>
<tr>
<td></td>
<td>14.3</td>
<td>9.7</td>
<td>3.2</td>
<td>67.8%</td>
<td>22.3%</td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td>9.6</td>
<td>3</td>
<td>68.5%</td>
<td>21.4%</td>
</tr>
</tbody>
</table>
No. 12 (Tholangamuwa var. *compressa*; Fig 13, Plate II)

**Sizes (in mm.)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Length</td>
<td>11'1</td>
</tr>
<tr>
<td>Diameter</td>
<td>5'2</td>
</tr>
<tr>
<td>Height</td>
<td>2'5</td>
</tr>
<tr>
<td><strong>Index L : D</strong></td>
<td>46'8%</td>
</tr>
<tr>
<td><strong>Index L: H</strong></td>
<td>22'5%</td>
</tr>
</tbody>
</table>

The sizes given are from the biggest specimens in the samples. In comparing the indices Length : Diameter of the shells from No. 3 and 11 with No. 12 the difference between the var. *tesselaria* and the var. *compressa* are seen. The var. *tesselaria* was found on stones and rocks, the slender var. *compressa* was found on the small leaves of water-plants.

**Operculum.** Irregularly squarish with two straight sides and two sides with pointed lobes. Along the shorter of the two straight sides there is a broad triangle with radiating ridges (No. 12 ; size 4 mm x2.2 : mm, Fig. 14).

**Anatomical remarks.** Descriptions of the internal anatomy of *Septaria* were made by BOURNE, 1908 (Proc. Zool. Soc. London, 1908 : 810) and by STARMÜHLNER, 1969 and 1970 for *Septaria borbonica*. Radula with slender central tooth, cutting edge without denticles, the first lateral tooth elongate-rectangular, the 4th lateral tooth with a serrate cutting edge consisting of many small denticles (Fig. 15). The female reproductive system is very similar to *S. borbonica*. The spermatophores are long and slender (Fig. 16).

**Ecological-biological remarks.** Like *N. (Neripteron) auriculata* found in the lower parts of the streams, mostly not very far from the mouth. Only the specimens of No. 12 were from the inside of the lowland of the Western Province. The snails prefer strong to moderate current (50 cm-1m/sec) and are found settled on the surface of stones and rocks, sometimes on floating water-plants (No. 12). The eggs are deposited on stones or on the shells of other specimens. The snails feed on algae, growing up on the stones and water-plants.

**Distribution.** South-India, Ceylon, Malay Archipelago, Philippines, New Guinea, Western Australia and Pacific Islands.

Mesogastropoda

Cyclophorea

Viviparidae

(3) *Bellamya dissimilis* (O.F. MÜLLER, 1774) var. *ceylanica* (DOHRN, 1857)

114


Septaria lineata; Fig. 14: operculum. Fig. 15: radula teeth, Fig. 16: female reproductive system and spermatophore; abbreviations like in Fig. 7.


Localities. Southern Province: No. 4 (5 ind.) Western Province: No. 10 (38 ind.) No. 13 (58 ind.), No. 17 (5 ind.), Sabaragamuwa Province: No. 36 (3 ind.) Central Province: No. 49 (3 ind.), No. 51 (10 ind.) North Western Province: No. 75 (40 empty shells), No. 76 (9 ind.), No. 84 (2 ind.), No. 86 (3 ind.)

Shell. According to NEVILL, 1884 (p. 27), KOBEIT, 1909(p.292) and PRASHAD, 1928 (p. 163) Bellamya ceylanica belongs to the group of the Indian B. dissimilis. According to KOBEIT, 1909 (p.284) this specific name is also a synonym of B. remossi (KÜSTER (not PHILIPPI), 1852). The same opinion has also been expressed by PRESTON, 1915 (p. 87) and ANNANDALE, 1921 (p.243). But KOBEIT, 1909 states that B. dissimilis is not a well described species and FRAUENFELD 1864 (p.600) and REEVE, 1863 (pl.9, f.56) state that the locality of the type described by MÜLLER.
is not known. His original description of 1774 was very short "Nerita dissimilis testa subovato acuminata, luteo-albescente, labro niger" NEVILLE, 1884 takes as the type of B. dissimilis the shell, figured by HANLEY and THEOBALD, 1876 on pl. 77 figs. 2,3 in the Conchologica Indica. KOSELT, 1909 did not agree with this opinion. He pointed out that MÜLLER 1774 gave the description of "labrum nigrum" for the type. This characteristic is typical for a form from South-India, described by FRAUENFELD, 1862 as B. variata. NEVILLE 1884, places variata as a variation of B. dissimilis ; B. dissimilis var. variata with subvar. ceylanica. After our studies of the shells and of the internal anatomy we agree with PRASHAD, 1928 that the form occurring in Ceylon is Bellamya dissimilis var. ceylanica.

The shell is ovately conical, rather solid, greenish-olive with 6 flatly-convex whorls, more or less flatly angled above and below (var. ecarinata of HANLEY and THEOBALD 1876 is a nearly ecarine shell with rounded whorls and painted with a narrow, brownish, to blackish, subperipheral band on the last whorl). The whorls are everywhere closely spirally and linearly striated and punctured obtusely keeled at the angles. The umbilicus is narrow bordered by a keel. The aperture is pyriformly broad-ovate, black edged and with black polished labrum (Fig. 17 Plate III)

| No. 4 (Hakmana) Apex eroded .. | .. | 18'8 | 14'4 | 9'5 | 8 |
| No. 10 (Kelaniya) .. | .. | 21'4 | 17 | 11'5 | 10 |
| No. 13 (Agalawatte) Apex eroded .. | .. | 26'2 | 17'8 | 12'2 | 10 |
| No. 36 (Kegalla) .. | .. | 20 | 14'4 | 11'2 | 9 |
| No. 49 (Kandy) .. | .. | 19'3 | 14'9 | 9'2 | 7'4 |
| No. 51 (Kandy) .. | .. | 17 | 13 | 9'5 | 7'7 |
| No. 75 (Parakrama Tank) (Fig.17) .. | .. | 26'3 | 19'1 | 12'8 | 11 |
| No. 76 (Wilpattu) .. | .. | 17 | 14 | 9'8 | 8 |
| No. 84 (Kurunegele) .. | .. | 13'6 | 11 | 8 | 6'1 |

The sizes are for the biggest shells in the samples.
Operculum. Broad-ovate, horny, with a subcentral nucleus and concentrical growth-rings (No.72 Size: 11mm × 9mm; Fig. 18, 19 (Plate III).


The radula of the specimens, investigated from our collections, possesses a central tooth with a trapezoid outline. The cutting edge bears one broad central denticle and 5 smaller denticles on either side (5-1-5). The lateral tooth consists of a quadrilateral portion with its base prolonged on one side. On the cutting edge are 4 small cusps on the inner portion, a big central denticle and 4 outside denticles (4-1-4). The inner and outer marginals possess 7, and 14 small denticles respectively. (Fig. 20). Nervous system: The cerebral ganglia are long-oval in outline and united by a short but broad commissure. From the outside to the inner area escapes the n. opticus, n. tentacularis and 5 nerves to the region of...
mouth and lips and the cerebrobuccal-connective. The pleural ganglia are approximated to the cerebral ganglia, being connected to them by very short connectives. The right pleural ganglion gives rise to the thick n. suprareintestinalis, the left gives rise to the left pallial nerve and the long and slender n. subintestinalis. These nerves cross each other, and are separated by the oesophagus (Fig. 21). The sexes are separate and the females-like all Viviparidae are viviparous. From the ovarium in the upper whorls, extends a small oviduct to the posterior edge of the mantle cavity, Entering into the mantle cavity it extends in to a broad tube-receptaculum seminis, forming a loop with two sides. Into the smaller side

Fig. 22: *Bellamya dissimilis* var *ceylanica*; female reproductive organs; ag: albumen gland, br: gill, es: exhalent siphon, fg: food groove, is: inhalent siphon, mw: mantle wall, os: osphradium, ov: oviduct, r: rectum, rs: receptaculum seminis, ur: ureter, ut: uterus, penis, vag: vagina  Fig. 23. male reproductive organs; abbreviations as in Fig. 22; and pe: te: testis, v.d. Vas deferens.
opens the big albumen gland. The proximal part of the receptaculum section of the lower oviduct opens abruptly to the big uterus. In the uteri of mature females 10-14 embryos in different stages of development are always found. The uterus opens into a short vaginal papilla near the right (ex-halant) siphon of the mantle cavity (Fig. 22).

The testis of the male form a big bean-shaped complex of yellowish-reddish colour situated on the right part of the floor of the mantle cavity. The vasa efferentia-in two separate ducts-unite after rising from the posterior part of the testis to form vas deferens. It enters into the mantle wall in the centre of the floor of the mantle cavity and runs, surrounded by the glandular cells of the prostate, forward to the right tentacle. This tentacle is longer than the left tentacle and serve as a penis (Fig. 23).

Like all Viviparidae, the genus Bellamya is partially filter feeding. On the right side of the mantle wall lies a small groove with ciliar-and glandular cells (food-groove). The collected material (by ciliary feeding of the gill in connection with the hypobranchial gland) is carried down in the food groove to the propodial region in front of the snout, from where it may be raked into the gut by the radula (Fig. 24).

Ecological-biological remarks. B. dissimilis var. ceylanica inhabits sandy-muddy bottoms of stagnant waters like pools, ponds, water reservoirs (tanks) and also found living on the borders of slow-running streams in the lowland, where this species can be very frequent. The females are viviparous and bear young snails the whole year round. They feed on algae and debris covering the muddy bottom. Sometimes the snails filter the microplankton from the respiratory water currents.

**Distribution.** India, Burma (var. ceylanica : low-and upland of Ceylon).

Ampullariidae.

(4) *Pila* (Pilo) globosa (SWAINSON, 1822)


Localities. Southern Province : No. 4 (12 ind.) ; Western Province : No. 10 (31 ind.), No. 14 (18 ind.), No. 17 (4 ind.), No. 18 (4 ind.), No. 19 (9 ind.), No. 21 (5 ind.) ; Sabaragamuwa Province : No. 36 (6 ind.) No. 37 (5 ind.) ; Central Province : No. 49 (3 ind.) ; North Western Province : No. 84 (16 ind.), No. 85 (1 ind.), No. 89 (6 ind.).

Shell. The types of the species of the genus Pila found in Ceylon have been described only after the shells. But like in all species of Ampullariidae the shell of Pila is extremely variable in form. After examining the series of shells land the anatomy of the soft bodies it is now concluded that all species of Pila described from Ceylon belong to the variable Indian species Pila (P.) globosa (SWAINSON, 1822).

In the collections of COSTA et al., 1971 and the Lund University Expedition 1962 Pila (P.) globosa was represented mostly by the var. carinata, described by SWAINSON, 1829 from Ceylon. At 2 localities (No. 17 (Attanagala) and No. 37 (Ratnapura) the shells are similar to the var. moesta (REEVE, 1856), the shells of No. 10 (Kelaniya) are closer to the var. layardi (REEVE, 1856) and some shells of smaller sizes, also from No. 10 (Kelaniya) looks very similar to the var. alucinans (SOWERBY, 1910) and var. tischbeini (DOHRN 1858). But all these shell connections are connected by transition forms.

