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Results of the Hydrobiological Mission 1974 of the Zoological Institute of the University of Vienna

Part VIII: Contributions to the Knowledge of the Freshwater-Gastropods of the Indian Ocean Islands (Seychelles, Comores, Mascarene-Archipelagos)

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(With 100 text-figures and 8 plates, with 58 figures in black and white)

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Abstract

The study deals with the collection on Freshwater- and Brackishwater Gastropods collected on the Seychelles-, Comores- and Mascarene-Archipelagos in the Western Indian Ocean, during the Austrian Hydrobiological Mission, 1974. Some remarks also made on the collection of the Swedish Lund University Mission, 1973, from Madagascar, Nossi-Bé and Rodriguez.

Thirty species of Gastropods are discussed with remarks on the shell, anatomy, ecological and biological features and their geographical range. In the General Part are given the distributions of the recorded species in the different localities of running waters and a survey of the zoogeography of the found water-snails.

Zusammenfassung

Die Studie behandelt die Sammlung an Süß- und Brackwasser-Schnecken der Seychellen-, Komoren- und Maskarenen-Inseln im westlichen Indischen Ozean, die von der Österreichischen Hydrobiologischen Expedition 1974 mitgebracht wurde. Von den 30 gefundenen Arten werden Angaben über ihre systematische Stellung, Schale Anatomie und Histologie gegeben. Sie werden von Bemerkungen über ihre Ökologie, Biologie und geographische Verbreitung ergänzt. Im Allgemeinen Teil wird die Verbreitung der Arten in den verschiedenen Lebensräumen der Fließgewässer besprochen sowie ihre zoogeographische Stellung erläutert.

1. Introduction

The exploration of the land- and freshwater-gastropods of the Western Indian Ocean Islands, such as Seychelles, Comores and Mascarene, started relatively early after the colonization of the uninhabited islands in the last 17th century. The first descriptions of gastropod shells are based especially on

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collections of different scientific missions, such as by BORY DE SAINT VINCENT 1804) for four principal islands of the Indian Ocean; by the Voyage of "COQUILLE" 1822/25, published by LESSON (1830); a collection from Mauritius and La Réunion, published by FÉRUSSAC; by the Voyage of "ASTROLABE", published by QUOY & GAIMARD (1832); from the Seychelles by DUFO (1840); and by the collections of the Voyage of Captain VESCO, published by MORELET 1851, 1860). SGANZIN (1843) has given a first list of the shells known from Mauritius and La Réunion, including Madagascar. Many shells from the islands were described at first in systematic works, such as *Thesaurus Conch.*, SOWERBY (Neritidae, 1836/49); further in the *Syst. Conch. Cabinet*, edited by MARTINI & CHEMNITZ with volumes by PFEIFFER, 1853 (*Cyclostoma*), BROT, 1876 (*Melania-cea*), BROT, 1874 (*Paludomus*), MARTENS, 1879 (Neritacea) and CLESSIN & KÜSTER, continued by DUNKER, 1886 (Lymnaeidae). Further, the *Conchologica Iconographica* edited by REEVE (continued by SOWERBY) with *Neritina*, 1856; *Navicella* 1856; *Melania*, 1860/61; *Limnaea*, 1872; *Physa*, 1873/74; *Planorbis*, 1878.

In the *Manual of Conchology* by TRYON (continued by PILSBRY) are published the Neritidae, 1888. MARTENS (1869) described some species from the Mascarene Islands from the collection of the Voyage of DECKEN to East-Africa and the nearby islands, and (1880) the collection of MÖBIUS from Mauritius and the Seychelles. MORELET (1882) has given some critical remarks to the publication of MARTENS (1880). DESHAYES (1863) published a catalogue of the molluscs of La Réunion, and CROSSE (1874) a malacological review of the island of Rodriguez (continued by MORELET, 1875, and SMITH, 1876). The widow of the shell-collector LIÉNARD published (1877) a list of the molluscs of the Seychelles and Mascarene-Archipelago, but without any figures and localities. Some shells found at the Seychelles and Mascarene are described by NEVILL (1878/84) in the *Hand-List of the Molluscs in the Indian Museum of Calcutta*.

The shells of land- and freshwater-molluscs of the Comores islands were described and partly figures by MORELET (1877, 1879 — Mission BEWSHER at Anjouan); (1881a, 1881b, 1882, 1883 — Mission MARIE at Mayotte). CROSSE (1879, 1881) and BOETTGER (1890, 1889, 1892) described shells from the islands of Nossi-Bé and Nossi Comba between the Comores and NW-Madagascar. Based on the collections made by BRAUER, the authors MARTENS & WIEGMANN (1898) published a survey of the land- and freshwater molluscs of the Seychelles.

The collections of "THE PERCY SLADEN-TRUST-EXPEDITION" led by GARDINER in 1905, and between 1908—1909, were the base for the studies of SYKES (1909). A list of gastropods of different East-African islands has been published by KOBELT (1910).

The most important study on the systematic conchology of land- and freshwater-molluscs of the Mascarene islands (including remarks about the malacofauna of the Seychelles) has been given by GERMAIN (1921), illustrated with many figures and photographs, and includes a complete bibliography till

1920. CONNOLLY (1925) published notes on a collection of non-marine molluscs from the Indian Ocean islands. GERMAIN (1934) gives a survey of the composition and origin of the land- and freshwater molluscs of the Seychelles Archipelago, and finally BARNACLE (1967) has published a list of the land- and freshwater shells of the Seychelles, including the islands of Aldebra, Amirantes, Coetivy, Cosmoleda, and Farquhar.

All cited works are almost exclusively lists or descriptions of shells with very few dates, localities or ecological conditions. Many synonyms named in consequence of the great variability—especially of the shells of freshwater molluscs— and anatomical studies of the soft-bodies and the radulae are mostly missing. Only few species from the islands were studied anatomically, such as some Neritidae by BOURNE (1908) and BOUVIER (1886, 1892); Lymnaeidae and Planorbidae by HUBENDICK (1951, 1955); Hydrobiidae and Melaniidae by THIELE (1928). A general survey of the conchology, anatomy, histology, ecology, and distribution of the freshwater-gastropods of Madagascar (with remarks on adjacent islands) has been given by STARMÜHLNER (1969) in a comprehensive monograph.

To complet the collections and studies of the Madegassian freshwater-gastropods, the author, assisted by his wife, Edith STARMÜHLNER, and Dr. G. WENINGER, collected in 1974 freshwater-gastropods at the Archipelagos of the Seychelles (Mahé), Comores (Grand Comore, Anjouan) and Mascarene (La Réunion, Mauritius). A small collection of freshwater gastropods from Rodriguez was given to us by P. BRINCK & P. H. ENCKELL (Mission 1973) and is also included in the study. Also we got a sample of *Cleopatra ajanensis* f. *silhouettensis* from Silhouette-island (Seychelles) from Mons. Guy LIONNET (Mahé).

2. Material and Methods

At the 83 stations (including the collections of the Lund-University-Mission, 1973, and Silhouette-island) altogether 30 species (including subspecies and formes) were found: 19 species belonging to the Prosobranchia and 11 species to the Euthyneura-Pulmonata-Basommatophora. The collections were made — if possible — in series, to study the variability of the shells. At every station the density of the species was noted (1 dm² for small species, $\frac{1}{16}$ m² for medium-size and larger species and 1 m² for rare species). The quantitative counting was made with the aid of wire-frame of 1 dm² and $\frac{1}{16}$ m². At all stations were measured the water-temperature (electrically and with a water-thermometer) and the velocity of the surface current. The nature of the bottom (mud, sand, gravel, boulders, rock), submerged vegetation, and the accompanied fauna were noted (STARMÜHLNER, 1978).

To characterize the chemistry of the water at each place, the pH, the electrolytic conductivity, and the total hardness were measured with chemicals (MERCK). Detailed chemical studies were made by G. WENINGER (1977).

The collected water-snails were preserved in 70% alcohol for anatomical studies, and in BOUIN's liquid for histological sections. Dissections of the specimens were made in a dish with wax under stereoscopic microscope (WILD M5) and the drawings were made with a camera lucida. Study of the prepared radulae was made with a REICHERT-BIONAR. Photographs of the shells in the laboratory were made with a NIKON (portrait lenses) and two electronic flashes. The specimens, discussed in this paper are registered under the number 81.110 in the Collection of Molluscs, 3rd Zool. Dept. of the Natural History Museum, Vienna (Austria).

3. Acknowledgments

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During the mission the author was assisted by his wife Edith STARMÜHLNER and Dr. G. WENINGER. At the islands the following institutions supported our mission:

Seychelles: Department of Agriculture, Mahé: Director S. M. SAVY, Conservation Adviser Mr. M. MASON and our guide Mr. LINDSAY; Seychelles Society: Secr. Général Hon. Mons. Guy LIONNET.

Comores: Ministère du Developpment Rural, Service de l'Élevage: Director Ing. H. CARSALADE, Dr. vet. F. DEBUISSY, Moroni and our guide Mons. A. NADJIB, Service des Eaux et Forêts, Mutsamudu, Anjouan; Service de Santé: Dr. J. Cl. GILLES and Dr. MÉROUZZI, Moroni and Mutsamudu.

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Museum Göteborg; and for checking the different species of small Planorbidae to Dr. S. BROWN, Department of Zoology, Experimental Taxonomy, British Museum.

The authors has at last, but not least, to thank Dr. R. W. DEXTER, Department of Biological Sciences, Kent State University, Ohio, for critical revision of the English text, translated from German.

4. List of the collected species (including subspecies, resp. forms)

The classification of species follows — with some exceptions — the system of the HANDBUCH DER PALÄOZOOLOGIE, Vol. 6, GASTROPODA : PROSOBRANCHIA, by W. WENZ, 1939, and EUTHYNEURA, by W. WENZ, continued by A. ZILCH, 1959/60.

Phylum: MOLLUSCA

Class: GASTROPODA

Subclass: PROSOBRANCHIA (= STREPTONEURA)

Order: Archaeogastropoda

Superfamily: Neritacea

Family: Neritidae

Subfamily: Neritinae

Genus: *Clithon* MONTFORT, 1810

Subgenus: *Clithon* s. str.

1) *Clithon* (Cl.) *chlorostoma* (BRODERIP, 1832) f. *comorensis* (MORELET, 1877)

2) *Clithon* (Cl.) *coronata* (LEACH, 1815) (= *longispina*, RÉCLUZ, 1841) including f. *despinosa* MOUSSON, 1867

3) *Clithon* (Cl.) *spiniperda* (MORELET, 1860)

Genus: *Neritina* LAMARCK, 1816

Subgenus: *Neripteron* LESSON, 1830

4) *Neritina* (*Neripteron*) *auriculata* LAMARCK, 1816 f. *mauriciae* LESSON, 1830

Subgenus: *Vittina* H. B. BAKER, 1923

5) *Neritina* (*Vittina*) *gagates* LAMARCK, 1822

Subgenus: *Neritina* s. str.

6) *Neritina* (*Neritina*) *pulligera* (LINNÉ, 1767) *knorri* RÉCLUZ, 1841

7) *Neritina* (*Neritina*) *pulligera* (LINNÉ, 1767) *stumpfi* BOETTGER, 1890

Genus: *Septaria* FÉRUSAC, 1807

8) *Septaria borbonica* (BORY DE ST. VINCENT, 1803)

Subfamily: Neritiliinae

Genus: *Neritilia* MARTENS, 1879

9) *Neritilia consimilis* MARTENS, 1879

Order: Mesogastropoda

Superfamily: Cyclophoracea

Family: Viviparidae

Subfamily: Bellamyanae

Genus: *Bellamyia* JOUSSEAUME, 1886

- 10) *Bellamyia bengalensis* (LAMARCK, 1822) f. *zonata* (HANLEY, 1860)
 Superfamily: Rissoacea
 Family: Synceridae (= Assimineidae)
 Subfamily: Syncerinae (= Assimineinae)
 Genus: *Paludinella* PFEIFFER, 1841
- 11) *Paludinella hidalgoi* (GASSIES, 1869) *granum* (MORELET, 1882)
 Genus: *Syncera* GRAY, 1821 (= *Assimineia* FLEMING, 1828)
- 12) *Syncera* (= *Assimineia*) *nitida* (PEASE, 1864)
 Subfamily: Omphalotropinae
 Tribe: Omphalotropeae
 Genus: *Omphalotropis* L. PFEIFFER, 1851
 Subgenus: *Omphalotropis* s. str. (= *Eutropis* KOBELT & MÖLLENDORF, 1898)
- 13) *Omphalotropis* (O.) *globosa* (BENSON, 1852)
- 14) *Omphalotropis* (O.) *picturata* (ADAMS, 1867)
- 15) *Omphalotropis* (O.) *rangi* (FERRUSSAC, 1827 — POTIEZ & MICHAUD, 1838)
 Superfamily: Cerithiacea
 Family: Thiaridae (= Melaniidae)
 Subfamily: Paludominae
 Tribe: Paludomeae
 Genus: *Cleopatra* TRÖSCHEL, 1856
 Subgenus: *Zanguebarica* P. FISCHER, 1881
- 16) *Cleopatra* (*Zanguebarica*) *ajanensis* (MORELET, 1860) f. *silhouettensis* (NEVILL, 1869)
 Subfamily: Thiarinae
 Tribe: Thiareae
 Genus: *Thiara* BOLTEN (RÖDING), 1798
 Subgenus: *Plotia* (BOLTEN) RÖDING, 1798
- 17) *Thiara* (*Plotia*) *scabra* (O. F. MÜLLER, 1774)
 Genus: *Melanoides* OLIVIER, 1804
 Subgenus: *Melanoides* s. str.
- 18) *Melanoides* (M.) *tuberculata* (O. F. MÜLLER, 1774)
 Family: Potamididae
 Subfamily: Potamidinae
 Genus: *Terebralia* SWAINSON, 1840
 Subgenus: *Terebralia* s. str.
- 19) *Terebralia* (T.) *palustris* (LINNÉ, 1767)
 Subclassis: EUTHYNEURA
 Order: Basommatophora
 Superfamily: Ellobiacea (= Actophila)
 Family: Ellobiidae
 Subfamily: Melampodinae
 Genus: *Melampus* MONTFORT, 1810
 Subgenus: *Melampus* s. str.

- 20) *Melampus (Melampus) lividus* (DESHAYES, 1830)
Subgenus: *Micromelampus* MÖLLENDORF, 1898
- 21) *Melampus (Micromelampus) cf. caffer* (KÜSTER, 1844)
Superfamily: Lymnaeacea
Family: Physidae
Genus: *Physa* DRAPARNAUD, 1801
Subgenus: *Physa* s. str.
- 22) *Physa (Physa) borbonica* FÉRUSAC, 1825
Family: Lymnaeidae
Subfamily: Lymnaeinae
Genus: *Lymnaea* LAMARCK, 1799
Subgenus: *Radix* MONTFORT, 1810
- 23) *Lymnaea (Radix) natalensis* KRAUSS, 1848 and
Lymnaea (Radix) natalensis KRAUSS, 1848 *hovarum* TRISTRAM, 1863
- 24) *Lymnaea (Radix) mauritiana* MORELET, 1875
Family: Planorbidae
Subfamily: Planorbinae
Genus: *Planorbella* HALDEMAN, 1842 (= *Helisoma* SWAINSON, 1840)
- 25) *Planorbella* (= *Helisoma*) *duryi* (WETHERBY, 1879)
Genus: *Gyraulus* CHARPENTIER, 1837
- 26) *Gyraulus mauritianus* (MORELET, 1876)
Genus: *Afrogyrus* BROWN & MANDAH-BARTH, 1973
Subgenus: *Afrogyrus* s. str.
- 27) *Afrogyrus (Afrogyrus) rodriguezensis* (CROSSE, 1873)
Subgenus: *Hovorbis* BROWN & MANDAH-BARTH, 1973
- 28) *Afrogyrus (Hovorbis) cf. crassilabrum* (MORELET, 1860)
Genus: *Ceratophallus* BROWN & MANDAH-BARTH, 1973
- 29) *Ceratophallus* sp.
Family: Ferrissidae
Genus: *Ferrissia* WALKER, 1903
Subgenus: *Pettancylus* IREDALE, 1943
- 30) *Ferrissia (Pettancylus) sp.*

5. List and Description of the stations

The 83 stations, where freshwater- and brackish-water gastropods were collected, during the Austrian Mission (1974), Lund-Mission (1973) and by G. LIONNET (Mahé):

Seychelles-Archipelago:

Mahé:	9 stations
Silhouette:	1 station

Comores-Archipelago:

Grand Comore:	2 stations
Anjouan:	16 stations
Nossi-Bé:	1 station
Madagascar:	1 station

Mascarene-Archipelago:

La Réunion:	24 stations
Mauritius:	25 stations
Rodriguez:	4 stations

Abbreviations in the list of stations:

Alt: Altitude above sea-level (in m); B: Breadth of the running water (in m); D: Depth of the running water (in m); p: pools between cascade-zones; C: velocity of the surface Current (in m/sec); b: banks; Bo: nature of the Bottom; T: Temperature of the water, during the collection at the station (in ° Celsius); Col: Colour of the water; Ch: Chemistry of the water measured at place; pH: concentration of Hydrogen-ion; El₂₀: Electrolytic conductivity in μ Siemens (at 20° C); T. H: Total Hardness (in German Hardness degree = ° dH).

5.1 Seychelles-Archipelago (Fig. 1)

The Seychelles consist of well over hundred islands. Our mission collected at Mahé (at Praslin and La Digue, no freshwater-gastropods were found). We received one sample from Silhouette island, collected by G. LIONNET. The granitic islands were a part of ancient Gondwanaland, the old Precambrian South-Continent (STARMÜHLNER, 1978). The steep slopes of Mahé (highest elevation: 800 m) descend into the sea; joints and dolerite dykes give rise to narrow, deep valleys with V-profiles. The rock faces are smooth and gently rounded. The flat low-lying coastal areas at the mouths of the streams are of calcareous construction from the debris of the adjacent fringing reefs. These areas are inhabited and cultivated, and the streams particularly polluted. The primary tropical rain-forests are reduced to a few patches in the upper slopes of Mahé and Silhouette. Photographs of the stations are to find by STARMÜHLNER (1978).

5.1.1 Mahé**5.1.1.1. Headwaters to Upper courses (600 m—400 m):**

Freshwater-gastropods absent (Ch: pH: 5.3, El₂₀: 33, T. H: 0.095° dH).

5.1.1.2. Upper to Middle courses (400 m—200 m):

No. 1: F/Sey/11/9. 2. 1974: River Seche; slightly polluted by farm-houses and plantations nearby; scrub.

Alt: 310 m

B: 2—5 m

D: 10—20 cm; p: 1 m

T: 23.5° C (10^h)

Bo: granitic boulders, gravel; b, p: muddy water-mosses

Col: brownish, putrid odor

Ch: pH: 6.6, El₂₀: 47, T. H: 0.55° dH

Species found: *Gyraulus* cf. *mauritanus*.

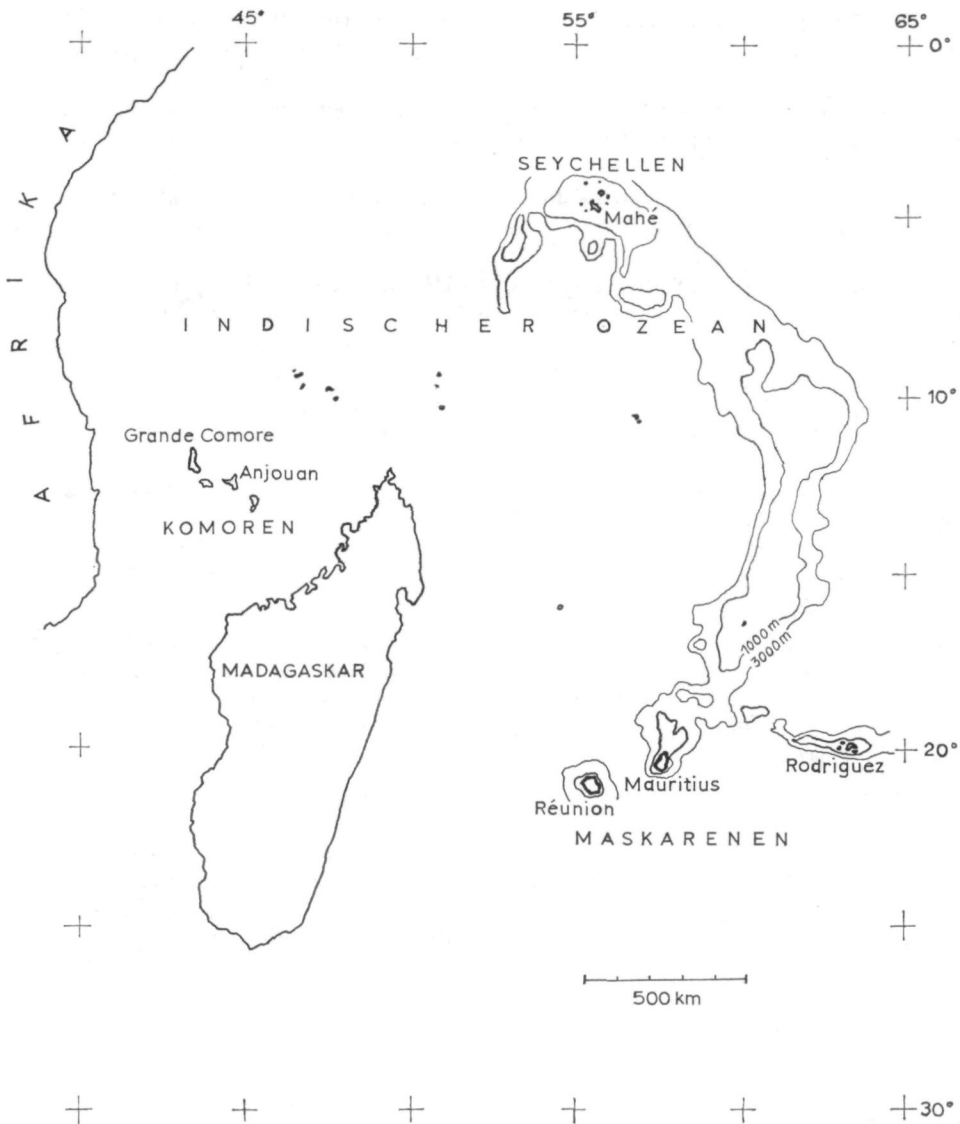


Fig. 1. Map of the Western Indian Ocean with Seychelles-, Comores-, Mascarene-Archipelagos and Madagascar

5.1.1.3. Middle to Lower courses (200 m–10 m):

No. 2: F/Sey/18/15. 2. 1974: River Plaisance; beyond a waterfall of about 20 m height; meadows with small pools, filled with water from floods and rains.

Alt: 120 m

B: 20 cm–1 m

D: 5–20 cm; p: 20–50 cm

C: 30–75 cm/sec; p: 0

T: 24.7° C (10³⁰)–24.9° (12^h)

Bo: granitic boulders, gravel, sand;

p: muddy sand, vegetable debris

Ch: pH: 6.5, El₂₀: 35, T. H: 0.15° dH

Species found: *Lymnaea (Radix) cf. natalensis* (only in the pools!).

No. 3: F/Sey/2/5. 2. 1974: River Mamelles; dense secondary forest, very shady.

Alt: 40 m—20 m	Bo: granitic rock, boulders (10 cm Ø),
B: 2—10 m	gravel, sand; algae
D: 5—15 cm; p: 50 cm—1.5 m	Ch: pH: 6.9, El ₂₀ : 54, T. H: 0.65° dH
C: 50 cm—>1 m/sec; p: 0—20 cm/sec	
T: 24.4° C (10 ^h)	

Species found: From about 40 m: *Neritina pulligera stumpfi* and *knorri*; from about 20 m: *Neritina* (V.) *gagates*, *Neritilia consimilis*.

No. 4: F/Sey/23/18. 2. 1974: River Quenet (or Seychelles College), near the tennis-court of the College; dense, secondary forest, plantations, villages nearby: polluted.

Alt: 30 m	Bo: granitic boulders (50 cm—1 m Ø),
B: 1—3 m	gravel, covered with water-mosses;
D: 1—5 cm; p: 5—30 cm	b, p: muddy sand, vegetable debris
C: 50 cm—>1 m/sec; p: 0—30 cm/sec	Ch: pH: 6.9, El ₂₀ : 46, T. H: 0.33° dH
T: 25.5° C (16 ^h)	

Species found: *Neritina* (V.) *gagates*, *Neritina* (N.) *pulligera stumpfi*, *Gyraulus* cf. *mauritanus*.

No. 5: F/Sey/12/9. 2. 1974: River Royal, near the Canelle Road; secondary forest, plantations, village nearby: slightly polluted.

Alt: 30 m	Bo: granitic boulders (20—50 cm Ø),
B: 20—50 cm	covered with water-mosses; p: sand,
D: 5—20 cm	red lateritic mud, vegetable debris
C: 30 cm—>1 m/sec; b, p: 10—30 cm/sec	Ch: pH: 7.2, El ₂₀ : 116(!), pollution;
T: 26.3° C (16 ^h)	T. H: 1.39° dH

Species found: *Melanoides tuberculata*, *Gyraulus* cf. *mauritanus*.

No. 6: F/Sey/25/19. 2. 1974: River Cascade; near the barrage, upstream of the Mangrove-zone in the range of brackish estuary; scrub, plantations nearby.

Alt: 30 m	Bo: granitic rock, boulders, gravel, sand
B: 8—10 m	Ch: pH: 6.6, El ₂₀ : 33, T. H: 0.18° dH
D: 20—50 cm; p: 1 m	
C: 50 cm—>1 m/sec	
T: 26° C (14 ^h)	

Species found: *Septaria borbonica*.

5.1.1.4. Lower courses to the Mouth-region (10m—0 m):

No. 7: F/Sey/21/17. 2. 1974: River Grande Anse; near the bridge of the western coastal road; scrub.

Alt: 2 m	Bo: granitic rock, boulders (10—30 cm Ø),
B: 3—6 m	gravel, sand
D: 10—50 cm	Ch: pH: 6.8, El ₂₀ : 35, T. H: 0.2° dH
C: 50—75 cm/sec; b: 0—30 cm/sec	
T: 28° C (16 ^h)	

Species found: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*.

No. 8: F/Sey/8/7. 2. 1974: River Anse de la Mouche; near the Canelles-road, crossing coconut-plantations to the western coastal road, near Anse de la Mouche; the mouth-region dammed up by high-tide; flooded brackish-water pools near the borders of the

rivulet; many marine and brackish species occurring, such as *Periophthalmus* sp., crabs etc.).

Alt: 0.5 m

Bo: boulders of dead corals, sand,

B: 2–3 m (low-tide!)

filamentous blue-green algae

D: 5–50 cm (low-tide!); p: 1–20 cm

Ch: El₂₀: about 30.000 (brackish)

C: 30 cm/sec (low-tide!)

T: 32° C–32.5° C (16h)

Species found: Rivulet: *Melanoides tuberculata* (dense population of pigmy specimens!), *Syncera* (= *Assimineae*) *nitida*, *Melampus* cf. *caffer*; Brackish pools nearby: *Terebralia palustris*.

5.1.2 Silhouette

No. 1: Upper course of the River Maccabee, N of Grande Barbe; leg.: G. LIONNET (Mahé). No ecological data.

Species found: *Cleopatra ajanensis* f. *silhouettensis*.

5.2 Comores-Archipelago (Fig. 1)

The Comores comprise four main-islands: Grand Comore, Anjouan, Mohéli and Mayotte. They are almost entirely of volcanic origin. Grand Comore, the biggest and youngest island has undissected, active shield volcanoes. It has no river erosion and the waters of the rains seep away in the lava slacks. The rainwater must be collected in large cisterns by the population. The precipitous mountains of Anjouan (highest point: 1595 m) are composed of successions of basalts and ankamarites; the younger lavas partly highly alcalic. In older basaltic sequences are found deep river erosions modified by younger flows and well-preserved cinder cones. The remainder of primeval forests is restricted to the higher, steep parts of the central mountains. The hills and plains are cultivated, mostly with perfume-plantations, such as Ylang.

5.2.1 Grand Comore

No. 1: 28. 2. 1974: Walls of the Beach-Hotel Coelacanth, near Moroni; near the coast in the range of scattered rocks in the Upper-Tidal-zone.

Species found: *Melampus* (*M.*) *lividus*.

No. 2: F/Gr. Co/1/28. 2. 1974: Cistern of a village, N of Moroni; filled with collected rain-water; walls covered with filamentous algae.

T: about 28° C

Ch: pH: 8.1, El₂₀: 118, T. H: 2.85° dH

Species found: *Afrogyrus* (*Hovorbis*) cf. *crassilabrum*.

5.2.2 Anjouan

5.2.2.1. Headwaters to Upper courses (900 m–600 m):

T: 20° C (12³⁰–13. 3. 1974)

Ch: pH: 7.8–8.6, El₂₀: 35–94, T. H: 0.6°–1.9° dH

Freshwater gastropods absent!