The shell of var. carinata is round, globose, thick, with 5 whors like the var. typica of P. globosa, but it is more or less carinated near the suture; flatly angled at the upper part of the whorl so as to present a narrow shelf. The colour is yellowish-olive with narrower and broader bands, specially in young shells. In the older shells the bands disappear sometimes. Aperture ovate, adult shells with thickened lip, tinged with yellow (Fig. 25, Plate IV).
### Sizes (in mm.):

<table>
<thead>
<tr>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ht.</strong></td>
<td><strong>Diam.</strong></td>
</tr>
<tr>
<td><strong>Ht.</strong></td>
<td><strong>Diam.</strong></td>
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<table>
<thead>
<tr>
<th>No. 4 (Hakmana)</th>
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<th>37</th>
<th>37'7</th>
<th>20</th>
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<tbody>
<tr>
<td>No. 14 (Beruwala)</td>
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<td>46'5</td>
<td>42</td>
<td>35'2</td>
<td>23</td>
</tr>
<tr>
<td>No. 20 (Ja-Ela) (Fig. 25)</td>
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<td>50</td>
<td>43'4</td>
<td>38</td>
<td>24'8</td>
</tr>
<tr>
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<td>. .</td>
<td>35'5</td>
<td>32</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>No. 36 (Kegalla)</td>
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<td>52</td>
<td>47</td>
<td>41'5</td>
<td>27'5</td>
</tr>
<tr>
<td>No. 84 (Kurunegla)</td>
<td>. .</td>
<td>40</td>
<td>37</td>
<td>32'1</td>
<td>19'5</td>
</tr>
<tr>
<td>No. 85 (Narramala) young specimens!</td>
<td>. .</td>
<td>35'8</td>
<td>30'8</td>
<td>28'6</td>
<td>12'6</td>
</tr>
<tr>
<td>No. 89 (Mundel-Lake)</td>
<td>. .</td>
<td>49'2</td>
<td>42'2</td>
<td>36</td>
<td>22</td>
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</table>

- The shells of var. *maesta* are ovately globose narrowly umbilicated, the spire is rather exerted the whorls are slightly flattened at the upper part then rounded and smooth the colour is dull olive encircled with narrow darker bands, the aperture is lunar-ovate the lip yellowish-white within.

### Shell

<table>
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<th>Sizes (in mm.)</th>
<th>Shell</th>
<th>Aperture</th>
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</thead>
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<td><strong>Diam.</strong></td>
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<tr>
<td><strong>Ht.</strong></td>
<td><strong>Diam.</strong></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>No. 17 (Attanagalla)</th>
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<th>33'5</th>
<th>28'3</th>
<th>24</th>
<th>14'7</th>
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<tbody>
<tr>
<td>No. 37 (Ratnapura)</td>
<td>. .</td>
<td>36'4</td>
<td>31</td>
<td>26'3</td>
<td>17'5</td>
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</tbody>
</table>

- The shells of var. *layardi* are rather compressly globose, the whorls narrowly flatly impressed round the upper part then rounded smooth, shining; umbilicus small contracted ; aperture ovate, whitish covered with an olive horny epidermis ; several darkbrown narrow and broad bands specially on young shells (Fig. 26, Plate IV.)
### Shell Aperture Sizes

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<thead>
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</thead>
<tbody>
<tr>
<td>No. 10 (Kelaniya) (Fig. 26)</td>
<td>44'6</td>
<td>40'6</td>
<td>33'4</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>38</td>
<td>31</td>
<td>19'5</td>
</tr>
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</table>

The juvenile shells of this locality (No. 10, Kelaniya) correspond to the small var. *alucinans* with altitudes between 23'5 and 28mm. From the same area, but from another locality in Kelaniya are some smaller shells corresponding to the var. *tischbeini*: ovate-globose, solid, 5 whors with impressed suture the upper part flatly angled, then rounded; typical for these variations is a prominent riblike striation of the shell, formed by the growth lines; colour olive with some bands not very distinct (Fig. 27, Plate III).

### Shell Aperture Sizes

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</thead>
<tbody>
<tr>
<td>No. 10 (Kelaniya) (Fig. 27).</td>
<td>33</td>
<td>28</td>
<td>24</td>
<td>17'2</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>29</td>
<td>24'3</td>
<td>18'3</td>
</tr>
<tr>
<td></td>
<td>32'5</td>
<td>28</td>
<td>25</td>
<td>17'5</td>
</tr>
<tr>
<td></td>
<td>31'5</td>
<td>26'7</td>
<td>23'2</td>
<td>16'8</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.

*Opeclum.* Ovate, outside horny, inside calcareous. Sizes: var. *carinata*: No. 4: 27'7mm x 16mm, No. 14: 34mm x 18mm, No. 26: 35mm x 22mm, No. 21: 25'1mm x 14'5mm, No. 36: 35mm x 21'5mm, No. 84: 30'2mm x 16'7mm, No. 89: 33mm x 19mm; var. *layardi*: No. 10: 30'7mm x 17'7mm (Fig. 28, 29, Plate IV); var. *tischbeini*: No. 10: 22'4mm x 13'5mm (Fig. 30; Plate III); var. *moesta*: No. 17: 22'2mm x 13'5mm.

Anatomical remarks. A detailed study of the anatomy of *Pila (P.) globosa* has been given by PRASHAD, 1925 and HAGLER, 1923 has studied *Pila (P.) cinerea* (REEVE, 1856) a species, which is considered by SOWERBY, 1910 to be also a variation of *Pila (P.) globosa*. A further anatomical study of a species of the genus *Pila* was also given by STARMÜHLNER 1969, who described the anatomy and histology of the Madagassian *Pila (P.) cecillei* (PHILIPPI, 1848) in comparison with the results of PRASHAD and HAGLER.
The radula of *Pila (P.) globosa* var. *carinata* from Ceylon is very similar to the figures of radulae given by ANNANDALE, 1921 (Rec. Ind. Mus. Calcutta 22:7) for *Pila (P.) globosa* (typica) from India and by STARMÜHLNER, 1969 (Malacologia 8(1/2):126, f. 169) for *Pila (P.) cecillei* from Madagascar: the central tooth is trapezoid in outline. The base is cut into on both sides. The cutting edge shows one broad central cusp and two lateral denticles on either side (2-1-2). The lateral tooth is from a quadrilateral form prolonged on the base, the formulae of the denticles is 1-1-2, the inner and outer marginals have only two prominent cusps (Fig. 31).

Ecological-biological remarks. *Pila (P.) globosa* is found in the lowland and in the upland and is a typical inhabitant of stagnant water, like the pools, ponds, water reservoirs (tanks), irrigated paddy fields, sometimes also found living on the muddy borders of slow-running streams. They prefer waters with a dense growth of water-plants, like *Azolla* and other species. The species occurs also in slightly brackish waters of lagoons like in No. 89 (Mundel-Lake). If the water disappears in dry season the snails dig in to the mud or move on land to other places. *Pila* has a type of taenioglossa radula with strong cusps to feed on water plants cutting parts from the submerged stems and blades.

![Fig. 31. *Pila globosa*; radula teeth.](image)

**Distribution.** India, Ceylon.

Rissoacea

Hydrobiidae

Lithoglyphinae

(5) *Tricula montana* BENSON, 1843


**Locality.** Central Province: No.53 (1 ind)–First record for Ceylon.

Shell. Minute, conical-ovate, 6 whorls moderately rounded, suture impressed, smooth, colour olive-brown; apex blunt umbilicus narrow; aperture oblique-ovate but acutely pointed posteriorly, peristome continuously moderate reflexed, blackish (Fig. 32, Plate III).
--- | --- | --- | --- | ---
No. 53 (Madugoda) Fig 32, Plate III | .. | 3 | 1'25 | 1 | 0'8

**Operculum.** Horn, paucispiral.

**Anatomical remarks.** In the collection of the Lund University Expedition 1962 there was only one specimen of this species for which reason it was not possible to dissect the soft body part without destroying the shell. In the literature the radula is figured by ANNANDALE, 1924 (Amer. J. Hygiene (Monogr. Ser.), 3:247,279, text fig.4A) from a specimen from India.

The internal anatomy of species of *Tricula* from Thailand has been described by DAVIS, 1968 (Arch. Moll., 98 (5/6): 291-317). The anatomy of *T. montana* is unknown.

**Ecological-biological remarks.** Known only from mountain-streams in India (Bhim-Valley on stems of water iris and Jhiri-Valley (N-Cachar) in Assam) and now from Central Ceylon. In No. 53 (Madugoda) at 800m. altitude in a small stream in forest-clad mountain side.

**Distribution.** India (Bhim-Valley), Assam (Jhiri-Valley); Central Ceylon.

Stenothyridae

6. *Gangetia burmanica* (PRASHAD, 1921) subspec. ?

**Lit.** 1921 Astenothyra burmanica (PRASHAD and ANNANDALE, Rec. Ind. Mus., 22:135; pl. 16, figs.1-12).

**Locality.** Northern Province: No. 99(35 ind).

**Shell.** After a letter from Mr. H. SCHÜTT (Düsseldorf-Benrath; Germany), a recognized specialist for Rissoacea, the shells are attached to the Stenothyrid *Gangetia burmanica* described by PRASHAD, 1921 from the coast of the Arakan Mountains in Burma.

The specimens from Ceylon may be perhaps a new subspecies, but the material on adult specimens in the sample is too small to arrive at definitive conclusion.

The minute shells have creamy-white colour and are ovate with a bluntly apex; 6 whorls, suture deeply impressed somewhat canaliculate and only slightly oblique. The first whorls are very minute, the third a little more than half of the fourth while the penultimate whorl is more than twice as broad as the fourth. The body-whorl is large inflated and dorsal view trumpet-shaped. Aperture oblique-ovate, but acutely pointed posteriorly. Peristome continuous and only slightly thickened with a rather broad callus; on the body-whorl spiral pitted lines are marked (Fig. 33 Plate III).

Sizes (in mm.):

<table>
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<tbody>
<tr>
<td>No. 99 (Nay Aru) Fig. 33 Plate, III</td>
<td>..</td>
<td>2'8</td>
<td>1'5</td>
<td>1</td>
<td>0'75</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimen of the sample. The type has an altitude of 1'5 mm and a diameter of 1 mm. (PRASHAD, 1921: p. 136).

**Operculum.** Corresponds in outline with the aperture; thin, transparent, paucispiral with subcentral nucleus

On the inner surface are the two diverging ridges which are very difficult to recognize (Fig. 34).

**Anatomical remarks.** Back and head of the soft body is greyish, the long and slender foot is lightly greyish and, pointed behind. A few minute blackish spots are found on the mantle lobe. Proboscis is long and truncate, tentacles long and filiform, the eyes are situated on the outside of the bases of the tentacles (Fig.36). Radula: central-tooth form trapezoid outline with long slender prolongations on both sides of the base; the cutting edge with a prominent central cusp and two smaller denticles on either side (2-1-2) on the base 2-3 denticles on either side. The lateral-tooth with the denticles on either side. The lateral-tooth with the denticle-formula 2-1-4 and the inner and outer marginals with 7, resp. 5 small denticles (Fig 35).
The male with a thick, coiled penis in the middle of the neck; inside a single duct (Fig. 36).

Gangetia burmanica. Fig. 34: exterior of operculum, Fig. 35: radula teeth, Fig. 36: male with the coiled penis behind the neck.

Ecological-biological remarks. The snails occur in slightly brackish water near the coast. The locality No. 33 (Nay Aru) in North Ceylon was a flooded river, crossing salt meadows. The animals feed on microscopic algae, like diatoms.