5.2.2.2. Upper courses (600 m—400 m):

No. 1: F/An/12 I/11. 3. 1974: River Tatinga, near Dindi; primeval and secondary forest; scrub; on the left side border, influence of a mineral source.

Alt: 600 m	Bo: basaltic boulders, gravel sand;
B: 3—8 m	filamentous algae; near the mineral
D: 5—10 cm; p: 30—50 cm	source: iron-ochre mud
C: 75 cm—>1 m/sec;	Ch: pH: 7.9, El ₂₀ : 120, T. H: 2.6° dH
b, p: 10—30 cm/sec	
T: 22.9° C (16 ^h)	
22.2° C (18 ^h)	

(Mineral source: Ch: pH: 6, El₂₀: 1600, T. H: 55° dH(!), CaO: 221 mg/l, MgO: 102 mg/l, Fe: 13 mg/l, HCO₃: 1312 ppm, CO₂ (free): 550).

Species found: *Lymnaea (Radix) natalensis* (also outside of the river in the spray-water near the mineral source!)

No. 2: F/An/12/9. 3. 1974: Headwater and upper course with tributary and reservoir near the village Bazmini on the road Oueni-Col de Patsi; plantations; scrub.

Alt: 520 m	Bo: basaltic boulders, gravel
B: 50 cm—>1 m; reservoir: 5 m × 5 m	(5—20 cm Ø); b: muddy stones, sand,
D: 3—10 cm; reservoir: 50 cm	vegetable debris
C: 50 cm—>1 m/sec; b: 10—30 cm/sec	Ch: pH: 7, El ₂₀ : 130, T. H: 2.5° dH
reservoir: 0	
T: 23° C (9 ^h); reservoir: 23.5° C (9 ^h)	

Species found: *Lymnaea (Radix) natalensis* (near the border of the river and on the walls of the water-reservoir).

No. 3: F/An/5/5. 3. 1974: Tributary of the upper course of the River Mutsamudu; secondary forest; scrub.

Alt: 500 m	Bo: basaltic boulders, gravel
B: 1—2 m	(1—10 cm Ø); b: muddy stones, algae
D: 2—5 cm	Ch: pH: 8, El ₂₀ : 142, T. H: 3.15° dH
C: 50 cm—>1 m/sec;	
b, p: 10—30 cm/sec	
T: 22.5° C (10 ^h); 23° C (12 ^h)	

Species found: *Septaria borbonica* (sporadic), *Melanoides tuberculata*.

5.2.2.3. Upper to Middle courses (400 m—150 m):

No. 4: F/An/4/4. 3. 1974: River Mutsamudu, downstream of No. 3; secondary forest; scrub; plantations.

Alt: 250 m	Bo: basaltic boulders, gravel
B: 5—7 m	(5—20 cm Ø), sand
D: 10—20 cm	
C: 75 cm—>1 m/sec;	Ch: pH: 8.1, El ₂₀ : 117, T. H: 2.7° dH
b, p: 10—30 cm/sec	
T: 24.8° C (15 ^h)	

Species found: *Lymnaea (Radix) natalensis*.

No. 5: F/An/10/8. 3. 1974: River Ouani; narrow gorge near Patsi; plantations; near the banks flooded pools.

Alt: 250 m

B: 4–8 m; p: 3–5 m \varnothing

D: 5–10 cm; p: 1–2 m

C: 50 cm—>1 m/sec; b: 0–10 cm/sec

T: River: 24.3° C (9^h–12^h);

p: 26.3° C (12^h)

Bo: basaltic boulders (50 cm \varnothing), covered with mosses; gravel, muddy sand; p: muddy sand, vegetable debris;

Col: brownish

Ch: pH: 8.4, El₂₀: 180, T. H: 3.5° dH

Species found: River: *Lymnaea (Radix) natalensis*, *Ceratophallus* sp.

Flooded pools: *Melanoides tuberculata*, *Lymnaea (Radix) natalensis*, *Ceratophallus* sp.

5.2.2.4. Middle to Lower courses (150 m–10 m):

No. 6: F/An/18/20. 3. 1974: River Foubani; near the village Foubani (region Sima, NW of the island); scrub; plantations.

Alt: 150 m

B: 1–2 m

D: 1–10 cm

C: 30–75 cm/sec

T: 26° C (11^h)

Bo: basaltic rocks with cavities, gravel with algae, sand

Ch: pH: 6.8, El₂₀: 255, T. H: 5.5° dH

Species found: *Ceratophallus* sp.

No. 7: F/An/6/5. 3. 1974: River Mutsamudu; downstream of a waterfall and flowing out from a pool of 20 m \varnothing and 2–3 m depth in cascades; scrub; plantations.

Alt: 120 m

B: 10–20 m

D: 20–50 cm; p: 1–1.5 m

C: 1 m/sec; b. p: 20–30 cm/sec

T: 24.9° C (16^h); 24.5° C (16³⁰)

Bo: basaltic rock, boulders (30 cm–1 m \varnothing); gravel (5 cm \varnothing), sand

Ch: pH: 8.2, El₂₀: 135, T.H: 2.9° dH

Species found: *Clithon spiniperda*, *Neritina (V.) gagates*, *Neritina pulligera knorri*, *Septaria borbonica*, *Neritilia consimilis*.

No. 8: F/An/8/7. 3. 1974: River Hanghoué; scrub; plantations.

Alt: 90 m

B: 2–8 m

D: 5–10 cm; p: 50 cm

C: 30 cm–1 m/sec

T: 23.6° C (9^h); 25.8° C (12^h)

Bo: basaltic boulders (50 cm–2 m \varnothing), gravel (5–10 cm \varnothing), sand

Ch: pH: 7.9, El₂₀: 130, T.H: 2.6° dH

Species found: *Neritina pulligera stumpfi*, *Septaria borbonica*.

No. 9: F/An/15/13. 3. 1974: River Gégé; near the village Gégé on the SE-coast; scrub; coconut-plantations.

Alt: 20 m

B: 4–8 m

D: 5–30 cm

C: 75 cm—>1 m/sec; b, p: 0–30 cm/sec

T: 25.6° C (10^h); 27.3° C (12^h)

Bo: basaltic boulders (10–50 cm \varnothing), gravel (5 cm \varnothing), sand

Ch: pH: 8, El₂₀: 120, T.H: 2.3° dH

Species found: *Septaria borbonica*.

5.2.2.5 Lower courses to the mouth-regions (10 m—0 m):

No. 10: F/An/19/20. 3. 1974: River Bouékouni on the NW-coast; narrow gorge with waterfall and pool of 5 m in diameter and 1—2 m depth; out-flow of the pool reaches the sea in about 50 m.

Alt: 10 m (out-flow)

B: 2—5 m

D: 5—20 cm

C: 75 cm—>1 m/sec

T: 25.5° C (12^h)

Bo: basaltic rock, boulders (20 cm—1 m ø), lateritic layers

Ch: pH: 8.1, El₂₀: 186, T.H: 3.9° dH

Species found: *Neritina* (V.) *gagates*, *Neritina pulligera stumpfi*, *Septaria borbonica*.

No. 11: F/An/11/8. 3. 1974: River Oichiconi on the N-coast; about 200 m upstream of the mouth; coconut-plantations.

Alt: 5 m

B: 3—5 m

D: 10—30 cm

C: 30 cm/sec—>1 m/sec

T: 24.6° C (16^h); 24.2° (17³⁰)

Bo: basaltic boulders (10—50 cm ø), gravel

Ch: pH: 7.6, El₂₀: 43, T.H: 1° dH

Species found: *Septaria borbonica*.

No. 12: F/An/20/20. 3. 1974: River Pagé; near the mouth.

Alt: 3 m

B: 5—10 m

D: 10—50 cm

C: 50 cm—1 m/sec

T: 25° C (13^h)

Bo: basaltic boulders (10—50 cm ø), gravel

Ch: pH: 7.7, El₂₀: 102, T.H: 2.1° dH

Species found: *Clithon spiniperda*, *Septaria borbonica*.

No. 13: F/An/7/6. 3. 1974: River Pouzine on the N-coast; near the mouth; lower parts under influence of the brackish current during high tide; Ylang-plantation.

Alt: 2—1 m

B: 2—3 m

D: 10—30 cm

C: 30 cm/sec—>1 m/sec

T: 25.7° C (15^h); 26° C (17^h)

Bo: basaltic boulders (20—50 cm ø), gravel (5—10 cm ø), sand

Ch: pH: 7.7; El₂₀: 122 (during lowtide!), T.H: 2.5° dH

Species found: *Clithon chlorostoma* f. *comorensis*, *Clithon spiniperda*, *Neritina pulligera stumpfi*, *Septaria borbonica*, *Neritilia consimilis*.

No. 14: F/An/22/21. 3. 1974: River Jomani on the SO-coast; approx. 100 m upstream of the mouth; scrub; plantations.

Alt: 2—1 m

B: 8 m

D: 20—50 cm

C: 50—75 cm/sec; b: 20—30 cm/sec

T: 26.5° C (13^h)

Bo: basaltic boulders (40 cm—1 m ø), gravel (5—10 cm ø), sand

Ch: pH: 7.9, El₂₀: 108, T.H: 1.8° dH

Species found: *Septaria borbonica*.

No. 15: F/An/25/25. 3. 1974: River Pomoni (SE-coast); 100 m upstream of the mouth; scrub; plantations and villages nearby.

Alt: 2–1 m

Bo: basaltic boulders (50 cm–1 m \varnothing), sand

B: 10–20 m

Ch: No data!

D: 5–30 cm

C: 50–75 cm/sec; b: 20–30 cm/sec

T: 25° C (14^h)

Species found: *Septaria borbonica*.

No. 16: F/An/26/25. 3. 1974: River Bandoni on the SE-coast; mouthregion with influence of brackishwater during high-tide; scrub; coconut-plantation.

Alt: 1 m

Bo: basaltic boulders

B: 5 m

Ch: pH: 7.4, El₂₀: 85, T.H: 1.7° dH
(values taken at low-tide!)

D: 10–20 cm

C: 50 cm–1 m/sec

T: 25° C (17^h)

Species found: *Clithon chlorostoma f. comorensis*.

No. 17: F/An/3/3. 3. 1974: Source of Papani on the W-coast; S of Domboni; the run-off over a steep slope from a cave, flows in small streams 10–30 m to the sea; the pool in the cave is used as bath and lavatory by the population from villages nearby.

Alt: 1 m

Bo: basaltic boulders (20–30 cm \varnothing), gravel (5–10 cm \varnothing), sand

B: 1–2 m

Ch: pH: 7.7, El₂₀: 216, T.H: 3.7° dH

D: 2–5 cm; p: 50 cm

C: 1–2 m/sec; p: 0–20 cm/sec

T: 23° C (run-off, 15^h)

Species found: *Neritina pulligera stumpfi*, *Septaria borbonica*, *Neritilia consimilis*.

5.3 Island of Nossi-Bé (Fig. 1)

Nossi-Bé is situated on the NW-coast of Madagascar. The freshwater-gastropods of the island were studied by STARMÜHLNER (1969). The Swedish Mission (1973) by P. BRINCK and P. H. ENCKEL has given to us one sample:

No. 1: River Djabala/5. 11. 1973: No ecological data!

Species found: *Clithon spiniperda*.

5.4 Madagascar (Fig. 1)

The freshwater-gastropods of Madagascar were reported in a monograph by STARMÜHLNER (1969). The mission of P. BRINCK & P. H. ENCKEL in 1973 has sent us one sample from the Province Diego-Suarez in N-Madagascar:

No. 1: Loc. 51/3. 11. 1973: River Saharena; 19 km SW of Mahavanona (Prov. Diego-Suarez); Alt: 375 m; no ecological data!

Species found: *Lymnaea (Radix) natalensis hovarum*.

5.5 Mascarene-Archipelago (Fig. 1)

The Mascarene-islands comprise three main islands: La Réunion, Mauritius and, far to the East, Rodriguez. All islands are of volcanic origin.

5.5.1 La Réunion (Fig. 1)

The island (Highest elevation: Piton des Neiges, 3069 m) consists of two volcanoes. One, the Piton de la Fournaise, is still active. The second, the inactive Piton des Neiges, is apart from a number spectacular gorges with torrents quite well preserved. The central regions have been eroded in three great cirques as an extreme development of amphitheatre-headed valley erosion. Not only the youngest lavas and ashes are preserved, but also the ancient suites of effusive and intrusive rock, ranging from ultrabasic to acid composition are displayed deep within the core of the original volcano. A number of ancient terraces, composed of fluvatile sands and pebble-beds occur in the river gorges draining out from the cirques.

5.5.1.1 Headwaters to Upper courses (2500 m—1500 m):

T: 15°—16° C

Ch: p: 7.9, El₂₀: 52; T.H: 1.15° dH

Freshwater gastropods absent!

5.5.1.1 Upper courses (1500 m—700 m):

No. 1: F/Ré/18/13. 4. 1978: Riv. Cilaos, Bras de Benjouin, SW-slope of the Piton des Neiges, Cirque de Cilaos; high-mountain-scrub.

Alt: 1400 m

Bo: basaltic boulders (1—2 m ø), gravel

B: 1—3 m

b, p: sand, stones with algae

D: 5—10 cm

Ch: pH: 8, El₂₀: 130, T.H: 3° dH

C: 1—1.5 m/sec; b, p: 30 cm/sec

T: 15.2° C (17^h)

Species found: *Physa borbonica*.

No. 2: F/Ré/19/14. 4. 1974: Confluence of the Bras des Etangs with the Ravine Prudent as tributary of the River Cilaos; near the town in the Cirque de Cilaos; approx. 300 m upstream is the inflow of a thermal source, used as thermal-bath; the water-temperature of the thermal-water is 39° C, high deposits of iron-ochre mud; meadow-slope, shrubery borders.

Alt: 1200 m

Bo: basaltic boulders (20—50 cm ø),

B: 1—5 m

gravel; b, p: mud

D: 5—20 cm, p: 30—50 cm

Ch: no data!

C: 75 cm—>1 m/sec,

b, p: 30—50 cm/sec

T: 18.2° C (11³⁰)

Species found: *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

5.5.1.3 Upper to Middle courses (700 m—200 m):

No. 3: F/Ré/9/8. 4. 1974: River Mathérine; near the road St. Benoit-Takamaka; a tributary of the River Marsouin; torrent with waterfalls in a gorge of a steep slope; misty rain-forest; scrub.

Alt: 700 m

Bo: basaltic boulders (30—50 cm ø),

B: 1—2 m

gravel (5—20 cm ø), sand

D: 5—20 cm

Ch: pH: 7.8, El₂₀: 62, T.H: 1.25° dH

C: 1—2 m/sec; b, p: 0.30 cm/sec

T: 18° C (12^h, rain)

Species found: *Omphalotropis (O.) picturata* (near the borders), *Physa borbonica*.

No. 4: F/R6/3/4. 4. 1974: Tributary of the upper course of the River Mât; near the road to Hellbourg (Cirque de Salazie); torrent through plantations of water-cress; secondary forest (influence of fertilizers?).

Alt: 650 m Bo: basaltic boulders, gravel; gelatinous
 B: 50 cm—1 m globular algae (cf. *Nostoc* sp.) and
 D: 5—10 cm filamentous algae; b: matlike algae
 C: 50 cm—>1 m/sec (cf. *Spirogyra* sp.)
 b, p: 0—30 cm/sec
 T: 23.2° C (15³⁰) Ch: pH: 8.3, El₂₀: 250, T.H: 5.25° dH
 Species found: *Thiara scabra*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 5: F/R6/1/4. 4. 1974: River Mât; near Salazie; deep, V-like gorge; from the steep slopes, waterfalls of 20—30 m height in the river; shrub and secondary forest.

Alt: 450 m Bo: basaltic rock, boulders (20—30 cm
 B: 5—10 m Ø), gravel, sand
 D: 30 cm; p: 1—2 m Ch: pH: 8.3, El₂₀: 235, T.H: 4.8° dH
 C: 1—2 m/sec; b, p: 0—30 cm/sec
 T: 21.5° C (11^h); 23.4° C (13^h)
 Species found: *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica* (both species also on wet areas of rocks outside of the water!).

No. 6: F/R6/11/9. 4. 1974: River Langevin; between St. Philipp and St. Pierre; near the borders, small pools.

Alt: 400 m Bo: basaltic rock, boulders (20—30 cm
 B: 6—8 m Ø), gravel, sand
 D: 10—20 cm Ch: pH: 7.7, El₂₀: 69, T.H: 1.1° dH
 C: 75 cm—1 m/sec
 T: 17.8° C (15^h)
 Species found: *Physa borbonica*.

5.5.1.4 Middle to Lower courses (200 m—50 m):

No. 7: F/R6/21/14. 4. 1974: River Cilaos; a tributary of the River St. Etienne, near St. Louis.

Alt: 200 m Bo: basaltic boulders (20—30 cm Ø),
 B: 20 m gravel (5—10 cm Ø); b: mud and
 D: 5—10 cm paddings of algae
 C: 1 m/sec; p: 0—10 cm/sec Ch: pH: 8, El₂₀: 258, T.H: 8.8° dH
 T: 24° C (16^h)
 Species found: *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 8: F/R6/15/12. 4. 1974: River St. Suzanne, downstream of the waterfall called "Niagara" (height: 40 m) and a basin of 80 m in diameter; borders shrubbery.

Alt: 172 m Bo: basin: basaltic gravel; b: muddy
 B: 5—10 m (flow out of the basin!) sand, stones, on the borders plants
 D: 1 m; b: 10—30 cm are hanging over in the water, algae;
 C: 30—50 cm/sec river: basaltic boulders, gravel; b:
 basin: 0—10 cm/sec muddy sand
 T: 23.5° C (10^h) Ch: pH: 7.4, El₂₀: 92, T.H: 1.65° dH
 Species found: Basin, banks: *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*; river: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra* (only up to 30 cm/sec!).

No. 9: F/Ré/22A/15. 4. 1974: River St. Marie; near Flacourt; bordered by bamboo-cane, shady.

Alt: 156 m

B: 1–2 m

D: 10–30 cm

C: 75 cm/sec–1 m/sec; p: 30 cm/sec

T: 21.3° (16^h)

Bo: basaltic boulders (30 cm–1 m Ø),
gravel (3–10 cm Ø); b: muddy sand

Ch: pH: 7.6, El₂₀: 52, T.H: 1° dH

Species found: *Thiara scabra*, *Physa borbonica*.

No. 10: F/Ré/7/6. 4. 1974: Small brook near the road Cap Homard–St. Gilles les Hauts; a tributary of the Ravine St. Gilles; bordered by shrub and meadows.

Alt: 150 m

B: 1 m

D: 20–30 cm

C: 30–50 cm/sec

T: 19° C (15^h)

Bo: basaltic gravel, sand; b: muddy

Ch: pH: 7.4, El₂₀: 115, T.H: 2.3° dH

Species found: *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 11: F/Ré/4/5. 4. 1974: River Mât; near the bridge of the coastal road St. André–Bras Panon–St. Benoit; bordered by scrub and plantations.

Alt: 145 m

B: 10–20 m

D: 10–30 cm

C: 1–2 m/sec; b, p: 0–30 cm/sec

T: 23.8° C (10^h)–24.5° C (13^h)

Bo: basaltic boulders (1–10 m Ø),
gravel (5–30 cm Ø), sand

Ch: pH: 8.1, El₂₀: 152, T.H: 3.1° dH

Species found: *Thiara scabra*, *Lymnaea (Radix) mauritiana* (also be found on wet areas of rocks outside of the water!), *Physa borbonica*.

No. 12: F/Ré/25/17. 4. 1974: Left side tributary of the River Galets (No. 13).

Alt: 120 m

B: 1 m

D: 1–2 cm; p: 20–50 cm

C: 50–75 cm/sec; p: 0–30 cm/sec

T: 23.8° C (17^h)

Bo: basaltic gravel (5–20 cm Ø), sand,
mud

Ch: see No. 13

Species found: *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 13: F/Ré/24/17. 4. 1978: River Galets; E of the road-bridge near Le Port; broad trough-like valley; bordered by scrub and meadows.

Alt: 118 m

B: 8–10 m

D: 20–50 cm

C: 75 cm–1 m/sec;

b, p: 10–30 cm/sec

T: 24° C (15³⁰)

Bo: basaltic boulders (50 cm–3 m Ø),
gravel (10–20 cm Ø); b, p: muddy
stones with gelatinous brown-green
algae (cf. *Nostoc*)

Ch: pH: 8.6, El₂₀: 142, T.H: 2.45° dH

Species found: *Thiara scabra*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 14: F/Ré/12/9. 4. 1974: River Langevin; W of St. Philipp.

Alt: 100 m

B: 10–15 m

D: 5–10 cm

C: 30–50 cm/sec

T: 20° C (17^h)

Bo: basaltic boulders (50 cm–1 m Ø),
gravel (10–20 cm Ø) sand; stones
covered with gelatinous film of
diatoms, globular algae (cf. *Nostoc*),
filamentous algae

Ch: pH: 7.7, El₂₀: 69, T.H: 1.1° dH

Species found: *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 15: F/Ré/14/11. 4. 1974: River des Pluies; near the village River des Pluies; broad trough-like valley; bordered by shrub and plantations.

Alt: 100 m T: 23.5° C (14^h)
 B: 5–8 m Bo: basaltic boulders (20–50 cm ø),
 D: 10–20 cm gravel, sand
 C: 50–75 cm/sec; b: 0–30 cm/sec Ch: pH: 7.8, El₂₀: 102, T.H: 2.1° dH

Species found: *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

5.5.1.5 Lower courses to the Mouth-regions (50 m–0 m):

No. 16: F/Ré/22/15. 4. 1978: River St. Suzanne; upstream of the coastal road St. Suzanne–St. André; bordered by bamboo-cane, shady.

Alt: 45 m T: 22.1° C (14^h)
 B: 5–8 m Bo: basaltic boulders, gravel and mud
 D: 50 cm–1 m Ch: pH: 7.4, El₂₀: 62, T.H: 1° dH
 C: 30–50 cm/sec

Species found: *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*.

No. 17: F/Ré/23/16. 4. 1978: River St. Denis; upstream of the capital St. Denis in a broad gorge; bordered by scrub and plantations; upstream villages, pollution influence of sewage is to except.

Alt: 25 m Bo: basaltic boulders (20–50 cm ø),
 B: 5–8 m gravel (5–10 cm ø), covered with
 D: 10–30 cm algae; b: floating plants and roots
 C: 50 cm–1 m/sec from the borders; submerged water-
 b, p: 0–30 cm/sec plants, such as *Hydrilla* sp.; mud
 T: 23.2° C (17^h) Ch: pH: 8.4, El₂₀: 105, T.H: 2.5° dH

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*, *Planorbella* (= *Helisoma*) *duryi*, *Ferrissia (Pettancylus)* sp.

No. 18: F/Ré/16/12. 4. 1974: Ravine de Charpentier; upstream of St. Marie; bordered by bamboo-cane, shady.

Alt: 20 m T: 23° C (14^h)
 B: 4–6 m Bo: basaltic gravel (5–20 cm ø), sand
 D: 5–30 cm Ch: pH: 7.2, El₂₀: 65, T.H: 1° dH
 C: 75 cm–>1 m/sec; b: 10–20 cm/sec

Species found: *Septaria borbonica*, *Neritilia consimilis*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 19: F/Ré/5/5. 4. 1974: River des Roches; near Beauvallon; 1 km upstream of the mouth-region; bordered by scrub, plantations.

Alt: 10 m T: 26.6° C (14^h); 28.4° C (14^h, creek
 B: 10–15 m near the banks
 D: 30 cm–1.5 m Bo: basaltic boulders (30 cm–1 m ø),
 C: 50 cm–>1 m/sec; covered with algae
 b, p: 0–30 cm/sec Ch: pH: 7.4, El₂₀: 77, T.H: 1.5° dH

Species found: *Clithon coronata*, *Neritina* (N.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*.

No. 20: F/Ré/10/8. 4. 1974: River Marsouin; near St. Benoit; upstream of the mouth-region; bordered by scrub and plantations.

Alt: 10 m T: 22.7° C (15^h)
 B: 10–20 m Bo: basaltic boulders (10–50 cm ø),
 D: 20–50 cm gravel (5–10 cm ø), sand
 C: 50 cm—>1 m/sec; b: 0–30 cm/sec Ch: pH: 8.1, El₂₀: 80, T.H: 1.5° dH

Species found: *Clithon coronata*, *Septaria borbonica*, *Lymnaea (Radix) mauritiana*.

5.5.1.6 Stagnant waters

No. 21: F/Ré/20/14. 4. 1974: Mare de Cilaos; two connected ponds near the town of Cilaos; bordered by scrub and partly polluted by domestic sewage.

Alt: 1220 m Bo: basaltic boulders, gravel, mud, vege-
 Diameter: 20–30 m table debris
 T: 23.7° C (15^h) Ch: pH: 9.2, El₂₀: 160, T.H: 3.8° dH

Species found: *Physa borbonica*.

No. 22: F/Ré/8/7. 4. 1974: Grand Bras de la Ravine Seche; Plaine de la Palmiste; a temporary stream, flowing only after heavy rainfall; outside of the rainy season, ponds and pools in channels and cavities of basaltic rocks; bordered by scrub.

Alt: 950 m Bo: basaltic rock, boulders, muddy lava-
 Diameters: sand, vegetable debris
 Big pond: ca. 140 m long; Ch: pH: 6.9, El₂₀: 24, T.H: 0.45° dH
 B: 5–10 m, D: 1–2 m T: 23° C (16^h-big pond)

Downstream, small ponds and pools of
 50 cm—1 m ø; rock-pools: 10–50 cm ø
 and D: 5–10 cm

Species found: *Physa borbonica*.

No. 24: F/Ré/6/6. 4. 1974: Source de la Moulin d'Eau; from a sourcepond a small brook flows off to the Etang St. Paul, a big pond with marshes and swamps reaching to the coast in contacts brackish-water; bordered by scrub, plantations, dense growth of *Colocasia antiquorum* on the border of the source-pond.

Alt: 20 m—10 m Bo: source-pond: basaltic boulders,
 Diameter: Source-pond: 20 m gravel, sand mud; on the surface
 D: 20–50 cm *Lemna* sp.; outflow: basaltic gravel,
 Outflow of the source-pond: sand, submerged plants, such as
 B: 50 cm; D: 20–30 cm; C: 30–50 cm/sec *Potamogeton pectinata*, *Naja mada-*
 T: source-pond: 21.7° C (10^h-shady part) *gascariensis*, cf. *Fissidens* sp., fila-
 22.5° C (10^h-sunny part) mentous algae
 23.7° C (12^h-sunny part)
 outflow: 21.2° C (10^h-shady) Ch: pH: 8, El₂₀: 1600, T.H: 10.7° dH

Species found: source-pond: *Neritina* (V.) *gagates*, *Thiara scabra*, *Melanoides tuberculata*; outflow: *Syncera* (= *Assimineae*) *hidalgoi granum*; Etang St. Paul: *Thiara scabra*.

5.5.2 Mauritius (Fig. 1)

Mauritius is like La Réunion a volcanic island, but 5–6 million years older. The central table land, separated from the plains on and near the coast,

is a plateau of about 580 m altitude. It is surrounded by mountains with some prominent peaks to more than 800 m altitude. The denuded stamps of an older series of basalts are covered by a twofold younger series, again basaltic. The island is drained by many rivers receiving in their courses numerous tributaries from the mountains. The tropical primeval forests, with many endemic species, remain only in the natural forest reserves of the mountains in the SW-Black River Gorge. More than two third of Mauritius is cultivated, mostly with plantations of sugar-cane. The center and the coasts shows a high density of population.

5.5.2.1 Headwaters (700 m—600 m):

T: 18° C—20° C (12^h)

Freshwater — gastropods absent!

Ch: pH: 6.1—6.5, El₂₀: 43—54, T.H: 0.28°—0.3° dH

5.5.2.2 Upper courses (600 m—400 m):

No. 1: F/Mau/7. 5. 1974: River des Anguilles; near the tea-estate of Bois-Cheri; bordered by scrub, secondary forest.

Alt: 580 m

B: 4—6 m

D: 5—20 cm

C: 75 cm—>1 m/sec

b, p: 20—30 cm/sec

T: 19.4° C (11^h); 19.5° C (12^h)

Bo: basaltic rock, boulders (30 cm—1 m ø), filamentous algae; b, p: muddy sand, brightreen cushions of tube-like algae

Ch: pH: 7.6, El₂₀: 97, T.H: 1.95° dH

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymanaea (Radix) mauritiana*, *Physa borbonica*.

No. 2: F/Mau/25/6. 5. 1974: River Doudy; a tributary of the Grand River NE; bordered by scrub and plantations.

Alt: 400 m

B: 3—5 m

D: 5—10 cm; p: 20—30 cm

C: 50—75 cm/sec;

b, p: 20—30 cm/sec

T: 19.9° C (12^h)

Bo: basaltic boulders (20—30 cm ø), gravel (2—5 cm ø); Characea gen. sp., filamentous algae, globular algae (cf. *Nostoc* sp.)