Distribution. Locus typicus: coast of the Arakan-Mountains in Burma, perhaps also on other similar biotopes on the coast of the Gulf of Bengal; North-Ceylon.

Bulininidae (= Bithyniidae)

(7) Bulimus (= Bithynia) inconspicua (DOHRN, 1857)


Localities. Southern Province: No. 6 (6 ind.) No. 8 (24 ind.), No. 9 (5 ind.) Western Province: No. 10 (2 ind.); Central Province: No. 51 (6 ind.), Nr. 52 (3 ind.), Nr. 53 (1 ind.); Uva Province: Nr. 60 (1 ind.); North-Central Province No. 79 (5 ind.), No. 80 (36 ind.) ; North-Western Province No. 86 (8 ind.), No. 88 (14 ind.), No. 89 (4 ind.), Nr. 90 (16 ind.); Northern Province: No. 96 (10 ind.), No. 97 (3 ind.).

Shell. Oblong-conically, fragile, transparent, spire acute, 4-5 convex whorls, weak striated in spiral lines (lens 1); white to brown; aperture oblong but acutely pointed posterior. In shape the shell of this species is nearly allied to the common European B. tentaculata but differing in sizes. The whors are rounder and broader in proportion to the height and flatter than in B. orcula and the whole form is more conical. There are some shells with transitions to B. stenothyroides, but the typical inconspicua is smaller in size and more conical with a spire more elevated (Fig. 37, 38, Plate III)
Sizes (in mm.):  

<table>
<thead>
<tr>
<th>No.</th>
<th>Size</th>
<th>Height</th>
<th>Diameter</th>
<th>Height</th>
<th>Diameter</th>
</tr>
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<tr>
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<td>Gilcroft</td>
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<td>Yoda Wewa</td>
<td>5'4</td>
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</tr>
<tr>
<td>9</td>
<td>Wirawila</td>
<td>5'4</td>
<td>3'8</td>
<td>3'1</td>
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<tr>
<td>10</td>
<td>Kelaniya</td>
<td>5'6</td>
<td>3'6</td>
<td>3</td>
<td>2'4</td>
</tr>
<tr>
<td>51</td>
<td>Kandy</td>
<td>5'3</td>
<td>3'7</td>
<td>3</td>
<td>2'3</td>
</tr>
<tr>
<td>52</td>
<td>Udawela</td>
<td>5'2</td>
<td>4</td>
<td>2'7</td>
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<tr>
<td>60</td>
<td>Kuda Oya</td>
<td>4'8</td>
<td>3'5</td>
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<td>2'1</td>
</tr>
<tr>
<td>79</td>
<td>Wilpattu</td>
<td>4'2</td>
<td>3'6</td>
<td>2'7</td>
<td>2'2</td>
</tr>
<tr>
<td>80</td>
<td>Maha Bulankulama (Fig. 37)</td>
<td>5'3</td>
<td>3'7</td>
<td>3</td>
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</tr>
<tr>
<td>88</td>
<td>Madampe</td>
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<td>3'3</td>
<td>2'3</td>
<td>1'8</td>
</tr>
<tr>
<td>89</td>
<td>Mundel Lake</td>
<td>5'1</td>
<td>3'6</td>
<td>3</td>
<td>2'4</td>
</tr>
<tr>
<td>90</td>
<td>Puttalam (Fig. 38)</td>
<td>5</td>
<td>3'5</td>
<td>2'8</td>
<td>2'3</td>
</tr>
<tr>
<td>96</td>
<td>Mankulam</td>
<td>5'1</td>
<td>3'6</td>
<td>2'6</td>
<td>2'1</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.

Fig. 39. Bulimus inconspicua; exterior of operculum.

Operculum. Oblong-ovate, pointed posteriorly; horny-calcareous, concentric striatious (Sizes: No. 80:3mm x 2'2 mm; Fig. 39).

Between the dissected specimens of *B. inconspicua* and *B. stenothyroides* no differences are to be recognized. Some remarks on the internal anatomy are given below on *B. stenothyroides*.

**Ecological-biological remarks.** *Bulimus inconspicua* (and *stenothyroides*) inhabits swamps, pools, ponds, water reservoirs (tanks) and the borders of slow-running streams with muddy bottom, and which are rich with debris. They occur in Ceylon from the coast to the low-and upland (to 800m). The shells are mostly encrusted with mud and filiform algae. The snails feed on algae and organic matter. The genus *Bulimus* partially filters the respiratory water with the gills. (SCHÄFER, 1952, 1953 a, b, LILLY, 1953).

At one locality (No. 89, Mundel Lake, 16 mls. N of Chilaw) *B. inconspicua* was found in a brackish lagoon with exposed grassy shores.

**Distribution**: Coast, low and upland of Ceylon.

(8) *Bulimus (=Bithynia) stenothyroides* (DOHRN, 1857)


**Localities.** Sabaragamuwa Province : No. 33 (7 ind.) ; North-Central Province : No. 76 (14 ind.).

**Shell.** It is noted above that in the same populations are to be found transitions in the form of the shells between the typical *B. inconspicua* and the typical *B. stenothyroides*. The latter is in the typical form bigger in size and more ovate, the last whorl is bulging and blowing up, the spire is shorter; the 4–5 whorls are convex, the colour is whitish to brownish-transparent, smooth, under a lens fine spiral striations could be recognized. The aperture is oblong-ovate, but acutely pointed posteriorly. PRESTON, 1915 (p. 74) notes, that this species has some characters of a "*Stenothyra*": the last whorl is for a *Bulimus (=Bithynia)-unusually great, the aperture is somewhat contracted, but the general aspect is that of *Bulimus (=Bithynia)* (Fig. 40, Plate V).

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Ht.</th>
<th>Diam.</th>
<th>Ht.</th>
<th>Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 33 (We Genga) (Fig. 40)</td>
<td>6'6</td>
<td>5</td>
<td>3'8</td>
<td>2'8</td>
</tr>
<tr>
<td>No. 75 (Wilpattu)</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimen in the samples.

**Operculum.** Oblong-ovate, pointed posteriorly, horny-calcareous, concentric striated (Size No. 39 : 4 mm x 3'2 mm ; Fig. 41).

**Anatomical remarks.** Radula: central-tooth with trapezoid outline, prolonged on the base on either side, cutting edge with 3 central cusps and 3 smaller denticles on each side (3–3–3) ; on the base 3 small denticles on either side. The lateral with the denticle formula of 2–2–3, the central cusp is bifurcate. Inner and outer marginals with 17, resp. 11 denticles (Fig. 42). Nervous system: Big ovate cerebral ganglia, from the outside escapes the n. opticus, n. tentacularis the cerebro-buccal-connective and two ramified nerves to the mouth and lips (by the male also one to the penis). The pleural-and the sub-and suprainingestinal ganglia are attached to the base of the cerebral ganglia. Cerebral and pleural ganglia are connected with thick, but very short connectives to the broad-ovate pedal ganglia (Fig. 43). The male possesses a prominent penis with an accessory gland, containing a long rolled up flagellum. In the penis duct is also the lower part of the vas deferens (Fig. 44).
Ecological-biological remarks. *B. stenothyroides* is found in similar biotopes like *B. inconspicua*, but this species was much more rare in the samples. In the locality No. 33 (We Ganga,), a branch of the Kalu Ganga, near Balangoda this species occur near the border of the stream on stones, covered with mud. The frequency was 3-5 ind./dm² (!) in a current of 10-30cm/sec. Other ecological factors were: temperature: 24.7° to 25.6°C (10.12.1970), pH: 7.2, El₂₀: 89, p: Siemens, Total hardness: 2.35°dH, CaO: 15.6mg/l, MgO: 5.7mg/l.

Distribution.—South-India (Nilgiris Distr., Madras State); Ceylon.

*Bulimus stenothyroides*. Fig. 41: exterior of operculum. Fig. 42: radula teeth, Fig. 43: nervous system, abb. as in fig. 21, Fig. 44: male with penis and accessory gland, br: gill, as exhalent siphon, ih: inhalent siphon, os: osphradium, pe: penis, r: rectum.

(9) *Mysorella costigera* (KÜSTER, 1852)

Lit.—1852 *Paludina costigera* (KÜSTER (non BECK) in MARTINI & CHEMNITZ, Syst. Conch. Cab. 1 (21) : 33 ; pl. 7, fs. 18, 19)–1852 *Valvata sulcata* (EYDOUX & SOULEYET, Voy. “BONITE”, Zool., 2 : 517 ; pl. 31, fs. 19-21) 1876 *Bithynia costigera* (HANLEY & THEOBALD, Conch Ind. : 60 ; pl. 151, f. 10, after the authors it is possible that *Cyclostoma gradatum* PFÉIFFER, 1854 (Zool. Proc. 1854 : 303) and *Turbo marginatus* CHEMNITZ are indentical with this species)–1884 *Bithynia costigera* (NEVILL, Handl. Ind. Mus. Calcutta, 2 : 42, with var. curta)–1915 *B. (?Fossarulus) costigera* (PRESTON, F. Br. Ind. (Freshw. Gastr. & Pelec.) : 78, no 156)–1919a *Mysoria (?Fossarulus) costigera*
JFRESHWATER GASTROPODS:


Localities. Southern Province: No. 9 (1 ind.) ; Western Province: No. 10 (1 ind.) ; North-Central Province: No. 79 (2 ind.), No. 80 (3 ind.) ; Northern Province: No. 96 (1 ind.).

Shell. Small, rigid, gyroform to conical-ovate, spire moderate elevated with 5-6 stairstep-shaped depressed, convex whorls, prominent spiral edges, crossed by weaker vertical ridges; the penultimate whorl bulging and blowing up; umbilicus open. Aperture oblique-circular, slightly extended, peristome continuously thick (Fig. 45, Plate V).

<table>
<thead>
<tr>
<th>Sizes (in mm)</th>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 9 (Wirawila) (Fig. 45)</td>
<td>7 3</td>
<td>6 3</td>
</tr>
<tr>
<td>No. 10 (Kellaniya)</td>
<td>7</td>
<td>5 6</td>
</tr>
<tr>
<td>No. 79 (Wilpattu)</td>
<td>5 8</td>
<td>4 6</td>
</tr>
<tr>
<td>No. 80 (Maha Bulankulama)</td>
<td>6 7</td>
<td>5</td>
</tr>
<tr>
<td>No. 96 (Mankulama)</td>
<td>6 9</td>
<td>5 5</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.

Operculum. Calcareous nucleus situated spirally, than concentrically (Size: No. 80:3'1 mm x 2'6 mm; Fig. 46).

Anatomical remarks. The internal anatomy of M. costigera has been described SESHAIYA, 1930 (Rec. Ind. Mus. Calcutta, 32:28) after specimens from India. Radula of an individual of No. 80: central tooth with one prominent central cusp and 4 denticles on either side (4-1-4), on the base of the trapezoid tooth on either side 3 fine basal denticles. The lateral tooth with the denticle formula of 3-1-3. The inner and outer marginals with a sawlike cutting edge formed by 25-30 resp. 12 very small denticles (Fig. 47).
Ecological-biological remarks. It is a rare species found in the stagnant waters of the lowland (pool, ponds, water reservoirs) with muddy bottom and dense vegetation. The shells are mostly eroded and covered with filiform algae.

Distribution.—India (Bengal, Bangalore); Ceylon.