Ch: pH: 6.6, El₂₀: 66, T.H: 1° dH

Species found: *Omphalotropis gibbosa* (near the banks), *Melanoides tuberculata*, *Lymanaea (Radix) mauritiana*, *Physa borbonica*.

No. 3: FMau/26/6. 5. 1974: Grand River NE; bordered by scrub and plantations.

Alt: 400 m

B: 10—20 m

D: 10 cm; p: 1—2 m

C: 50 cm/sec;

b, p: 10—20 cm/sec

T: 20.9° C (13^h)

Bo: basaltic rock, boulders (1 m ø), filamentous algae, water-mosses; p: iron-ochre mud

Ch: pH: 7, El₂₀: 69, T.H: 1° dH

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymanaea (Radix) mauritiana*, *Physa borbonica*, *Gyraulus mauritanus*.

5.5.2.3 Upper to Middle courses (400 m—200 m):

No. 4: F/Mau/21/4. 5. 1974: Tributary of the River Moka, a tributary of the Grand River NW; bordered by meadows, sugar-cane plantations, dense growth of *Colocasia antiquorum*; slightly polluted by a laundry-place of a village nearby.

Alt: 380 m

B: 1 m

D: 10—50 cm

C: 50 cm/sec;

b, p: 10—30 cm/sec

T: 21.2° C (10^h)

Bo: basaltic boulders (50 cm—1 m Ø),
gravel (1—20 cm Ø); b: mud, sub-
merged waterplants and filamentous
algae

Ch: pH: 6.6, El₂₀: 116, T.H: 1.85° dH

Species found: *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*, *Ferrissia (Pettancyclus) sp.*

No. 5: F/Mau/4/28. 4. 1974: Brook Le Canal; a tributary of the River Baie du Cap, near the road Fantaisie-Chamarel; bordered by scrub.

Alt: 300 m

B: 2—5 m

D: 5—30 cm

C: 50—75 cm/sec;

b, p: 10—30 cm/sec

T: 21.2° C (10^h)

Bo: basaltic boulders (30 cm—1 m Ø),
gravel (10 cm Ø); b: muddy sand

Ch: pH: 7.7, El₂₀: 130, T.H: 1.85° dH

Species found: *Clithon corona f. despinosa*, *Neritina (V.) gagates*, *Septaria borbonica*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*.

No. 6: F/Mau/10/30. 4. 1974: River Cascade; downstream of the confluence with the River Terre Rouge, a tributary of the Grand River NW; near the road-bridge between Rose Hill and Reduit; bordered by scrub, dense growth of *Colocasia antiquorum*, plantations, gardens.

Alt: 300 m

B: 4—6 m

D: 3—5 cm; p: 30—50 cm

C: 50—75 cm/sec;

b, p: 10—30 cm/sec

T: 23.8° C (14^h)

Bo: basaltic boulders (50 cm—1 m Ø),
gravel, dense growth of submerged
waterplants such as *Hydrilla* sp. and
others, filamentous algae; b: *Salvia*
sp.

Ch: pH: 7.6, El₂₀: 155, T.H: 2.8° dH

Species found: *Thiara scabra*, *Melanoides tuberculatus*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*, *Gyraulus mauritanus*.

No. 7: F/Mau/9/30. 4. 1974: River Rempart W; near the road Trois Cavernes-Quatres Bornes; bordered by scrub, sugar-cane plantations, dense growth of *Colocasia antiquorum* near the banks.

Alt: 250 m

B: 3—6 m

D: 20—50 cm; p: 1—2 m

C: 50 cm—1 m/sec;

b, p: 0—30 cm/sec

T: 22.6° C (10^h)

Bo: basaltic rock with cavernes, boulders,
gravel; dense vegetation of water-
mosses, near the borders: *Hydrilla* sp.

Ch: pH: 7.5, El₂₀: 200, T.H: 4.25° dH

Species found: *Clithon coronata f. despinosa*, *Neritina (V.) gagates*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

No. 8: F/Mau/12/1. 5. 1974: River Patates; NE of Chemin Grenier, S-slope of the Piton Savanne; bordered by secondary forest with dense undergrowth.

Alt: 220 m	T: 22.6° C (13 ^h)
B: 2–3 m	Bo: basaltic boulders (20 cm–1 m ø),
D: 20–30 cm; p: 50 cm–1 m	gravel; few algae
C: 75 cm–1 m/sec; b. p: 10–20 cm/sec	Ch: pH: 7.9, El ₂₀ : 93, T.H: 1.45° dH

Species found: *Neritina* (V.) *gagates*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

5.5.2.4 Middle to Lower courses (200 m–10 m):

No. 9: F/Mau/19/9. 5. 1974: River Rempart E; near Amaury-bridge; bordered by dense growth of *Colocasia antiquorum* and sugar-cane plantations; slightly polluted by a laundry-place of a village nearby.

Alt: 140 m	T: 24° C (12 ^h)
B: 5–7 m	Bo: basaltic boulders, gravel, sand, mud
D: 30–40 cm; p: 50 cm–1 m	and vegetable debris
C: 75 cm–>1 m/sec;	Ch: pH: 7.6, El ₂₀ : 163, T.H: 2.3° dH
b. p: 10–20 cm/sec	

Species found: *Neritina* (V.) *gagates*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 10: F/Mau/5/28. 4. 1974: Small spring-brook in cascades; near the road Chamarel-Grand Case Noyal; bordered by scrub.

Alt: 130 m	T: 23.6° C (13 ^h)
B: 30 cm	Bo: gravel, sand
D: 10 cm	Ch: no data!
C: 50 cm/sec	

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 11: F/Mau/6/28. 4. 1974: River Citronniers; near Bel Ombre.

Alt: 130 m	T: 23.5° C (17 ^h)
B: 1–3 m	Bo: basaltic rock, boulders, covered with
D: 10 cm; p: 50 cm	algae; brown mud
C: 30–50 cm/sec; b. p: 0–10 cm/sec	Ch: pH: 7.8, El ₂₀ : 175, T.H: 2.35° dH

Species found: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Melanoides tuberculata*.

No. 12: F/Mau/11/1. 5. 1974: Confluence of the rivulets Jaquot and Ruisseau Fay d'Herbe; tributaries of the middle course of the River des Gallets; near Chemin Grenier, ravine between sugarcane plantations; laundry place of a village nearby.

Alt: 130 m	T: 22.4° C (9 ³⁰); 23.4° C (12 ^h)
B: Rivulets before the confluence: 1 m;	Bo: basaltic rock, boulders, gravel, some
Diameter of the confluence-pool: 10 m;	stones covered with algae; p: mud
Outflow of the confluence-pool: 1–2 m	and muddy stones
D: rivulets: 2–5 cm; p: 10–50 cm	Ch: pH: 7.4, El ₂₀ : 134, T.H: 2.35° dH
C: Fay d'Herbe: waterfall of 10 m	
height, borders with wet rocks;	
Jaquot and outflow of the pool:	
75 cm–>1 m/sec; p: 0–30 cm/sec	

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 13: F/Mau/22/5. 5. 1974: River Savannes; downstream of the Rochester Falls in a pool of about 20 m length and 8 m breadth where the rivers flows out; water level of the pool and the outflow depends on the water consumption of a power station upstream of the walls; bordered by scrub and sugar-cane plantations.

Alt: 100 m	T: 21.7° C (10 ^h : outflow)
B: Rochester Falls: 15 m	Bo: basaltic boulders, gravel (5–20 cm ø), sand, vegetable debris
outflow: 2–3 m	
D: 5–10 cm (low-water level)	Ch: pH: 7.9, El ₂₀ : 96, T.H: 1.55° dH
40–60 cm (high-water level)	
C: outflow: 50 cm/sec (low-water level)	
75 cm—>1 m/sec (high-water level)	

Species found: *Clithon coronata*, *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Melanoides tuberculata*.

No. 14: F/Mau/1/27. 4. 1974: Small brook in the Botanical Garden of Pamplermousses; bordered by scrub and meadows.

Alt: 70 m	Bo: Mud, vegetable debris, some stones
B: 50 cm	Ch: pH: 7.6, El ₂₀ : 125, T.H: 1.8° dH
D: 10 cm	
C: 30 cm/sec; b: 10 cm/sec	
T: 25.7° C (13 ^h)	

Species found: *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 15: F/Mau/3. 5. 1974: River Tombeau; near the road-bridge Terre Rouge — Petite Rosalie; bordered by scrub, meadows, sugar-cane plantations and with dense growth of *Colocasia antiquorum*.

Alt: 60 m	Bo: basaltic boulders (30 cm—1 m ø), gravel (10—20 cm ø), sand; dense growth of <i>Hydrilla</i> sp., watermosses and filamentous algae
B: 10 m	
D: 10—30 cm	
C: 50 cm—>1 m/sec; b: 0—30 cm/sec	
T: 22.3° C (11 ^h); 23.8° C (13 ^h)	Ch: pH: 8.2, El ₂₀ : 132, T.H: 2.5° dH

Species found: *Clithon coronata* f. *despinosa*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 17: F/Mau/13/1. 5. 1974: Black River in the Black River Gorge; near the borders are rock-pools, filled with water from floods and rains; bordered by scrub, secondary forest.

Alt: 30—40 m	T: 24.5° C (16 ^h)
B: 15—20 m	Bo: basaltic gravel (5—20 cm ø), sand; b: mud, water-mosses, filamentous algae
D: 10—30 cm; p: 1—2 m	
C: 50 cm—>1 m/sec; b, p: 10—30 cm/sec	Ch: pH: 8.1, El ₂₀ : 175, T.H: 2.65° dH

Species found: (eggs of *Neritidae*), *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*; rock-pools: *Lymnaea* (*Radix*) *mauritiana*.

No. 18: F/Mau/20/3. 5. 1974: River Remparts E; near Haute Rive; bordered by sugar-cane plantations and dense growth of *Colocasia antiquorum*.

Alt: 20 m	T: 25.4° C (13 ^h)
B: 10–15 m	Bo: basaltic gravel (5–20 cm Ø), sand;
D: 20–50 cm	b: mud, water-mosses, filamentous
C: 20–50 cm/sec; b: 0–20 cm/sec	algae
	Ch: pH: 8.1, El ₂₀ : 175, T.H: 2.65° dH

Species found: *Neritina* (V.) *gagates*, *Bellamyia bengalis* f. *zonata*, *Thiara scabra*, *Melanoides tuberculata*.

No. 19: F/Mau/8/29. 4. 1974: River Jacotet; near Beau Champ; about 50 to 100 m upstream of the return current of brackish water during high tide; bordered by scrub.

Alt: 15 m	T: 23.8° C (16 ³⁰ -shady!).
B: 1–5 m	Bo: basaltic rock, boulders, gravel (5–
D: 10–50 cm	20 cm Ø); b: iron-ochre mud; Col:
C: 50–75 cm/sec;	opalescent
b: 0–10 cm/sec	Ch: pH: 7.8, El ₂₀ : 150, T.H: 2.5° dH

Species found: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Melanoides tuberculata*.

5.5.2.5 Lower courses to the Mouth-region (10 m–0 m):

No. 20: F/Mau/28/8. 5. 1974: River du Poste; near the coastal roadbridge; bordered by sugar-cane plantations and scrub.

Alt: 10 m	T: 23.6° C (10 ^h)
B: 5–10 m	Bo: basaltic boulders (30 cm–1 m Ø),
D: 30–50 cm; b: 1 m	gravel
C: 50 cm/sec; b, p: 10 cm/sec	Ch: pH: 7.8, El ₂₀ : 150, T.H: 2.5° dH

Species found: *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

No. 21: F/Mau/29/8. 5. 1974: River Le Chaux; near the town of Mahébourg in the park of the Museum; bordered by scrub, plantations, gardens and large trees (shady); laundry places nearby.

Alt: 10 m	T: 24.5° C (13 ^h)
B: 15 m	Bo: basaltic boulders (30–50 cm Ø),
D: 10–30 cm	gravel (5–10 cm Ø), sand; b: mud,
C: 50 cm–>1 m sec;	vegetable debris
b: 20–30 cm/sec	Ch: pH: 7.8, El ₂₀ : 133, T.H: 2.3° dH

Species found: *Clithon coronata*, *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*.

No. 22: F/Mau/30/8. 5. 1974: River des Créoles; near the bridge of the coastal-road: Ville Noire to Ferney; bordered by scrub, plantations, villages nearby.

Alt: 10 m	T: 24.5° C (13 ^h)
B: 10–20 m	Bo: basaltic boulders (30–50 cm Ø),
D: 20–50 cm	gravel, sand; b: mud
C: 50 cm–>1 m/sec;	Ch: pH: 8, El ₂₀ : 130, T.H: 2.4° dH
b: 20–30 cm/sec	

Species found: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Bellamyia bengalensis* f. *zonata*, *Thiara scabra*.

No. 23: F/Mau/7/29. 4. 1974: River Baie du Cap; near the influence of brackish water during the return current by high-tide; approx. 50 m upstream of No. 24, the mouth-region; bordered by scrub, plantations of sugar-cane.

Alt: 5 m

B: 6–7 m

D: 10–30 cm

C: 30–75 cm/sec; b: 10–30 cm/sec

T: 22.3° C (9^h); 22.6° C (12^h)

Bo: basaltic gravel (10–30 cm Ø), sand;

dense growth of *Salvinia* sp., *Pota-*

mogeton sp., *Hydrilla* sp., filamentous

algae

Ch: pH: 8.2, El₂₀: 165, T.H: 2.65° dH

Species found: *Clithon coronata*, *Neritina* (V.) *gagates*, *Neritina* (*Neripteron*) *auriculata* f. *mauriciae*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Melanoides tuberculata*.

No. 24: F/Mau/3/28. 4. 1974: River Baie du Cap; mouth-region near the coastal road; in the reach of brackish water during hightide (about 50 m downstream of No. 23), many marine animals; bordered by scrub.

Alt: 1 m

B: 20–30 m

D: 10–50 cm (low-tide!)

C: 10–30 cm/sec (low-tide!)

T: 26.3° C (10^h)

Bo: basaltic gravel, mud, vegetable

debris; dense growth of brackish

water algae

Ch: no data!

Species found: *Neritina* (V.) *gagates* (rarely!); *Ostreidae* gen. sp.

5.5.2.6 Stagnant waters:

No. 25: F/Mau/2/27. 4. 1974: Artificial pond in the Botanical Garden of Pample-mousses; with *Victoria regia*, *Eichhornia crassipes*, *Nymphaea* sp., *Hydrilla* sp. and other submerged waterplants and filamentous algae.

Alt: 70 m

Diameter: 200 to 300 m

D: 30 cm

T: 26.3° C (13^h)

Bo: basaltic stones, mud, vegetable

debris, borders with cement walls

Ch: pH: 7.6, El₂₀: 125, T.H: 1.8° dH

Species found: *Bellamya bengalensis* f. *zonata*, *Thiara scabra*, *Melanoides tuberculata*.

5.5.3 Rodriguez (Fig. 1)

An old, small volcanic island E of Mauritius. Collections of freshwater gastropods were made by the Mission (1973) of the University of Lund (P. BRINCK & P. H. ENCKEL).

No. 1: Loc. 106/28. 11. 1973: St. Gabriel, 4 km SE of Port Mathurin.

Alt: 400 m

Species found: *Omphalotropis rangi*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Afrogyrus rodriguezensis*.

No. 2: Loc. 107/28. 11. 1973: St. Gabriel, 4.5 km SE of Port Mathurin.

Alt: 400 m

Species found: *Afrogyrus rodriguezensis*.

No. 3: Loc. 105/28. 11. 1973: Solitude, 2 km SE of Port Mathurin.

Alt: 250 m

Species found: *Omphalotropis rangi*, *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*, *Afrogyrus rodriguezensis*.

No. 4: Loc. 109/28. 11. 1974: River Manglie; 6 km SW of Port Mathurin.

Alt: 250 m

Species found: *Thiara scabra*, *Lymnaea (Radix) mauritiana*.

6: Systematic-anatomical Part

Abbreviations of the Islands in the list of stations: Sey: Seychelles; M: Mahé; S: Silhouette; Co: Comores; G.Co: Grand Comore; A: Anjouan; N.B: Nossi-Bé; Mad: Madagascar; Mas: Macarene; Ré: La Réunion; Mau: Mauritius; Ro: Rodriguez.

Class: GASTROPPODA

Subclass: PROSOBRANCHIA (= STREPTONEURA)

Order: Archaeogastropoda

Superfamily: Neritacea

Family: Neritidae

Subfamily: Neritinae

Genus: *Clithon* MONTFORT, 1810

Subgenus: *Clithon* s. str.

1) *Clithon (Clithon) chlorostoma* (BRODERIP, 1832) f. *comorensis* (MORELET, 1877)

Lit.: 1832 *Nerita chlorostoma* (BRODERIP, Proc. Zool. Soc., 1832: 201) — 1855/56 *Neritina chlorostoma* (REEVE, Conch. Icon.: Fig. 94) — 1877 *Neritina comorensis* (MORELET, J. d. Conch., 25: 345; Pl. 13, Fig. 6) — 1879 *Neritina chlorostoma* (MARTENS, in M. & CH., Conch. Cab., 2 (10): 168; Pl. 17, Fig. 14, 15, 17) — 1879 *Neritina comorensis* (MARTENS, ibid.: 271) — 1888 *Neritina chlorostoma* (TRYON, Man. Conch., 10: 66, including the synonyms: *pisiformis* RÉCLUZ, 1842; *siderea* GOULD, 1847; *parvula* (GUILLOU) RÉCLUZ; *tristis* REEVE, 1856; *lentiginosa* REEVE, 1856; *dispar* PEASE, 1867; *harveyensis* MOUSSON; *paludosa* GARRETT; Pl. 24, Fig. 38, 39; Pl. 25, Fig. 62; Pl. 26, Fig. 83—85) — 1888 *Neritina comorensis* (TRYON, ibid.: 72; Pl. 26, Fig. 94, 95) — 1929 *Neritina comorensis* (HAAS, Zool. Jb. (Syst.), 57: 401) — 1976 *Clithon* cf. *chlorostoma* (STARMÜHLNER, Ann. Naturhist. Mus. Wien, 80: 507; Pl. 6, Fig. 26, 27).

Localities: Co: A: No. 13 (11 ind.), No. 16 (ca. 120 ind., mostly iuv.).

Shell: The shells of f. *comorensis* (MORELET, 1877) are nearly identically with the shells of specimens described by STARMÜHLNER, 1976 from Guadalcanal (Solomon-Islands) as cf. *chlorostoma*. Both populations were found in the lower parts of rivers near the mouth-region and in the zones, influenced by brackish water during high-tide. Mr. Henk H. MIENIS (Curator of the Mollusc-Section of the Zoological Museum of the Hebrew University of Jerusalem, Israel) a well-known specialist of Neritidae, has checked the shells of Guadalcanal and Anjouan. He wrote to the author on 24th March 1977: "I checked again your specimens of *Clithon chlorostoma* from Guadalcanal and this convinced me that they are indeed *chlorostoma*. There is a great resemblance

between *comorensis* (MORELET, 1877) and *chlorostoma* (BRODERIP, 1832) and I'll not be surprised if they turn out to belong to one and same taxon".

Oblong, spire solide, with $3\frac{1}{2}$ whorls, the adult shells mostly strongly corroded, last whorl bulging, suture with irregular margin and covering a part of the previous whorl; greenish-grey; young specimens show a brown-spotted network; between arrow-head like spots with black borders are very narrow wave lines; compression of the black borders produces three dark bands; growth striae fine, very narrow and wave-like, crossed by fine long striae ($25\times$ enlargement!); aperture grey to greyish brown; columellar area plain with shallow transverse and longitudinal furrows; margin with one to three obtuse denticles; colour greyish to blueish (Pl. 1, Fig. 1a, b).

Sizes (in mm)

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Co: A: No. 13	13.9	10	10	8.2	4
	12.7	9.7	9.7	8.1	3.8
Co: A: No. 16 (iuv.)	8.7	6.7	6.7	3.8	2.5

The measurements are for the largest shells in the samples.

Operculum: Size (from a specimen with shell-height: 13.9 mm): $6.8\text{ mm} \times 4\text{ mm}$; semilunar, surface granulated with a basal nucleus, growth lines fan-like, in the middle with a narrow arched groove; the superior margin with incision; colour: to the nucleus blackish, to the middle groove yellow-whitish, between the median arch and exterior margin alternately black-yellowish striped, toward the superior margin gradually darker, outer margin horny-brownish to yellowish; inner surface yellowish to blackish; the outside groove corresponds on the back surface with an arched ridge; the peg yellowish, broad incised, connected with the arched, corded rib (Pl. 3; Fig. 14a, b).

Anatomical remarks: The outside of the mantle dark blue, the margin with yellowish border; Radula: corresponds with the description, given by STARMÜHLNER, 1976 for the specimens from Guadalcanal: central tooth higher than broad, cutting edge in the lower part, first lateral tooth on the outside cutting edge scarcely or not denticulated; the 4th lateral tooth with one denticle on the inner cutting edge and 15–20 smaller denticles along the outer edge; marginal teeth with 7–9 denticles (Fig. 2); Femal reproductive system: spermatheca larger than in the pacific specimens (STARMÜHLNER, 1976) with 10–11 spermatophors: greenish-yellowish, cigar-shaped, one end cork-screw-like and darker coloured, the other end long filiform (length: 18 mm!); the vaginal connecting duct is long, slender and the superior part is in narrow loops; it enters in the superior part of the vagina at the base of an ampoule-shaped enlargement; the end of the vagina is again narrow and arched; the

dark coloured receptaculum seminis with a short duct; ductus enigmaticus and crystal-sae, are typically developed (Fig. 3a, b).

Ecological-biological remarks: Like the specimens of *Clithon* cf. *chlorostoma* from Guadalcanal (STARMÜHLNER, 1976) these specimens, found at Anjouan, occur only in the lowest parts of the streams, near the mouth-region, in the zones of the return current of brackish water during high tide and with freshwater during low tide. They were associated with *Clithon spiniperda*,

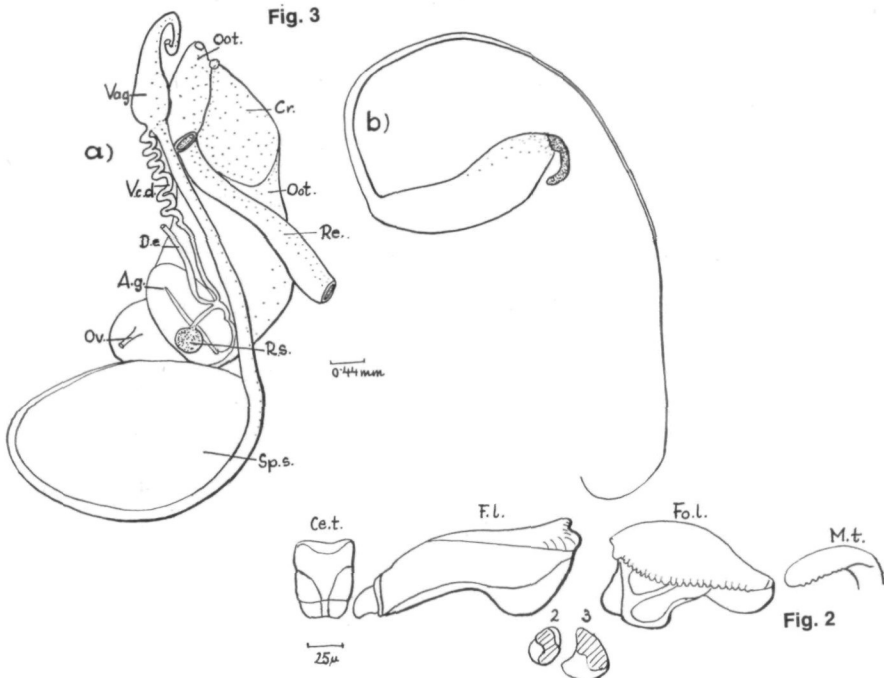


Fig. 2. *Clithon chlorostoma* f. *comorensis*: Radula-teeth

Fig. 3. *Clithon chlorostoma* f. *comorensis*: a) Female reproductive-system; b) Spermatophor

Septaria borbonica and *Neritilia consimilis*. In these zone also typically brackish water fishes are to observed, such as *Kuhlia rupestris* and *Eleotris fusca*. The snails are attached on and between boulders and gravel in a density of about 1 specimen/dm² with a current between 30 and 75 cm/sec, the water-temperature was between 25.7° C and 26° C (March, 15^h—17^h); chemistry: pH: 7.7, conductivity: 122µ Siemens and total hardness: 2.5° dH. All values in freshwater during low tide. Also MARTENS (1879) states, that *Clithon chlorostoma* was found in the mouth of a brook on Tahiti, partly in saltwater.

Geographical range: *Clithon chlorostoma* (including the synonyms: *pisiformis*, *siderea*, *parvula*, *tristis*, *lentiginosa*, *dispar*, *harveyensis* and *paludosa*) is recorded by TRYON (1888) in the Pacific from the Marquesas-, Harvey-, Cooks-, Samoan- and Fiji-Islands, MARTENS (1879) cited also Tahiti and Nukahiwa-Islands. STARMÜHLNER (1976) has found the species in Guadalcanal

(Solomon-Islands). *Clithon chlorostoma* f. *comorensis* from Anjouan is the only record in the Indian Ocean. These records indicate, that these species, such as *Neritina pulligera* and *Neritina* (*Neripteron*) *auriculata* are distributed in many local forms from the Western Indian Ocean to the Eastern parts of the Pacific.

2) *Clithon* (*Clithon*) *coronata* (LEACH, 1815) = (*longispina*, RÉCLUZ, 1841)

Lit.: 1815 *Clithon coronata* (LEACH, Zool. Misc., II: Pl. 104) — 1841 *Neritina longispina* (RÉCLUZ, Rev. Mag. Zool.: 312) — 1843 *Neritina corona* (SGANZIN, Mém. Soc. Hist. Nat. Strasbourg, 3: 19) — 1849 *Neritina longispina* (SOWERBY, Thes. Conch., 2: 552; Pl. CX, Fig. 62) — 1850 *Neritina longispina* (RÉCLUZ, J. de Conch., 1: 147) — 1855 *Neritina longispina* (REEVE, Conch. Ic.: Fig. 21) — 1855 *Chlithon longispina* (H. & A. ADAMS, Gen. rec. Moll.: Pl. XLII, Fig. 30) — 1859 *Neritina longispina* (CHENU, Man. Conch., 1: 337; Fig. 2474) — 1860 *Neritina longispina* (MORELET, Sér. Conch., 2: 120) — 1863 *Neritina longispina* (DESHAYES, Cat. Moll. Réunion: 79) — 1867 *Neritina mauritiana* (MORELET, J. de Conch., 1867: 440) — 1877 *Neritina longispina* (LIÉNARD, Cat. Moll. Mauritius: 48) — 1879 *Neritina* (*Clithon*) *longispina* (MARTENS, in M. & CH., II (10): 147; Pl. 15, Fig. 16, 17, Fig. 20, 21) — 1879 *Neritina despinosa* (MOUSSON, in coll.) — 1880 *Neritina* (*Clithon*) *longispina* (MARTENS, in MÖBIUS, Beitr. Meeresfauna Mauritius: 213) — 1892 *Neritina* (*Clithon*) *longispina* (BAKER, Proc. Rochester Ac. Soc., II: 33) — 1908 *Paranerita* (*Neritina*) *longispina* (BOURNE, Proc. zool. Soc. London, 1908: 847; Pl. 55, Fig. 35; Pl. 64, Fig. 64) — 1910 *Neritina longispina* (KOBELT, Abh. senck. nat. Ges., 32: 93) — 1921 *Neritina* (*Chlithon*) *longispina* (GERMAIN, Mém. Soc. zool. France, 1920; vol. suppl.: 389; Fig. 42) — 1956 *Clithon longispina* (BENTHEM-JUTTING, Treubia, 23 (2): 282; Fig. 12) — 1969 *Clithon* (*Clithon*) *longispina* (STARMÜHLNER, Malacologia, 8 (1/2): 56).

Localities: Mas: Ré: No. 19 (7+48 iuv. ind.), No. 20 (3 ind. f. *despinosa*); Mau: No. 5 (37 ind., f. *despinosa*), No. 7 (2 ind., f. *despinosa*), No. 13 (4 ind.), No. 16 (1 ind., f. *despinosa*), No. 21 (some ind.), No. 23 (53 ind.).

Sizes (in mm):

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Mas: Ré: No. 19	14	13	11.5	9.7	4
No. 20					
(f. <i>despinosa</i> , iuv.)	5.3	7	no measurements!		
Mau: No. 5 (f. <i>despinosa</i>)	19	18	12.6	12.8	6
No. 7 (f. <i>despinosa</i>	21	23	24	24	11.4
eroded)					
No. 13 (with spines	14	13.8	11.9	10.2	4.3
eroded)					
(f. <i>despinosa</i>	17	16.3	12.9	10.4	4.5
eroded)					
No. 16 (f. <i>despinosa</i>	19	14.5	14	11	5
eroded)					
No. 21 (with spines)	17.7	16.5	14	11.5	4.6
No. 23 (with spines	13.6	13.8	11.6	10	4.8
eroded)					

The measurements are from the largest shells in the samples.