Synceridae

(10) Syncera (= Assiminea) cf. hidalgoi (GASSIES, 1869)


Locality.—Northern Province: No.99 (40 ind.).

Shell.—The recorded shells from No. 90 probably belongs to Syncera (Assiminea) hidalgoi (GASSIES, 1869): moderately conical, solid colour yellowish white to brown but somewhat shining and transparent finely sculptured by the growth lines, crossed by still more delicate spiral lines (lens 50 x !). The top is smooth, but whorls 2,3, and 4 with some raised spiral lines (clearly recognizable on the shells from No. 99), after the fifth whorl these lines fade away and there is no sutural thread. The 6 whorls are rapidly increasing somewhat convex suture distinct but not deep periphery rounded. The narrow umbilicus is open. Aperture oblique-oval with rounded base and pointed top, the peristome is nearly continuous, the parietal side as callus against the previous whorl, exterior margin somewhat thickened, columellar margin thick, flattened and expanded (Fig. 48, Plate V).

<table>
<thead>
<tr>
<th>Sizes (in mm)</th>
<th>Ht.</th>
<th>Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 99 (Nay Aru) (Fig. 48)</td>
<td>2'5</td>
<td>2'1</td>
</tr>
</tbody>
</table>

The size is from the biggest specimen in the sample.

Operculum. Thin corneous paucispiral with excentrical nucleus, the inner surface with a small thin slightly curved apophyse, incised on free end (Size: No. 99: 1'1mm × 0'8mm; Fig 49).

Syncera (Assiminea) cf. hidalgoi Fig. 49 : interior and exterior of operculum, Fig. 50 : radula teeth.
Anatomical remarks. The animals do not have-like all Synaceridae (=Assiminesidae)-true tentacles, but instead, two short stunted eyestalks in which are embedded the round black eyes. There are no gills and respiration is by means of a lung which opens to the right side of the mantle (see also AEBOT, 1948, Bull Mus. Comp. Zool., 100 (3) : 281-282). The central tooth of the radula is trapezoid in outline. On the cutting edge with one central cusp and two denticles on either side (2-1-2); on the base are 3-4 fine basal denticles. The lateral shows the denticule formula 2-1-2, the inner and outer marginal with 4, resp. 7-8 denticles (Fig 50). This type of radula found in the dissected specimens of No.99 differs from the drawing of the radula of Paludinella hidalgoi given by STARMÜHLNER 1970 (p. 60, f.52) from a specimen from New Caledonia. But the radula is very is similar to the drawing of a radula from Syncera (=Assiminea) abbotti (BRANDT, 1968, Arch. Moll., 98 (5/6) : 262-263, f. 32) from Thailand.

Ecological and biological remarks. At No. 99 (Nay Aru) found in brackish water of a flooded river, crossing a salt meadow near the coast. Lives associated with Gangetic burmanica and Syncera (=Assiminea) cf. woodmasoniana.

Distribution. Syncera (=Assiminea) hidalgoi is known from the brackish shores of the Indian and Pacific Ocean between Mauritius and New Caledonia.

(11) Syncera (=Assiminea) cf woodmasoniana (NEVILL, 1880)


Locality. Northern Province: No. 99 (48 ind).

Shell.—Adult shells are attached to Syncera (=Assiminea) woodmasoniana, described from Lower Bengal by NEVILL 1880. They are high-conical and rather solid, the colour changes from yellowish to chestnut-brown, the apical whorls are somewhat reddish. The surface is smooth and shining with oblique, darker growth lines and very delicate spiral lines (lens, 50x!). Near the periphery of the last whorl is in typical shells, described by NEVILL, 1880 and figured by BENTHEM-JUTTING, 1956, f. 66 a distinct raised spiral thread. But the shells from locality No. 99 bear the threads, below the periphery of the last whorl. Each succeeding whorl is pressed collar-like against the preceding whorl. Part of the previous whorl shines through, so that a false margin is formed along the suture. 7 whorls regularly increasing in diameter, form an ideal cone with nearly flat sides. Suture shallow, periphery rounded, only in immature shells bluntly angular. The apex is pointed, but not sharp, the base rounded. The umbilicus is nearly closed, the aperture is oblique oval with rounded base and pointed top. The parietal side of the continuous peristome is pressed against the penultimate whorl. The exterior margin is sharp, the columellar side is almost vertical, thickened and flattened (Fig. 51, Plate V).

<table>
<thead>
<tr>
<th>Size (in mm.)</th>
<th>Ht.</th>
<th>Diam.</th>
<th>Ht.</th>
<th>Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 99 (Nay Aru) (Fig. 51)</td>
<td>3'2</td>
<td>2</td>
<td>1'3</td>
<td>1</td>
</tr>
</tbody>
</table>

The sizes are from the largest shells in the sample.

Operculum. Thin, horny, oval with round base and a pointed top, paucispiral with excentrical nucleus (Size : No. 99 : 1'1mm. x 0'6mm. ; Fig. 52).

Anatomical remarks. 2 short stunted eyestalks with round eyes. The snout short and with blackish pigmentation. A deep oblique furrow in the flesh on each side of the body divides the head and body from the lower foot (Fig. 53). Radula : central tooth squarish with a long handle-shaped process at the lower margin ; the denticule-formula on the cutting edge is 2—1—2, also 2 very small basal denticles on either side of the base. The lateral has 3—1—3 denticles. The inner and outer marginals are with 7—8, and 20 denticles (Fig. 54) respectively.

The penis of the male is coiled and coloured before the free end and consists of only one simple duct. (Fig. 55).
Syncera (Axtiminea) cf woodmasoniana. Fig. 52: exterior of operculum, Fig. 53: Snout, eyestalks and oblique furrow in the flesh of each side of the body, Fig. 54: radula teeth, Fig. 55: penis.
Ecological and biological remarks:—The habitat of the snails from locality No. 99 (Nay Ari) was brackish water in a flooded river, crossing a salt meadow. The snails were found associated with Syncera (Assiminea) cf. hidalgoi and Gametia burmanica.

Distribution.—Lower Bengal (Calcutta, Fort Canning, Chandipal), Andaman Islands, Amsterdam Island in Djakarta Bay (Malay Archipelago). Probably first record for Ceylon.

Cerithiacea

Thiaridae (Melanidae)

Melanopsinae

2. *Faunus ater* (Linnd., 1758)


Localities. Southern Province : No. 3 (15 ind.) ; Western Province : No. 19 (3 ind.), North-Western Province : No. 87 (3 ind.).

Shell. High turreted with long and regular spire, thick ; colour dark-brown; whorls flat with shallow suture and fine undulating growth striae crossed by a few strong and numerous fine spiral lines. Aperture vertical, broad-oval, with a distinct sinus at upper and lower end ; peristome outer margin with an incision at the upper corner, then protracts and recedes again towards the basal margins which are somewhat thickened and often with yellow reddish colour (Fig. 57, Plate VI).

The var. *perdecollata* NEVILL, 1884 is a form characterized by strong decollation, erosion of the surface and ironrust reddish colour of the peristome (Fig. 56, Plate VI.).

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Ht.</th>
<th>Shell Diam.</th>
<th>Aperture Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 3 (Ambalangoda var. <em>perdecollata</em> (Fig. 56, Plate VI))</td>
<td>69</td>
<td>19</td>
<td>18.5</td>
</tr>
<tr>
<td>No. 19 (Panadura var. <em>perdecollata</em>)</td>
<td>64.5</td>
<td>20.5</td>
<td>18.5</td>
</tr>
<tr>
<td>No. 19 (Panadura var. <em>perdecollata</em>)</td>
<td>66</td>
<td>19</td>
<td>18.8</td>
</tr>
<tr>
<td>No. 19 (Panadura var. <em>perdecollata</em>)</td>
<td>50.8</td>
<td>17.7</td>
<td>15</td>
</tr>
<tr>
<td>No. 15 (Panadura var. <em>perdecollata</em>)</td>
<td>50.3</td>
<td>16.5</td>
<td>15</td>
</tr>
<tr>
<td>No. 87 (Kadaimpani) (Fig. 57, Plate VI)</td>
<td>66</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>No. 87 (Kadaimpani) (Fig. 57, Plate VI)</td>
<td>64</td>
<td>17.8</td>
<td>17</td>
</tr>
<tr>
<td>No. 87 (Kadaimpani) (Fig. 57, Plate VI)</td>
<td>63.2</td>
<td>18.2</td>
<td>17.5</td>
</tr>
</tbody>
</table>

The sizes are form the biggest specimens in the samples.
Operculum. Horny, ovoid with the nucleus at the base, the growth striae are subspiral (Size: No. 3: 17 mm × 12.5 mm; Fig. 58; Plate VI).

Anatomical remarks. Radula: Central tooth with broad trapezoid outline, on the cutting edge with a prominent broad central cusp and 3 small denticles on either side (3-1-3). The lateral tooth with the denticles formula 1-1-3, the inner and outer marginals with 3 resp. 4 denticles; both marginals have thin “wings” on either side (Fig. 59). This type of radula is very similar not only to the radula type of the genus Melanopsis (STARMOHLNER, 1970 Cah. O.R.S.T.O.M., sér. Hydrobiol., 4 (3/4): 73, f. 88-90) but also to the radula type of the genus Melanatria (STARMOHLNER, 1969, Malacologia 8(1/2): 167, f. 220).

The dissected female shows, like the genus Melanopsis (STARMOHLNER, 1970, Cah. O.R.S.T.O.M., sér. Hydrobiol. 4 (3/4): 75, f. 92) and the genus Melanatria (STARMOHLNER, Malacologia, 8 (1/2): 176, f. 234) in the pallial cavity an open ciliated groove as oviduct separated by a fold from an other groove, the open duct of the receptaculum seminis (Fig. 60). The tentacles are long and slender and coloured with blackish and yellowish rings. The mantle edge possess many very small fringes.

Ecological-biological remarks.—In the coastal areas in fresh and slightly brackish water (No. 87, lagoon), living on mud flats which run dry during low tide. The females are oviparous.


Faunus ater. Fig. 59: radula teeth. Fig. 60: mantle cavity opened to show the lower parts of the open female ducts, a: albumen gland, br: gill, f: flange bordering edge of the left wall of the pallial oviduct, fi: fold, fo: female opening, gr: groove in the right side of the foot or: oviduct, r: rectum, res: receptaculum seminis.

Paludominae

(13) Paludomus (Paludomus) chilinoides REEVE, 1847

**fulguratus**


**Localities.** Western Province: No. 17 (1 ind.); Sabaragamuwa Province: No. 36 (48 ind.); Central Province: No. 49 (22 ind.), No. 50 (80 ind.), No. 52 (13 ind.), No. 54 (5 ind.), No. 55 (12 ind.); Uva Province: No. 60 (6 ind.), No. 63 (49 ind.), No. 64 (9 ind.), No. 65 (77 ind.); Eastern Province: No. 72 (4 ind.), North Central Province: No. 74 (39 ind.), No. 81 (4 ind.), No. 82 (1 ind.), No. 83 (1 ind.); North Western Province: No. 84 (1 ind.), No. 85 (26 ind.).