Shell: Globular, small spire with 3—4 whorls, the last inflated; above the periphery "shouldered", along this "shoulder" long pointed distantly placed spines of 10—15 mm length; the f. *despinosa* without spines, but the shoulder is well developed; irregularly sculptured by the growth lines, they are sinuous between the suture and the row of spines; the upper whorls often dark olive to brown, either with black spiral bands of various width and number; between these bands occasionally some irregular dark wavy lines or network; aperture oblique, half-moon shaped, columellar area slightly concave, whitish, granular,

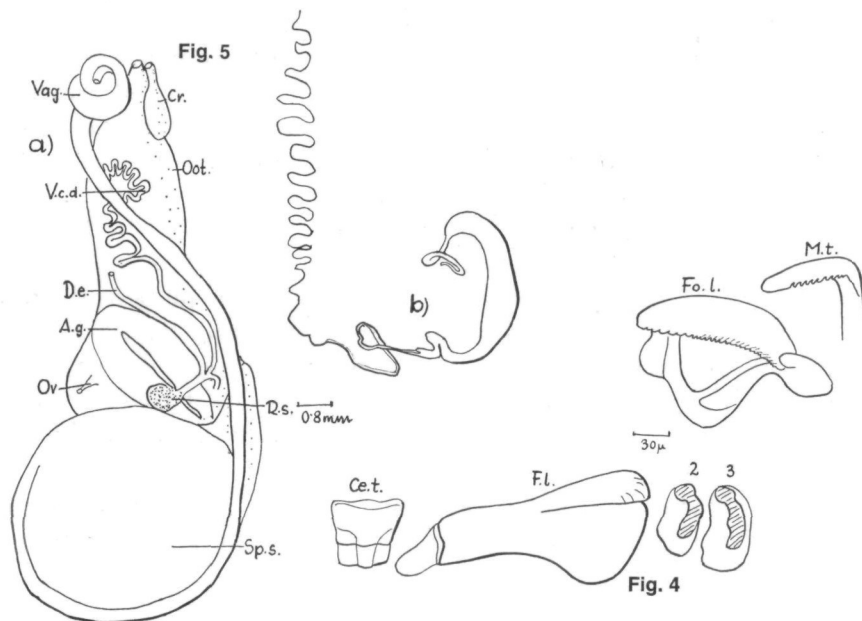


Fig. 4. *Clithon coronata*: Radula-teeth

Fig. 5. *Clithon coronata*: a) Female reproductive-system; b) Spermatophor

porcellanous; columellar edge concave, hardly any or no denticulations (Pl. 1; Fig. 2a, b: f. *coronata* s. str., Fig. 3a, b, c: f. *despinosa*).

Operculum: Size (from a specimen with shell-height: 14 mm): 8.5 mm × 4.7 mm; semilunar, exterior surface cloudy-brown to blackish, except the nucleus reddish to yellow-brownish; outer margin reddish-brown to yellowish, transparent, a shallow groove on the surface correspond with a low ridge on the back surface; over the exterior surface are numerous, fine, distantly placed granules; back surface yellowish-whitish, except around the peg is yellowish-orange and connected with the yellowish rib, which is grooved and broadened towards the free tip (Pl. 3, Fig. 15a, b).

Anatomical remarks: Mantle dark blue, except the margin with yellowish border; Radula: central tooth nearly as high as broad, the upper margin as broad as the base; cutting edge slightly curved; inner lateral teeth

elongate-rectangular, nearly without denticulation; the 4th lateral tooth with 6—7 broad inner denticles and about 20 very small denticles towards the outside, the marginal teeth with 1+8/10 denticles (Fig. 4). Female reproductive system: large, globular spermatheca with 10—11 spermatophors, one end of the spermatophor very short and S-looped; other end a long, very slender filament in many narrow sloops, which reach to the long, slender and looped vaginal connecting duct, which enters at the superior part of the vagina; the end of the vagina is rolled up in three loops; receptaculum seminis dark coloured and with an short duct; ductus enigmaticus and the crystal sac on the upper part of the ootype are typical (Fig. 5a, b).

Ecological-biological remarks: These species were found only in the lower courses of the running waters crawling over boulders and gravel in a current between 50 cm—1 m/sec in a density of 1—2 ind./1/16 m²; the temperatures at the stations of La Réunion and Mauritius were between 21.7° C and 28.4° C, mostly around 22° and 23° C; the chemical conditions: pH: 7.4—8.2; conductivity: 77—200 μ Siemens; total hardness: 1.5°—4.35° dH. It is to be noted, that the forma *despinosa* (without spines) was only found in the upstream parts of the lower courses, the typical form with spines in the downstream parts near the influence of brackish water during high tide (return current). In the upper parts of the lower courses the f. *despinosa* is associated with *Neritina* (V.) *gagates*, *Septaria borbonica*; in the lower courses near the mouth-zone the spiney form also with *Neritina auriculata* f. *mauriciae* and *Neritilia consimilis*.

Geographical range: Madegassian Subregion (Madagascar, La Réunion, Mauritius, Rodriguez). The occurrence in Java is doubtful (BENTHEM-JUTTING, 1956).

3) *Clithon* (*Clithon*) *spiniperda* (MORELET, 1860)

Lit.: 1860 *Neritina spiniperda* (MORELET, Sér. Conch., 2: 121; Pl. 6, Fig. 3) — 1879 *Neritina spiniperda* (MARTENS, in M. & CH., Conch. Cab., 2 (10): 266) — 1881 *Neritina spiniperda* (CROSSE, J. de Conch., 29: 208) — 1890 *Neritina spiniperda* (BOETTGER, Nachr.-Bl. dtsch. malak. Ges., 22: 101) — 1892 *Neritina* (*Clithon*) *rhysodes* (BOETTGER, ibid., 24: 57) — 1929 *Neritina* (*Clypeolum*) *pulligera knorri* (HAAS, Zool. Jb. (Syst.), 57: 428 (pars); Pl. 2, Fig. 25, 26) — 1969 *Clithon* (*Clithon*) *spiniperda* (STARMÜHLNER, Malacologia, 8 (1/2): 28; Figs. 4—57).

Localities: Co: A: No. 7 (6 ind.), No. 12 (8 ind.), No. 13 (30 ind.); N. B.: No. 1 (7 ind.).

Shell: A detailed description is given by STARMÜHLNER (1969) with notes to the descriptions of MORELET (1860) and HAAS (1929): globular, solid, small spire with 2½ whorls, mostly eroded; last whorl large and slightly “shouldered”, rarely with spines; typically with radially, slightly S-shaped grooves, which confine wrinkles of coarse growth striae, which are crossed by very fine spiral rows; olive-green, with light-green bands, but mostly very difficult to see; aperture oblique, broad, semilunar, whitish-bluish; the columellar area more

yellowish, concave border with a prominent denticle in the superior third, and 5—6 smaller denticles below (Pl. 1, Fig. 4a, b, c).

Sizes (in mm):

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Co: A: No. 7	17	13	12	10	3.5
No. 12 (iuv.!)	8.3	8.2	7.8	6	3
No. 13	13.2	11.9	11.3	9.5	3
N.B: No. 1 (iuv.!)	7.2	7.2	7	4.8	2.5

The measurements are from the largest specimens in the samples.

Operculum: Size (from a specimen with shell-height: 17 mm): 8.9 mm × 5 mm; semilunar; a shallow groove over the exterior surface, corresponding with a low ridge on the backside; exterior minutely puckered with distantly placed granules, yellowish-pink, except the nucleus dark-brown and the outer margin red-brownish bordered; interior surface dark yellowish with a distinct spot near the apophyses and a dark brown margin; the peg is connected with the ridge by a shelly callus (Pl. 3, Fig. 16a, b).

Anatomical remarks: A detailed study on the anatomy and histology of *Cl. spiniperda* is given by STARMÜHLNER (1969) from specimens collected on the island of Nossi-Bé. The specimens from Anjouan show, after dissections, no differences: Mantle outside dark blue; Radula: central-tooth nearly squarish, first lateral-tooth with an lateral, narrow cutting-edge, the fourth lateral-tooth with a serrated cutting-edge, only the inner denticle is more prominent; the marginal-teeth also with an serrated cutting-edge (Fig. 6). Femal reproductive organs: The spermatheca globular and filled with some spermatophors; they have a cigar-like shape, one end is short, cork-screw-like, the other end

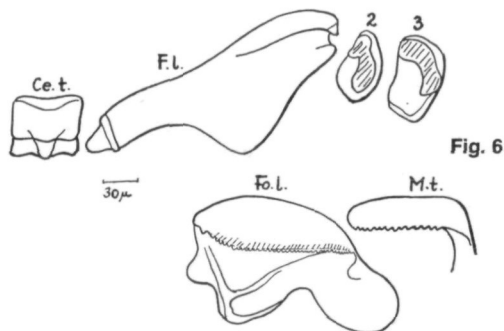
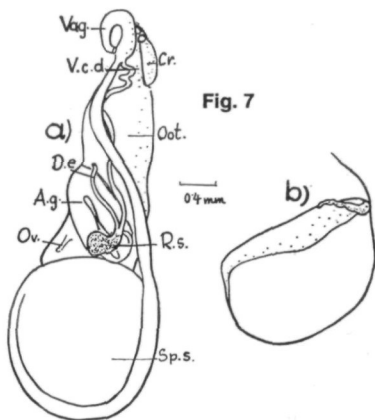


Fig. 6. *Clithon spiniperda*: Radula-teeth

Fig. 7. *Clithon spiniperda*: a) Female reproductive-system; b) Spermatophor

long, very slender (total-length: 10 mm); receptaculum seminis dark spotted with a short duct; the vaginal connecting duct very slender and looped, which enters in the upper, thickened part of the vagina; a very small ductus enigmaticus is developed (it was overlooked by STARMÜHLNER, 1969) also the crystal sac on the end of the ootype (Fig. 7a, b).

Ecological-biological remarks: As indicated by STARMÜHLNER (1969) *Cl. spiniperda* occurs only in the lower courses of the running waters near the mouth-zones with a return current of brackish-water during high-tide. They are attached to boulders and gravel with a current between 30 cm—1 m/sec in a density of about 1 ind./dm² to 1/16 m²; associated with *Cl. chlorostoma* f. *comorensis*, *Septaria borbonica* and *Neritilia consimilis*.

Temperatures	Chemistry		
	pH	conductivity	total hardness
24.5° C—26° C	7.7—8.2	102—135 µSiemens	2.1°—2.9° dH

It is to be noted that specimens, found near the influence of brackish water have developed short eroded spines, specimens in pure freshwater are always spineless.

Geographical range: Comores-Islands, Nossi-Bé and Nossi-Komba. *Clithon spiniperda* is from shell and operculum, related to the Indomalayan species *Clithon bicolor* (STARMÜHLNER, 1969).

Genus: *Neritina* LAMARCK, 1816

Subgenus: *Neripteron* LESSON, 1830

4) *Neritina* (*Neripteron*) *auriculata* LAMARCK, 1816 f. *mauriciae* LESSON, 1830

Lit.: 1816 *Neritina auriculata* (LAMARCK, Anim. s. vert. II (8): 527) — 1827 *Neritina auriculata* (FERUSSAC, Bull. univ. Sci. nat., 10: 412) — 1828 *Neritina cariosa* (GRAY (part), in WOOD, Ind. test. suppl.: 25; Pl. 8, Fig. 9 (non Fig. 11) — 1829 *Neritina auriculata* (RANG, Man. hist. Moll.: 47 (non LAMARCK) — 1830 *Neritina* (*Neripteron*) *mauriciae* (LESSON, Voy. Coqu., Zool., II: 384) — 1849 *Neritina auriculata* (SOWERBY, Thes. Conch., 2: Pl. CXIII, Fig. 129, 130) — 1855 *Neritina auriculata* (REEVE, Conch. Icon.: Fig. 83) — 1860 *Neritina mauritii* (MORELET, Sér. Conch., 2: 119) — 1863 *Neritina sandwichensis* (DESHAYES, Cat. Moll. Réunion, p.E: 81) — 1868 *Neritina deshayesii* (PEASE, ibid.: 101) — 1875 *Neritina alata* (ROBILLARD, in MARTENS, in M. & CH., Conch. Cab., 2 (10): 27 and 276; Pl. 6, Fig. 7—9) — 1879 *Neritina auriculata* (MARTENS, in M. & CH., Conch. Cab., 2 (10): 30; Pl. 6, Fig. 13—15, 24—27) — 1880 *Neritina* (*Neripteron*) *mauriciae* (MARTENS, in Moll., in MÖBIUS, Beitr. z. Meeresf. d. Insel Mauritius: 212) — 1888 *Neritina auriculata* (TRYON, Man. Conch., 10: 73; Pl. 21, Fig. 58—63) — 1892 *Neritina* (*Alina*) *mauritii* (BAKER, Proc. Rochester Acad. nat. Sc., 2: 33) — 1910 *Neritina auriculata* (KOBELT, Abh. senck. nat. Ges., 32: 93) — 1921 *Neritina* (*Neripteron*) *mauritiensis* (GERMAIN, Mém. Soc. Zool., 1920: 387; Fig. 40, 41) — 1955 *Neritina auriculata* (BUTOT, Treubia, 23 (2): 297; Fig. 222) — 1956 *Neritina auriculata* (BENTHEM-JUTTING, Treubia, 23 (2): 297; Fig. 222) — 1969 *Neritina auriculata* (STARMÜHLNER, Malacologia, 8 (1/2): 56; Fig. 58—62) — 1970 *Neritina auriculata* and f. *lecontei* (STARMÜHLNER, Cah. ORSTOM, sér. Hydrobiol., 4 (3/4):

35; Fig. 12–17) — 1974 *Neritina (Neripteron) auriculata* (STARMÜHLNER, Bull. Fish. Res. Stn., Sri Lanka, 25 (1/2): 108; Fig. 5–7; Pl. 2, Fig. 2–4) — 1976 *Neritina (Neripteron) auriculata* (STARMÜHLNER, Ann. Naturhist. Mus. Wien, 80: 511; Fig. 17–19; Pl. 9; Fig. 64, 65; Pl. 10; Fig. 76–79).

Locality: Mas : Mau : No. 23 (59, mostly iuv.).