**Shell.** Ovate rather thin spire small, exerted, 5 whorls depressed round the upper part, smooth. The chief variation of form consists in the whorls being more or less depressed around the upper part, after the manner of a *Chilina*, with spire varying considerably in its elevation. Mostly the whorls of the apex are eroded and there remains only 2-3 whorls. Colour yellow-brown to olive, spotted or waved with one or more rows of dots. The markings are very variable, sometimes oblique zigzag lines, extending over the whole surface of the whorls, sometimes sagittate or short zigzag spots in transverse series. Some specimens are of a uniform olive to dark green or the coloration is masked by a thick layer or black iron-oxide. Aperture broad-ovate, top pointed, base rounded, peristome continuous, at the parietal side as callus, thick and expanded. Umbilicus closed (Fig. 61-64, Plate V & VI).  

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Ht.</th>
<th>Diam.</th>
<th>Ht.</th>
<th>Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 17 (Attanagala) Apex eroded</td>
<td>21'3</td>
<td>14'6</td>
<td>15'3</td>
<td>12</td>
</tr>
<tr>
<td>No. 36 (Kegalla) Apex eroded</td>
<td>20'1</td>
<td>12'8</td>
<td>13</td>
<td>10'4</td>
</tr>
<tr>
<td>No. 49 (Kandy) Apex eroded</td>
<td>18'7</td>
<td>12'6</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>No. 50 (Peradeniya) Apex eroded</td>
<td>20'2</td>
<td>13'3</td>
<td>13'5</td>
<td>10'4</td>
</tr>
<tr>
<td>No. 65 (Mannaragala Mount.) Apex eroded</td>
<td>20'2</td>
<td>14'3</td>
<td>13</td>
<td>10'1</td>
</tr>
<tr>
<td>No. 72 (Kokagala Mount.) Apex eroded</td>
<td>18'5</td>
<td>14'7</td>
<td>13'3</td>
<td>10'5</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.
Operculum. Horný, ovoid; the outside border concave, base rounded; nucleus submedian left; subspiral, than concentric growth striae. At the inner surface, the region of the nucleus is distinctly marked by stairlike deposited growth lines (Size: No. 50.95mm/10mm × 6.67mm Fig. 65, Plate V.)

Anatomical remarks. SESHAIYA, 1934 (Rec. Ind. Mus. Calcutta, 36:185-212, 15 figs.) has given a detailed study on the anatomy of Paludomus (Paludomus) tanschauricus (GMELIN 1791). The internal anatomy of dissected specimens of Paludomus (Paludomus) chilinoides from Ceylon correspond with the results of SESHAIYA, 1934. Following are some accounts: Head tentacles and surface of the foot are darkbrown to olive with interspersed yellow spots arranged in transverse rows. The sole of the foot is of a light greyish colour and yellow spotted (Fig. 66, Plate VI).

The anterior part of the mantle has a broad greyish-white area behind the darker pigmented mantle edge. The mantle surface varies in colouration in different parts: in the male at the right side the male genital duct is of an orange colour, in the female the lower part of the oviduct is coloured greyish-white to creamy. Over the ctenidial region the mantle has a bluish-greenish appearance. On the lower end of the penultimate whorl is the pericardium and the termination of the style sac, as a translucent spot. In the female the ovary in the first and second whorl is composed of greyish tubes with interspersed yellow patches. In the male the corresponding whorls are occupied by the testis with an orange-reddish colour (Fig. 67, Plate VII).

The mantle edge possesses 15-17 finger-like processes. If the snails are moving these processes are extended in to the water and project forwards (Fig. 66, Plate VII).

The digestive system begins with the mouth in the form of a vertical split at the end of snout. The buccal mass, including the oral cavity, the pharynx with radula and cartilages is pyriform and surrounded by the musculus circularis on the oral part and the musculus levator pharyngis on either side of the pharynx. The salivary glands are long, slender and somewhat coiled. They enter below the cerebral commissure on the dorsal side of the pharynx where they open into the buccal cavity. The radula sac is short and slightly coiled (Fig. 68). Radula: central tooth with a broad trapezoidal outline. The base protrudes in the middle, the cutting edge bears one broad central cusp and 3-4 denticles on either side (3/4-1-3/4). The quadrilateral lateral tooth with a prolonged base possesses 4-5 denticles. The inner and outer marginals are somewhat spatulate in shape and bears 7-10, resp. 15-17 small denticles (Fig. 69). This type of radula agrees with the radula of Paludomus (P.) tanschauricus described by SESHAIYA 1934, p.195, fig.7) and the radula of Paludomus (P.) obesa figured by ANNANDALE, 1919 (Rec. Ind. Mus. Calcutta, 16:139-152). The radulae of the genus Paludomus, subgenus Paludomus shows also a close resemblance to the radulae of the genus Cleopatra and its species in Africa and Madagascar (STARMÜHLNER, 1969 Malacologia 8(1/2): C. colbeau: p.189, f. 247: C. madagascariensis and C. grandidieri: p. 204 fs. 266 and 270).

The esophagus is long and slender and stretches in the floor of the mantle cavity to the bean-shaped stomach with the style sac. The stomach shows in the cavity some folds forming a major and minor typhlosole in front of the gastric shield (Fig. 70). The intestine, after coming from the stomach, forms two loops before the rectum enters into the right outside part of the mantle cavity (Fig. 68).

The kidney is greyish to yellow in colour and is situated at the apex of the body whorl. The anterior 4/16 projects into the mantle cavity and is triangular in shape. The aperture is placed on the right side. The pericardium, including ventricle and auricle, lies between kidney and style sac. (Fig. 71). The gill consists of about 200 lamellae, which are triangular in shape (Fig. 71, 72).

The nervous system agrees with the description and the figure of Paludomus (P.) tanschauricus given by SESHAIYA, 1934 (p. 200, f. 10). From the oval cerebral ganglia which are connected by a short, thick commissure, arises seven nerves (n. tentacularis, n. opticus, 3 n. labialis and the connective between cerebral and buccal ganglion). A further, very thin nerve goes to the statocyst. The pleural ganglia are very closely approximated to the cerebral ganglia, only connected by short connectives. From the right pleural ganglia arises the suprainterintestinal connective and the right pleural nerve. The subintestinal ganglion is attached to the left pleural ganglion. From this ganglion arises the left pallial nerve and
Paludomus (Paludomus) chilinoides. Fig. 68; digestive systems; in : intestine, mc : musculus circularis, mph : musculus levetor pharyngis, oes : oesophagus, r : rectum, rs : radula sac, sg : salivary gland, St : stomach with crystal style sac) Fig. 69 : radular teeth. Fig. 70 : Stomach and crystal style sac opened to show the folds in the cavity and the gastric shield ; gsh : gastric shield, in : intestine, oes : oesophagus, r : rectum, sty : styl sac Fig. 71 : Mantle cavity of female : br : gill, dg : digestive gland, fl : flap, gr : groove at the right side of the foot, in : intestine, kd : kidney, Fig. 72 : 3 lamellae of the gill.

then. columellaris. From the subintestinal ganglion arises the connective to the visceral ganglion crossing the supraintestinal connective from the right pleural ganglion to the supraintestinal ganglion. From the subintestinal ganglion arises also a short nerve to the right side connecting with the right n. pallialis which is typical dialineurie (Fig. 73). The somewhat elongated pedal ganglia are connected by connectives of moderate length with the cerebral and pleural ganglia (Fig. 73).

In comparison with the nervous system of the genus Cleopatra (STARMÜHLNER, 1969; p. 196 f. 257, and p. 204, f. 271) the nervous system of Paludomus is very similar to it and confirms the close relationship of these two genera.
**Paludomus (Paludomus) chilinoides.** Fig. 73: nervous system; di: dialineuric, lcgl: left cerebral ganglion, lplgl: left pleural ganglion, no: nervus opticus, nt: nervus tentacularis, pgl: pedal-ganglia, rcgl: right cerebral ganglion, rplgl: right pleural ganglion, sbgl: subintestinal ganglion, spgl: suprainestinal ganglion. Fig. 74: Reproductive system of a female, shown from the outside; cfu: ciliated furrow, covered by a fl: flap, ov: ovary (lower part; efferent ducts), rs: receptaculum seminis, ut: uterus with albumen gland in the upper part and the capsule gland in the lower part of the walls. Fig. 75: Reproductive system of a female seen from inside; abbreviations like fig. 74 and dg: digestive gland, me: fringed mantle edge. Fig. 76: Reproductive system of a male, shown from inside; cfu: ciliated furrow, guarded by a fl: flap, pe: penis, pgl: penis gland, tes: testes, vd: vas deferens, vs: vesicula seminalis.
The female reproductive system consists of the ovary, oviduct, uterus, vagina, receptaculum seminis and in the lower part a ciliated furrow, guarded by a flap, conducting to a small groove on the right outside of the foot. The ovary consists of branched tubules. They are prolonged into small efferent ducts, which join in the oviduct. It runs on the columellar side of the digestive gland and enlarges on entering into the mantle cavity-into a thick walled uterus. The last forms, on the right side of the mantle cavity, a s-shaped loop and passes into the vagina. Near the opening of the vagina in the ciliated furrow, guarded by a thin flap, is also the opening of the sac of the receptaculum seminis (Fig. 74, 75). The formation of the female reproductive organs agrees with the description and figures of *Paludomus tanschauricus*, given by SESHAIYA, 1934 (Rec. Ind. Mus. Calcutta, 36 : 206-209, f. 14). They are also very similar to the conditions found by STARMÜHLNER, 1969, Malacologia 8 (1/2) : 196 f. 159 for the Madagascan species of the Genus *Cleopatra*.

The micro-anatomy of the female ducts of *Paludomus* is given for *Paludomus (Tanalia) neritoides*. (p. 153). There are no differences in the macro- and micro-anatomy of the reproductive system of the different species of the genus *Paludomus* examined. The male reproductive system consists of the testis, the vas deferens, the enlarged vesicula seminalis, the penis with an accessory gland and a ciliated furrow-like in the female-guarded by a thin flap. The testis consists of fine tubular follicles, from these ducts arises the vasa efferentia and lead to the vas deferens. The last runs on the columnellar sides somewhat coiled, in the right part of the mantle cavity. Entering into the roof of the mantle cavity, the vas deferens enlarges abruptly into the vesicula seminalis. These vesicula shows on the inside some furrows bordered by thick walls. These furrows allied to one ciliated furrow on the opening of the vesicula. Near these openings lies a sac-like gland conducting a small duct-the penis-to the mantle border. The furrow is bounded by a thin, small flap, which overlaps on to the outside of the vesicula seminalis (Fig. 76). This again corresponds with the, of *Paludomus (P.) tanschauricus*, described and figured by SESHAIYA, 1934 (p. 203-206, f. 12). In comparison with the genus *Cleopatra*, *C. colbeaui* from Madagascar (after the description from STARMÜHLNER, (1969), p. 198, 199) shows that the lower part of the male duct (called "prostata"-with glandular cells) opens into the posterior part of the mantle cavity and the furrow, bounded by a flap, is much longer than in *Paludomus*. There is also no penis in *Cleopatra*. BINDER, 1959 (Rev. Suisse Zool., 66 : 735) describes only a small male duct for *Cleopatra bulimoides* from Africa in the mantle cavity and gives no indication about a ciliated furrow. The micro-anatomy of the male reproductive system of a species of *Paludomus* is described and figured for *Paludomus (Tanalia) neritoides* in this study. (p. 153).

Ecological-Biological Remarks : *Paludomus (P.) chilinoides* is very frequent in slow to fairly fast-running streams with gravel and sandy bottom in the low and upland areas of Ceylon (up to 600 m). The physical and chemical data from two localities are as follows:

<table>
<thead>
<tr>
<th>No. 60 : KUDA OYA, a tributary of MENIK GANGA</th>
<th>No. 74 : a small stream between Habarane and Dambulla</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curr. : 30-50 cm/sec</td>
<td>30 cm/sec</td>
</tr>
<tr>
<td>PH : 7'7</td>
<td>7'25</td>
</tr>
<tr>
<td>El10 : 295 μSiemens</td>
<td>605 μSiemens</td>
</tr>
<tr>
<td>Tot. Hard. : 9'2°dH</td>
<td>12'9° dH</td>
</tr>
<tr>
<td>CaO : 52 mg/l</td>
<td>50'9 mg/l</td>
</tr>
<tr>
<td>MgO : 28'9 mg/l</td>
<td>56 mg/l</td>
</tr>
</tbody>
</table>

Both streams flow outside of the precambric granitic area and show much higher values in the conductivity, total hardness, content of CaO and MgO than the streams and rivers in the granitic region.

The frequency of the species in the locality No. 74 was as follows : At a current speed of 30 cm/sec : on sand : 2-3 ind./1/4m², on small stones, surrounded by sand and mud : 2-3 ind./1/16m² (=approx. 8-12 ind./1/4 m²).
The snails prefer stones and rocks emerging from the water surface and usually extend the anterior parts of their bodies out of water. On sandy bottom the animals usually come towards the water-edge of the stream and even crawl about outside the water. In an aquarium it could be observed that the animals crawl about outside the water and feel quite at home for some length of time provided that the air is humid. The snails are positively phototactile and move towards the light. In an aquarium, they disappear during the night into the upper layers of the sandy or gravelly bottom. They feed on diatoms and filamentous algae, growing on the stones and rocks. Fully grown specimens are to be met in abundance in the months between October and January. The shells of these specimens are mostly covered with filamentous algae and mud mixed with iron-oxide. In the aquarium, copulation was observed during the months of August-September. During copulation the male sits on the right side of the female (Fig. 77, Plate VII).

It is stated by RAMANAN, 1900 (Non-marine Mollusca of Madras) that the females of Paludomus are oviparous, but we have never found ripe eggs in the uterus. We believe that the snails are ovi-viviparous, this means that the young snails come out of the eggs after the eggs have passed the opening of the vagina and the ciliated groove from the anterior mantle cavity to the right part of the foot. But further observations are necessary.

**Distribution**: Low and upland of Ceylon.

*(14) Paludomus (Paludomus) inflatus* BROT, 1880


**Locality**:—Eastern Province: No. 71 (2 ind.).

**Shell**: There is some confusion in the literature concerning *Paludomus inflatus* and *striatulus*. The first species, recorded after BROT, 1880 (p. 44) from South India (Travancore, Amherghat, Tinnevelly) has a globular elevated shell, moderately rigid; the spine is elevated, but the apex is mostly eroded and it remains only as 3 steep-convex whorls. The penultimate whorl is abruptly enlarged and globular. Below the suture it is flat and then strongly arched; the shell has distinct, unequal spiral furrows, olive with zigzag lines. The aperture is broad ovate, inside arched and thick, the callus on the parietal side distinct, the peristome on the outside sharp and arched.

*Paludomus striatulus* is recorded after NEVILL, 1884 (p. 297), from Ceylon. The author has not given any figures for this species, he states: "in BROT's pl. 7, fs. 7-8, in the Syst. Conch. Cab., 1(25), 1880, *Paludomus isseli* from Borneo gives an exact representation of this new and rare Ceylon form; the well developed, crowded, almost granulose spiral striation will at once distinguish it." But PRESTON, 1915 (p. 49) notes— and we confirm this opinion—that BROT'S figures appear to depict a conically fusiform, solid, lightbrown form, with yellowish labrum and aperture. They do not, however, give any appearance of a spiral sculpture.

Therefore we believe that *Paludomus striatulus* is a synonym for *P. inflatus* from South India. Our shells, 2 specimens, not fully mature, correspond exactly with the description and figures of *Paludomus inflatus* given by BROT, 1880 (Fig. 78 Plate VIII).

**Table**

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Ht.</th>
<th>Diam.</th>
<th>Ht.</th>
<th>Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 71 (Rambukkan Oya) (Fig. 78, Plate VIII)</td>
<td>11'6</td>
<td>8'5</td>
<td>8'5</td>
<td>6</td>
</tr>
</tbody>
</table>

_Anoatomical remarks_. No dissections were made. _Operculum_. Typical.

_Ecological remarks_. The two immature individuals were found by the Lund University Expedition 1962 in a shallow river with sandy bottom and banks; partly open, partly covered by sedges in a secondary dry forest area.

**Distribution**. South-India (Travancore; Amherghat; Tinnevelly or Tirunelveli in Madras State); Eastern Ceylon.

*(15) Paludomus (Paludomus) palustris* LAYARD, 1854.

**Locality**: In the collection of COSTA et al. 1971, but without particulars of the locality (No. 100). In the literature (PRESTON, 1915 : 47) is noted: the grassy margin of a tank near Anuradhapura (North-Central Province).

**Shell**: Ovate with exerted spire form 3-4 whorls, rounded, rather flat, spirally closed grooved with minute granular striae (lens); apex mostly eroded, colour yellow to brown with dark brown spots, frequently running in wavy lines (Fig. 79, Plate VII).

<table>
<thead>
<tr>
<th>Sizes (in mm)</th>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceylon (Fig. 79, Plate VIII) . .</td>
<td>15'2</td>
<td>9'6</td>
</tr>
<tr>
<td></td>
<td>14'7</td>
<td>9'5</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the sample.

**Operculum**: Typical for the genus *Paludomus*, subgenus *Paludomus*. No data for anatomical ecological and biological remarks are available. PRESTON, 1915 (p. 47) notes: grassy margin of a tank.

**Distribution**: After PRESTON, 1915 (p. 47) : Anuradhapura : North-Central Province of Ceylon.

(16) *Paludomus (Paludomus) tanschauricus* Gmelin, 1791.


**Localities**. North-Central Province : No. 73 (7 ind.), No. 78 (1 ind.), No. 81 (2 ind.), No. 82 (8 ind.) ; Northern Province : No. 94 (1 ind.), No. 95 (4 ind.), No. 98 (2 ind.).

**Shell**: Globular turret-like with 4-8 convex whorls the first whorls with remarkable keeled spiral-ridges in the older shells the apex is sometimes eroded. On the penultimate whorl are the spiral-ridges mostly dissolved. Colour yellow-brown with darkbrown spots mostly running in wavy lines. Aperture ovate, top pointed (Fig. 80, Plate VIII).

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 73 (Anuradhapura) (Fig. 80, Plate VIII)</td>
<td>15</td>
<td>7'5</td>
</tr>
<tr>
<td>No. 78 (Wilpattu) Apex eroded</td>
<td>14'5</td>
<td>8'7</td>
</tr>
<tr>
<td>No. 81 (Ritigala) Apex eroded</td>
<td>11</td>
<td>7'4</td>
</tr>
<tr>
<td>No. 82 (Minneriya) Apex eroded</td>
<td>10'4</td>
<td>7'6</td>
</tr>
<tr>
<td>No. 98 (Paraiyanalankulam Apex eroded</td>
<td>14</td>
<td>9'5</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.
Operculum. Typical for the subgenus Paludomus s.str.

Anatomical remarks. SESHAIYA, 1934 (Rec. Ind. Mus. Calcutta 36:185-212) with 15 text figs, (gives a detailed study of the macro-and micro-anatomy of these species.

Ecological-biological remarks.—The species inhabits slow-flowing streams and canals. In No. 73 (Anuradhapura) the snails occur in a polluted canal moving on the sides at a speed of 30 cm/sec. In this locality the pH was 7 and the total hardness was F3DH. In locality No. 78 (Wilpattu) and No. 94 (Paranthan) the animals were found in temporary streams in dry secondary scrubland with water in the bed only during the rainy season. The occurrence of the snail in North Ceylon extends from the low to the upland in the Ritala Nature Reserve in 500 m. altitude. RAMAN, 1900 (Non-Marine Molluscs of Madras) and SESHAIYA, 1934 (p. 185) report that in South India the snails occur in clear, slow moving, shallow streams with a sandy bottom, where the animals usually come towards the water-edge of the stream and extend the anterior parts of their bodies out of water. The snails feel quite at home out of water for some length of time, and even crawl outside water. This behaviour gives the snails the possibility to leave dried out temporary streams—and to burrow in the mud. Fully grown specimens are found usually in November and December. The shells of these animals are mostly coated with encrustations of mud and algae. The food of the snails consists of diatoms and filamentous algae like Spirogyra. The females are oviviparous.


(17) Paludomus (Paludomus) tanschauricus (GMELIN, 1791) subspec. nasutus DOHRN, 1837.


Localities.—Sabaragamuwa Province : No. 33 (1 ind.) ; Central Province : No. 53 (8 ind.) ; Uva Province : No. 61 (75 ind.) ; No. 62 (2 ind.), No. 68 (8 ind.).

Shell.—Highly conical, smooth, with obsolete furrows on the penultimate whorl, grooved and mostly carinated, on the upper whorls the ridges are not always well developed like in tanschauricus s.str. The apex is sometimes eroded, but never in specimens occurring in habitats with high total hardness and high content of CaO, like locality No. 61. Spire variable in height, sometimes concave acute, consisting of 7–8 whorls, when perfect, of which 2–3 are sometimes eroded. Sutures deep, those of the last whorl marginate. Typical for the subspec. Nasutus is a distinct impressed line after the suture (DOHRN, 1837 describes on p. 123 as : "ad suturam linea valde impressa"). Upper whorls angular, penultimate whorl ventricose, flattened above towards the mouth, usually marked with 2–5 linear obsolete furrows on the periphery. Colour darkbrown, spiral bands only to see on the inner side of the peristome which is continuous. The aperture is gibbous, ovate, pointed above, the outer lip sharp, columella callous (Fig. 81, Plate VIII).

Sizes (in mm.)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 53 (Madugoda)</td>
<td>11'5</td>
<td>7'7</td>
<td>7'5</td>
<td>5'4</td>
</tr>
<tr>
<td>No. 61 (Wetakei Ela) (Fig. 81, Plate VIII)</td>
<td>15'1</td>
<td>8'2</td>
<td>8'4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>8'4</td>
<td>8</td>
<td>6'2</td>
</tr>
<tr>
<td></td>
<td>14'7</td>
<td>8'4</td>
<td>8'3</td>
<td>5'4</td>
</tr>
<tr>
<td></td>
<td>14'3</td>
<td>7'9</td>
<td>8'2</td>
<td>5'8</td>
</tr>
<tr>
<td>No. 62 (Diyaluma Falls) Apex eroded</td>
<td>11'6</td>
<td>7'4</td>
<td>6'9</td>
<td>4'9</td>
</tr>
<tr>
<td></td>
<td>10'8</td>
<td>7</td>
<td>6'8</td>
<td>4'8</td>
</tr>
<tr>
<td>No. 68 (Badulla) Apex eroded</td>
<td>14</td>
<td>9'7</td>
<td>9</td>
<td>6'8</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>7'8</td>
<td>7'5</td>
<td>5</td>
</tr>
</tbody>
</table>

The sizes are from the biggest specimens in the samples.

Operculum. Typical for the subgenus Paludomus s.str.

Anatomical remarks. No dissections were made.
Ecological-biological remarks. The snails prefer the edges of fast-running streams in the up-and highland of the Central and Eastern parts of the mountains in South Ceylon. In the locality No. 61 the subspec. *nasutus* occurs in a calcareous stream (Wetakei-Ela, an affluent of the Kirindi Ganga) running through dense forest. The rocks and gravel in this stream are coated by calcareous sinter. The snails crawl on sandy bottom in the edges of the stream. The ecological factor of No. 61 were recorded on 9.12.1970 (14H):

<table>
<thead>
<tr>
<th>Temp.</th>
<th>23°9°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8'3</td>
</tr>
<tr>
<td>El20.</td>
<td>360 μ Siemens</td>
</tr>
<tr>
<td>CaO</td>
<td>59.4 mg/l</td>
</tr>
<tr>
<td>MgO</td>
<td>40.8 mg/l</td>
</tr>
<tr>
<td>SiO₂</td>
<td>54.8 mg/l</td>
</tr>
<tr>
<td>Total Hard.</td>
<td>11°6dH</td>
</tr>
</tbody>
</table>

The frequency of *Paludomus (P.) tansehauricus* subspec. *nasutus* on the borders of the Wetakei-Ela was 1–5 ind/1.16m², and were living together with young specimens of *Paludomus (Tanalic) solidus*. At the Locality No. 62 (Diyalumana Falls), the frequency was lower (pH: 6°7, El20: 34μ Siemens, total hardness: 0°3dH, SiO₂: 24°8 mg/l). In this locality with very low hardness the apices of all shells were eroded like in all streams of the crystalline rocks in the highland with low content of CaO. In No. 68 the species occurs up to 1200 m. altitude.

Distribution.—The distribution of subspec. *nasutus* is only in the East and South East of the Central high and upland of Ceylon.

(18) *Paludomus (Philopotamis) bicinctus* REEVE, 1852


Localities. Central Province : No. 54 (9 ind.) : Uva Province : No. 66 (14 ind.), No. 67 (1 ind.), No. 68 (30 ind.)

Shell. Oblong-globular, spire small with 3 whorls, apex mostly eroded and 2 whorls remaining, convex, the penultimate whorl big and ovate; delicately striated, colour brown to olive. Aperture ovate, on the inner surface two broad, but indistinct chestnut-brown bands, base rounded, top pointed (Fig. 82, Plate VIII).

<table>
<thead>
<tr>
<th>Sizes (in mm.)</th>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 54 (20 mls E of Kandy) (Fig. 82, Plate VIII)</td>
<td>17'5</td>
<td>14</td>
</tr>
<tr>
<td>No. 66 (Yalakumbara)</td>
<td>12'7</td>
<td>9</td>
</tr>
<tr>
<td>Apex eroded</td>
<td>12'8</td>
<td>9'2</td>
</tr>
<tr>
<td>No. 67 (Adawatte)</td>
<td>12'7</td>
<td>9'7</td>
</tr>
<tr>
<td>Apex eroded</td>
<td>16'5</td>
<td>12'5</td>
</tr>
</tbody>
</table>

This sizes are from the biggest individuals in the samples.

Operculum. Horny, subtriangularly ovate, apex superior, paucispiral, nucleus sub-basal, dextral. The subgenus *Philopotamis* is based upon the characters of the operculum (see also *P. (Ph.) sulcatus* and *P. (Ph.) nigricans*).

Anatomical remarks. No dissections were executed.

Ecological-biological remarks. Occuring in fast to fairly fast-running streams with cascades, surrounded by bush or forest with thick layers of debris. Between 250m. and 1100m in the eastern parts of the central up-and highland.

Distribution. Ceylon: Mountains of the eastern Central and Uva Province.
Paludomus (Philopotam's) decussatus REEVE, 1852.


Locality.—Uva Province No. 66 (12 ind.).

Shell.—Allied to P. (Ph.) bicinctus but more acuminate-ovate and rigid; apex decollated, spire with 3-4 whorls, moderate convex, delicate and indistinct striated in spiral and vertical lines (finely “decussated” surface) but could be only seen with a lens; penultimate whorl ovate, convex; colour whitish-yellow to olive with indistinct, livid spiral-bands like in bicinctus seen on the inner surface of the peristome. Aperture ovate, top pointed (Fig. 83, Plate VIII).

Sizes (in mm.): Shell Aperture

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>66 (Yalakumbura)</td>
<td>14'2</td>
<td>9'5</td>
<td>8'6</td>
<td>6</td>
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</tbody>
</table>

The sizes are for the biggest specimen in the sample.

Operculum. Typical for the sub-genus Philopotamis.

Anatomical remarks. No dissections were executed.

Ecological-biological remarks. Occurring (No. 66) in a fast running stream with borders coated by debris at an altitude of 450m.

Distribution. Ceylon : uplands of the Uva Province.

Paludomus (Philopotamis) nigricans REEVE, 1847


Locality. Central Province : No. 46 (202 ind.) No. 53 (8 ind.), No. 57 (2 ind.) No. 58 (3 ind.).

Shell. Spire rather prominent exserted, 2-4 whorls but apex mostly eroded, in the var. typica surface neatly smooth in the var. subgranulosa NEVILL (=var. b of BROT 1880, p. 23 ; pl. 6, fs. 6a with spiral and vertical strize, forming a delicate granulation. The observations of BROT 1880 and our observations show all transitions between smooth and subgranulated surfaces of the whorls in one population. Last whorl faintly angled towards the base. Colour blackish interior of the aperture is ovate, pointed and is bluish; young specimens are reddish brown with chestnut-brown indistinct bands. These are not to be seen in adult specimens coated with darkbrown to blackish encrustations (mud and iron-oxide) (Fig. 84, Plate VII).

Sizes (in mm.):

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<tbody>
<tr>
<td>46 (Hakgala-Gardens (Fig. 84)</td>
<td>13'2</td>
<td>8'4</td>
<td>8</td>
<td>5'5</td>
</tr>
<tr>
<td>53 (Madugoda)</td>
<td>12'7</td>
<td>8</td>
<td>7'2</td>
<td>5'2</td>
</tr>
<tr>
<td>57 (Diyagama East)</td>
<td>11'5</td>
<td>7'7</td>
<td>7'5</td>
<td>5'3</td>
</tr>
<tr>
<td>58 (Horton Plains)</td>
<td>12'6</td>
<td>8'2</td>
<td>7'8</td>
<td>5</td>
</tr>
</tbody>
</table>

The sizes are for the biggest specimens in the sample.

Operculum. Typical for the sub-genus Philopotamis, peculiar are the distinctly spiral growth striae (Size of a specimen of No. 46 : 7'9 mm x 5'4 mm, Fig. 85).
**Anatomical remarks.** Radula: The central tooth is broad-trapezoid on the cutting edge with one prominent central cusp and 2-3 lateral denticles on either side; the lateral tooth is quadrilateral prolonged with 2-1-1 denticles (see also THELE, 1928, p. 392, f. 51), the inner and outer marginals with 8, resp. 21-23 small denticles (Fig. 86).

![Radula Drawing](image)

**Paludomus (Philopotamis) nigricans.** Fig. 85: exterior and interior of operculum, Fig. 86; radula teeth. Fig. 87: reproductive system of a female, shown from the outside, gr: groove on the left side of foot, vag: vagina, other abb. as: in fig. 74.

**Reproductive system:** The lower part of the female genitals are very similar to the investigated species of the subgenus *Paludomus*: the oviduct enlarges, after the entry into the right part of the mantle cavity, to a thickwalled uterus, forming a narrow S-shaped loop. This opens into a vagina in the ciliated furrow, guarded by a thin flap. The furrow guides to the right side of the foot in a small groove. Near the vagina opens also the sac-like receptaculum seminis (Fig. 87).

**Ecological-biological remarks:** *Paludomus (Ph.) nigricans* occurs in Ceylon exclusively in the cool brooks torrents and streams of the highland in the Central Province in altitudes between 8000m and 200m. The frequency of this species in locality No. 46 (Hakgala Dola in the Hakgala Gardens near Nuwara Eliya) was as follows:

Near the borders of the brook on sandy bands (also outside of the water) with debris: 10-20 ind./1/16 m² (current: 0-20 cm/sec); on stones and rocks in a current between 30-50 cm/sec: 15 ind./1/16 m². The temperature in the highland-streams is around 15° C (2.12.1970 (13°); 15° at No. 46). The pH in No. 46 was 6.9, the electrolytic conductivity: El ≈ 2.6 µSiemens; total hardness: 0.65° dH, CaO: 2.6 mg/l, MgO: 27 mg/l. It could be stated that the species is a stenothermic form living in cool, very soft and slightly acidic water.

**Distribution.** Ceylon: Crystalline Highland of the Central Province.

(21) *Paludomus (Philopotamis) regalis* (LAYARD, 1854)

Localities. Southern Province: No. 7 (2 ind). PRESTON, 1915, p. 55 notes the locality as Western Province: Ciana Corale.

Shell. Oblong-ovate, spire exserted, short whorls rounded, depressed at the upper part, spirally cored with close-set slight ridges, longitudinally minutely striated and crowned with a single row of short, sharp, hollow angular spines, closely set. Colour yellowish olive painted with wavy, dark brown longitudinal lines. Aperture ovate top pointed (Fig. 88, Plate VIII).

The altitude of an immature shell of No. 7 (Haycock Mountains) is 8'5 mm.

Operculum. Typical for the subgenus Philopotamis.

Anatomical remarks. No dissections of the immature specimens were executed.

Ecological-biological remarks. The record is from a stony fast running stream at an altitude of 325m, surrounded by the dense indigenous forest of the Haycock Mountains.

Distribution. Ceylon Upland of the Southern and Western Province.

(22) *Paludomus (Philopotamis) sulcatus* REEVE, 1847


Localities. Southern Province. No. 2 (2 ind.), No. 7 (6 ind.); Western Province: No. 22 (3 ind.); Sabaragamuwa Province: No. 26 (12 ind.) No. 39 (1 ind.); Localities in the literature are after BROT, 1880 (p. 21) and PRESTON, 1915 (p. 53) mountain streams at Ratnapura, Uda Pusselawa, Peradeniya and Ambegamunuwa.

Shell. Ovate with a prominent spire but mostly eroded; whorls 3-5, rounded, spirally very closely grooved, grooves and intermediate ridges very closely decussated with longitudinal striae. Colour yellowish to olive pointed here and there with black spots, sometimes forming vertical flames; Aperture subtriangually ovate, top pointed (Fig. 89, Plate IX).

<table>
<thead>
<tr>
<th>Sizes (in mm)</th>
<th>Shell</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2 (Nagahaketa-Dola, Nilvala Ganga)</td>
<td>19'7</td>
<td>12'3</td>
</tr>
<tr>
<td>No. 7 (Haycock Mountains)</td>
<td>16</td>
<td>12'8</td>
</tr>
<tr>
<td>No. 26 (Rajanawa Dola near Ratnapura)</td>
<td>15'5</td>
<td>10'3</td>
</tr>
<tr>
<td>No. 39 (Kuruwitn, 6mls NNW Ratnapura)</td>
<td>22'2</td>
<td>14</td>
</tr>
</tbody>
</table>

The sizes are for the biggest individuals in the samples.

Operculum. Typical for the subgenus Philopotamis (founded by LAYARD, 1855 Ann. Mag. Nat. Hist., ser. 2, 16:134 on the type *Paludomus sulcata* REEVE and based upon the characters of the operculum): horny, subtriangularly ovate, apex superior pascipiral, nucleus sub-basal and dextral (Sizes (No. 26) : 13mm x 11 mm; Fig. 90).
Anatomical remarks. One male from No. 26 was dissected and this showed the typical parts of the male reproductive system of the genus *Paludomus*: enlarged vesicula seminalis in the lower part of the male duct, a small penis with a sac-like gland and a ciliated furrow from the opening of the male duct to the outside of the right part of the mantle cavity. This furrow is like in the female of *Paludomus* covered by a thin flap. On the mantle edge of the dissected specimens were 19 finger-shaped processes. Radula: central tooth is broader than long, on the cutting edge with (2-3)-1(2-3) denticles, the prolongated lateral tooth with the formula 2-1-3 and the inner and outer marginals with 5-6, resp. 14-15 delicate denticles. Our observations agree with the figure of the radula, given by THIELE, 1928 (p. 392, fig. 54).

Ecological-biological remarks. *Paludomus (Philopotamis) sulcatus* inhabits moderately fast to fast-running mountain streams with gravel boulders and sand. In a current between 30 cm, and 75 cm/sec we found on stones and rocks in No. 2 (Nagahaketa Dola): 1-2 ind./m² and in No. 26 (Rajania Dola): 1-3 ind./1/m² = ca. 10 ind./m².

The temperature in these two streams ranges in November between 24° C and the 26° C, the pH: 5·8, E₂₅₋₂₉·35 μ, Siemens, Total hardness: 0·6°-1° dH and CaO: 2 mg/l. This species occurs in streams with low content of minerals and in very soft and slightly acidic water.

**Distribution**: Ceylon: Upland of the South West.

(23) *Paludomus (Tanalia) loricatus* REEVE, 1847

THEOBALD, FERNANDO, CHEMNITZ similis - shells (THEFFI, Paludomus Fernando, REEVE) - 1915 (12 and dark REEVE, F.B.r. Ind. (Freslnv: Gs.str. has 113; C2.lcutta 2:301-303; ibid.: 58 No. 114; as synonym is listed: No. dfstinguenda reevei type of shell is given above. This type includes also the upper part. Spirally encircled with close-set squamate ridges (varying in the different variations).


Localities. Southern Province: No. 1 (30 ind.), No. 26 (12 ind.), No. 3 (1 ind.); Western Province: No. 15 (12 ind.), No. 22 (5 ind.); Sabangamuwa Province: No. 24 (72 ind.), No. 26 (39 ind.), No. 27 (6 ind.), No. 28 (26 ind.), No. 30 (92 ind.), No. 35 (4 ind.), No. 38 (18 ind.), No. 39 (22 ind.), No. 40 (22 ind.), No. 43 (8 ind.).

Shell. Extremely varying in size, altitude of the spire and sculpture with all transitions. This variation in the shells was the reason for the descriptions of many species after characteristics of the shells. The typical loricatus s. str. has an obovate shell with an exserted, but mostly eroded spire. 2-3 whorls slightly angularly or flatly depressed around the upper part. Spirally encircled with close-set squamate ridges (varying in the different variations). Colour chestnut, to blackbrown with vertical zigzag or flame-like, darkbrown bands, but mostly seen only on immature shells. Mature shells mostly coated by black encrustations. Aperture broad-ovate, top pointed, interior whitish-blue, coloumella and edge of the lip violet to purple-brown. Outside of the peristome is irregularly grooved.

BROT, 1880 (p. 2 - 3) has created 4 variations of P. (T.) loricatus basing upon the sculpture of the shell:—

(a) Var. typica: with nodular ridges: loricatus s. str. (Fig. 91/A, 6; 92, 93 Plate IX). The description of this type of shell is given above. This type includes also aculeata (GEMLIN) BLANFORD (pro parte), undatus REEVE, ayardi REEVE, nodulosa DOHRN.

(b) Var. erinacea REEVE (Fig. 91/A, 5; 94, 95, 96, 97 Plate VIII): Obovate shell as in the form of loricatus s. str. but the spiral ridges show distinct thorn-like scales, specially in young specimens (Fig. 94, 95, Plate IX). This variation includes the var. erinacea REEVE, aculeata (GEMLIN) BLANFORD (pro parte), erinaceens (REEVE) LAYARD, loricatus REEVE var. (f. la in Conch. Icon., 1847).

(c) Var. funiculatus REEVE (Fig. 91/A, 2, A.3, A. 4; 98, 99, 100; Plate IX & X): Shell oblong-ovate, spire exserted, whorls rather depressed round the upper part, spirally cloved with rather distant obtuse ridges, some times vertically striated with well-marked close-set striate. Colour dark yellow-brown, thickly marked with vertical, slanting, jet-brown wavy bands. This variation includes the var. aureus REEVE, aculeata (GEMLIN) BLANFORD (pro parte), funiculatus REEVE and reevel LAYARD.

(d) Var. pictus REEVE (Fig. 91/A, 1. A. 2; 101, 102, 103, 104; Plate X): Shell oblong-ovate, spire exserted, whorls spirally and vertically obtusely striated or grooved. Colour dark yellow to olive, profusely marked with vertical, wavy dark bands and lines, sometimes interrupted by fine transverse bands of the same colour. The dark markings of the shell show through at the aperture, specially in young shells, margin of the coloumella stained with brown. These variations includes the var. pictus REEVE, distinguendus DOHRN, torrenticola DOHRN and similis LAYARD. It is probable that also Paludomus (Tanalia) hanleyi DOHRN 1858 (Proc. zool. Soc. London 1858: 353) figured by HANLEY & THEOBALD, 1876 (Conch. Ind.: 51 pl. 125, f. 10) and by BROT, 1880 (in MARTINI & CHEMNITZ, Syst. Conch. Ind.)

Cab., I (25) : pl. 4, f. 9) belongs to *loricatus*. Uncertain is also the position of *Paludomus* *sphaerica* DOHRN, 1857 (Proc. zool. Soc. London, 1857 : 124), figured by HANLEY & THEOBALD 187 (Conch. Ind. : 50; pl. 124, f. 8) and copies by BROT, 1880 (in MARTINI & CHEMNITZ, Syst. Conch. Cab. I (25) : pl. 4, f. 10). BLANFORD (Trans. Linn. Soc. L., 23) places these species as var. of his *Tanalia aculeata* (GMELIN), a species which is placed by BROT, 1880 (p. 2) as synonym of *P. (T.) loricatus*. But BROT, 1880 (p. 12) is not certain whether this species, described only, after one shell from the collection of CUMING, is also to be placed in the subgenus *Tanalia*. The colouration of the shell is similar to *P. (P.) chilianoides* and the shell is perhaps an abnormality.

| No. 1 (Thanipita Dola) var. *pictus* (Fig. 101, Plate X) | Ht. | Diam. | Ht. | Diam. |
| No. 2 (Nagahaketa Dola) var. *funiculatus* | 25'9 | 20'3 | 19' | 16'5 |
| No. 15 (Moratuwa, var. *pictus* | 26'7 | 19'5 | 18' | 14' |
| No. 22 (Alawala) var. *funiculatus* | 31'7 | 24'2 | 24' | 18'3 |
| No. 24 (Bodathpitiya Ela) var. *typica* (Fig. 92, Plate IX) | 41 | 34 | 32 | 28'5 |
| No. 26 (Rajanawa Dola) var. *typica* (Fig. 93, Plate VI) | 33'5 | 27'2 | 24' | 21'5 |
| No. 27 (Kalu Ganga) var. *erinaceus* (Fig. 96, Plate IX) | 40 | 31'5 | 31 | 25' |
| No. 28 (Kalu Ganga, upper reaches) var. *typica* and *erinaceus* (Fig. 97, Plate IX) | 34'2 | 26'2 | 24'5 | 22'5 |
| No. 30 (Ira Handha Pana Dola) var. *funiculatus* with transitions to var. *pictus* (Fig. 104, Plate X) | 30'8 | 24'5 | 22 | 19 |
| No. 31 (Belihul Oya) var. *pictus* | 30'5 | 23'5 | 19'7 | 16 |
| No. 32 (Kirikatu Oya) var. *funiculatus* (Fig. 100, Plate X) | 27'6 | 20'5 | 19'2 | 15'1 |
| No. 27 (Kalu Ganga) var. *erinaceus* (Fig. 100, Plate X) | 28'8 | 22'1 | 20'5 | 15'9 |
| No. 28 (Kalu Ganga, upper reaches) var. *typica* and *erinaceus* (Fig. 97, Plate IX) | 34'2 | 26'2 | 24'5 | 22'5 |
| No. 30 (Ira Handha Pana Dola) var. *funiculatus* with transitions to var. *pictus* (Fig. 104, Plate X) | 30'6 | 24'3 | 23'4 | 19 |
| No. 31 (Belihul Oya) var. *pictus* | 30'5 | 23'5 | 19'7 | 16 |
| No. 32 (Kirikatu Oya) var. *funiculatus* (Fig. 100, Plate X) | 27'6 | 20'5 | 19'2 | 15'1 |

Shell Sizes (in mm.)

- Ht.
- Diam.
Sizes (in mm.)

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<tbody>
<tr>
<td>35</td>
<td>(Kelani Ganga)</td>
<td>32'1</td>
<td>28</td>
<td>27</td>
<td>21</td>
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<tr>
<td></td>
<td>var. funiculatus</td>
<td>33'8</td>
<td>27'8</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>(Fig. 98, 99, Plate VIII)</td>
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<tr>
<td>38</td>
<td>(Rakwana)</td>
<td>19'1</td>
<td>14'5</td>
<td>13'6</td>
<td>10'5</td>
</tr>
<tr>
<td></td>
<td>var. pictus</td>
<td>17'3</td>
<td>13'2</td>
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<td>(Fig. 102, 103, Plate X)</td>
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<td>(Kuruwita)</td>
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<td>18'5</td>
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<tr>
<td></td>
<td>var. funiculatus</td>
<td>23'1</td>
<td>21</td>
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<tr>
<td>40</td>
<td>(Gilimale)</td>
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<tr>
<td></td>
<td>var. typica</td>
<td>34'5</td>
<td>31'4</td>
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</tr>
<tr>
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<td>(juv. = erinaceus)</td>
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<td>(Fig. 94, 95, Plate IX)</td>
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<tr>
<td>43</td>
<td>(Kahawatta)</td>
<td>15</td>
<td>7'8</td>
<td>11'5</td>
<td>9'3</td>
</tr>
<tr>
<td></td>
<td>var. pictus juv.</td>
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The sizes are from the biggest specimens in the samples.

**Paludomus (Tanalia) loricatus.** Fig. 105: exterior and interior of operculum; Fig. 106: Radula teeth.

**Operculum.** The subgenus *Tanalia* is based, like other subgenus of *Paludomus*, upon the structure of the operculum: horny, subtriangularly ovate, apex lateral, lamellated, nucleus lateral and dextral (sizes of a specimen of No. 24 (var. typica): 17'7mm x 12'3mm; Fig. 105).

**Anatomical remarks.** The anatomy of *P. (T.) loricatus* shows no particular differences from the dissected specimens of *P. (T.) neritoides*, described in the following pages. The anatomy is also very similar to those of *P. (P.) chilinoides* and *P. (P.) tanschauricus*. Radula: central tooth broad-trapezoid, the cutting edge with one prominent, broad central...