Shell: Semi-globular, with flat base; $1-1\frac{1}{2}$ whorls, apex mostly eroded; growth striae in semi-circles, alternately stronger and weaker; greenish-brown with dense fine, black coloured wave-lines; sometimes in a network with triangle-shaped spots; aperture large, half-moon shaped, surrounded by a broad peristome which ends in two, widely varying “wings” or “auricles”, the depends on the form of the surface, where the snail is resting; the specimens found at the locality Mau : No. 23 (River Baie du Cap) correspond with the figured shell of Fig. 41 of GERMAIN (1921: 388): the upper columellar margin (seen from below) is nearly straight, the “wings” are very little developed, the outer margin is curved, the lower columellar margin drawn forward with a prominent “wing”; columellar edge slightly sinuous, with about $1+8+1$ inconspicuous denticulations, whitish (Pl. 1; Fig. 5a, b).

Sizes (in mm):

Locality	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Mau: No. 23	11	13	13	11	6

The measurements are from the largest shell in the sample.

Operculum: Size (from a specimen with shell-height of 11 mm): 7 mm × 4.3 mm; semilunar, columellar side sinuous, nucleus at right hand base; greyish-black with a yellow nucleus and a red-yellowish outside edge; backside whitish to greyish; the peg with a rounded top, the rib sickle-shaped, with a weak denticle on the outside, a furrow on the inner side and an acute free top (Pl. 3; Fig. 17a, b).

Anatomical remarks: A detailed study of the anatomy and histology of *Neritina auriculata auriculata* is given by STARMÜHLNER (1969). Additional details are given from specimens from New Caledonia (f. *lecontei*) by STARMÜHLNER (1970) and from different Pacific islands by STARMÜHLNER (1976).

The mantle of the specimens from Mauritius (f. *mauriciae*) is not coloured and transparent; Radula: central-tooth higher than broad, the first lateral tooth without any denticulation on the cutting-edge, the third lateral tooth with a prominent inner denticle and 15–20 smaller denticle forward to the outer margin, the marginal-teeths with $1+6/7$ denticles (Fig. 8). Female reproductive organs: a large, globular spermatheca with 12 to 14 spermato-phors; they are thick, U-shaped, rolled up, with a short, slender, looped end; the vaginal connecting duct slender, and enters, beyond some loops in the middle part of the vagina, in the last third of the vagina, which is ampoule-

shaped; receptaculum seminis dark spotted, with a short duct; ductus enigmaticus and crystal-sac are typically developed (Fig. 9a, b).

Ecological-biological remarks: As stated by STARMÜHLNER (1969, 1970 and 1976) *Neritina auriculata* (and her forms) is a typical inhabitant of the lower courses of running waters near the influence of brackish water of the return current during high-tide. It was associated in the locality of Mauritius with *Clithon coronata*, *Neritina gagates*, *Septaria borbonica* and *Neritilia con-*

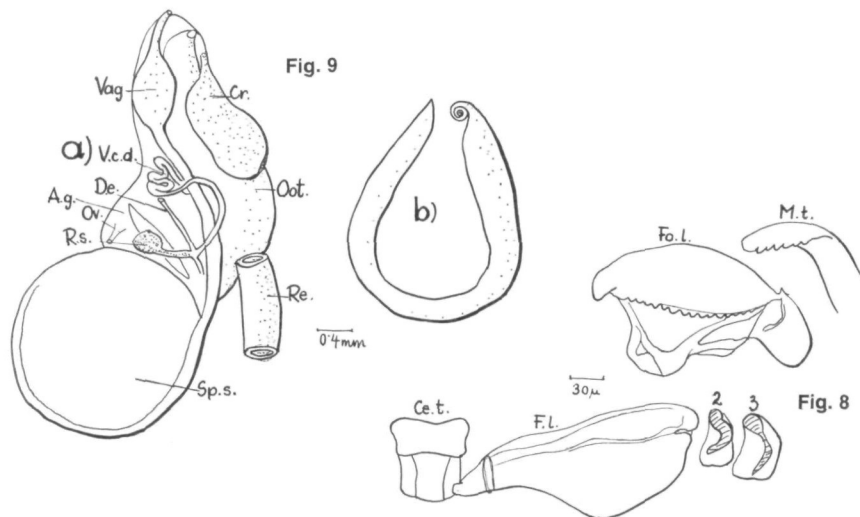


Fig. 8. *Neritina (Neripteron) auriculata* f. *mauriciae*: Radula-teeth; b) Fig. 9. *Neritina (Neripteron) auriculata* f. *mauriciae*: a) Female reproductive-system; b) Spermatophor

similis. These species tolerate slightly brackish water and is always attached below on stones, protected against the current on the surface of the boulders and gravel (30—50/75 cm/sec). The density by station Mau : No. 23 was about 5—10, mostly immature individues/1/16 m².

Temperature	Chemistry (during low-tide!)		
	pH	conductivity	total hardness
22.3° C—22.6° C	8.2	165 μSiemens	2.65° dH

Geographical range: The species-group (including different forms) is distributed in the Indopacific area (after RIECH, 1937) with the f. *auriculata* s. str.: Madagascar, Ceylon, Malayan Archipelago, Philippines, Moluccas, Aru, New Guinea, Bismarck Archipelago, Solomon-Islands, New Hebrides and New Caledonia. In New Caledonia it occurs also the f. (or subspecies?) *lecontei* (STARMÜHLNER, 1970). In the eastern parts of the South-Pacific the species is

recorded also from Fiji, Tahiti and other islands to Hawaii (after RIECH, 1937: f. *alata*). In the rivers of Tahiti STARMÜHLNER (1976) states the f. *tahitensis*, resembling the f. *alata*. At Mauritius occurs the widely varying f. *mauriciae*.

5) *Neritina* (*Vittina*) *gagates* LAMARCK, 1822

Lit.: 1822 *Neritina gagates* (LAMARCK, Hist. nat. an. s. vert., 6 (2): 185) — 1827 *Neritina zigzag* (FÉRUSAC, Bull. univ. Sci. nat., 10: 411 (non LAMARCK)) — 1828 *Neritina caffra* (GRAY, in WOOD, Ind. Test., supp.: Pl. 8, Fig. 10) — 1830 *Neritina gagates* (LESSON, Voy. Coqu., Zool.: 337) — 1838 *Neritina gagates* (LAMARCK, Hist. nat. an. s. vert., éd. 2 (8): 570) — 1841 *Neritina gagates* (DELESSERT, Rec. Coqu. décr. LAMARCK: Pl. 32, Fig. 2) — 1849 *Neritina gagates* (SOWERBY, Thes. Conch., 2: 537; Pl. 112, Fig. 103, 104) — 1849 *Neritina caffra* (SOWERBY, ibid.: 537; Pl. 112, Fig. 111, 112) — 1850 *Neritina caffra* (RÉCLUZ, J. de Conch., 1: 152) — 1855 *Neritina caffra* (REEVE, Conch. Icon.: Fig. 37) — 1855 *Neritina gagates* (REEVE, ibid.: Fig. 47) — 1859 *Neritina caffra* (CHENU, Man. Conch., 1: 335; Fig. 2448) — 1860 *Neritina zigzag* (MORELET, Sér. Coch., 2: 120) — 1863 *Neritina zigzag* (DESHAYES, Cat. Moll. Réunion: 79) — 1863 *Neritina strigilata* (DESHAYES, ibid.: 79) — 1863 *Neritina fulgurata* (?) (DESHAYES, in MAILLARD, Notes sur l'île de Réunion, Moll.: 80; Pl. 10, Fig. 1, 2) — 1863 *Neritina modicella* (?) (DESHAYES, ibid.: 70; Pl. 10, Fig. 3, 4 and in Cat. Moll. Réunion: 79) — 1869 *Neritina gagates* (NEVILL, Proc. zool. Soc. London, 1869: 66) — 1874 *Neritina caffra* (CROSSE, J. de Conch., 22: 241) — 1874 *Neritina gagates* (CROSSE, ibid.: 241) — 1875 *Neritina gagates* (MORELET, J. de Conch., 23: 29) — 1877 *Neritina caffra* (LIENARD, Cat. Moll. Maurice: 48) — 1877 *Neritina gagates* (LIÉNARD, Cat. Moll. Maurice: 48) — 1877 *Neritina gagates* (LIÉNARD, ibid.: 48 and 82) — 1877 *Neritina lineolata* (LIÉNARD, ibid.: 48) — 1879 *Neritina gagates* (MARTENS, in M. & CH., Conch. Cab., 2 (10): 94; Pl. 16, Fig. 11, 12; var. *minor*: Pl. 10, Fig. 18, 19; v. *subplana*: Pl. 13, Fig. 8) — 1880 *Neritina gagates* (MARTENS, Moll., in MÖBIUS, Beitr. Meeresf. Ins. Mauritius: 212) — 1882 *Neritina fulgetrum* (SMITH, Proc. zool. Soc. London, 1882: 387; Pl. 22, Fig. 23, 24) — 1888 *Neritina gagates* (including *liturata* RÉCLUZ, *caffra* GRAY, *zigzag* MORELET, var. *minor* and var. *subplanispira* MARTENS, probably also *fulgurata* DESHAYES: TRYON, Man. Conch., 10:35; Pl. 10, Fig. 77–79, 97, 98; Pl. 11, Fig. 6) — 1890 *Neritina* (*Neritaea*) *gagates* (BOETTGER, Nachr.-Bl. dtsh. malak. Ges., 22: 99) — 1908 *Paranerita* (*Neritina*) *gagates* (BOURNE, Proc. zool. Soc. London, 1908: 847; Pl. 54, Fig. 32; Pl. 55, Fig. 36, 37; Pl. 56, Fig. 38–41; Pl. 57, Fig. 42, 43; Pl. 58, Fig. 44, 45; Pl. 59, Fig. 48; Pl. 60, Fig. 50, 52; Pl. 63, Fig. 60) — 1910 *Neritina gagates* (KOBELT, Abh. senck. nat. Ges., 32: 94–96) — 1909 *Neritina zigzag* (KOBELT, ibid.: 94) — 1909 *Neritina ziczac* (KOBELT, ibid.: 95) — 1914 *Neritina gagates* (ROBSON, J. Linn. Soc., London, 32: 377) — 1921 *Neritina* (*Neritina*) *gagates* (GERMAIN, Mém. Soc. zool. France, 1920, suppl.: 382; Fig. 37–39; *modicella*: 385; *fulgurata*: 386) — 1929 *Neritina gagates* (DAUTZENBERG, Faune Col. Franc., Paris, 3: 526) — 1929 *Neritina gagates* (HAAS, Zool. Jb. (Syst.): 57: 427) — 1937 *Neritina gagates* (ANDREWS, J. Morph., 61: 525; Pl. 4, Fig. 24; Pl. 5, Fig. 33) — 1969 *Neritina* (*Vittina*) *gagates* (STARMÜHLNER, Malacologia, 8 (1/2): 61; Fig. 63–72).

Localities: Sey: M: No. 3 (some ind.), No. 4 (6 ind.), No. 7 (2 iuv.); Co: A: No. 7 (4 ind.), No. 10 (4 ind.); Mas: Ré: No. 8 (34 ind.), No. 19 (147, mostly iuv.), No. 24 (75, mostly iuv.); Mau: No. 5 (3 ind.), No. 7 (1 ind.), No. 8 (1 ind.), No. 9 (24 ind.), No. 11 (4 ind.), No. 13 (207, mostly iuv.), No. 15 (81 ind.), No. 18 (34 ind.), No. 19 (22 iuv.), No. 21 (215, mostly iuv.), No. 22 (6 ind.), No. 23 (25 and many iuv.), No. 24 (2 ind.).

Shell: Descriptions are given by REEVE (1855); MARTENS (1879); TRYON (1888); GERMAIN (1921) and STARMÜHLNER (1969): solid, globular spire with

2 $\frac{1}{2}$ whorls rapidly increasing, the last whorl about $\frac{4}{5}$ of the total height and slightly "shouldered"; apex mostly eroded; polished growth striae fine and delicate, the spiral striae very fine, only to be seen by higher magnification; periost dark brown, but mostly scraped off, by immature specimens close, black zigzag lines on a yellow-brownish ground; aperture yellow-greenish to white-bluish, border of the columellar area yellow to orange, sometimes a yellow-orange spot near the base; about 15 denticles on the border (4+1+1+9), (Pl. 1, Fig. 6a, b; 7a, b and 8a, b).

Sizes (in mm):

Localities		Shell		Aperture		Col.area
		Height	Diameter	Height	Diameter	
Sey: M:	No. 3	24.4	24	19.2	15	8.7
		23.5	21.5	18.2	15.3	6.5
	No. 4	23	21.6	18.1	15	7
		12.7	11.3	10.6	7.5	2.5
Co: A:	No. 7 (iuv.)	18.5	17	13.6	11.5	6
		21.3	19	12	12.5	7
	No. 10	18	17.6	15.7	12.5	6
Mas: Ré:	No. 8	12.5	12.2	10.2	7	4
		16.3	14.7	13	10	4.5
	No. 24	21	20.8	17.5	14	5.8
Mau:	No. 5	20.4	18	14.8	11	5.2
		27	24.5	21	17	8.5
	No. 8	16.5	15	12.2	10.6	4.5
		28	27	22	17	9
	No. 9 (eroded)	23.2	19.6	16.7	14	7
		21	19.8	16.4	12	7
	No. 11	20.7	18	15.5	12	6
		22	21	17	13.5	7.5
	No. 13	23.3	19	16.8	12	6.8
		27	24.4	20	16.3	8
	No. 15 (eroded)	22.2	20	16.4	13	7
		5	no measured!			
	No. 19 (iuv.)	21	19.5	17	14.4	6.5
		19	19.3	16.2	12.6	5.5
	No. 22	19	17.8	15.5	11.6	5.3
Mas: Mau:	No. 23	20.3	17	14.5	12.8	6
		15.8	13.5	12	10	5.5

The measurements are from the largest specimens from the samples.

Operculum: Size (from a specimen with shell-height of 24.4 mm): 11 mm × 7 mm; semilunar; external surface polished, very fine fan-like growth-striae with extremely fine granulations; dark brownish, outer edge horny, seddish-brownish; nucleus a little impressed and with a yellow spot; inner surface brownish with a porcellanous covering; peg broad and short, rounded; rib a slightly curved ridge (Pl. 3, Fig. 18a, b).

Anatomical remarks: Detailed studies are given by BOURNE (1908); BAKER (1923); ANDREWS (1937, spermatophors) and STARMÜHLNER (1969). Radula (specimen from Sey : M : No. 3): central-tooth slightly higher than broad; the inner lateral-tooth rectangular with a narrow cutting-edge without denticles; the third lateral-tooth with a serrated edge (1+16/18); marginal-teeth with 1+8 denticles (Fig. 10). Femal reproductive system: the specimen from Sey : M : No. 3 with a globular spermatophor-sac or spermatheca, vagina relatively long and broad, receptaculum seminis with a short duct, the vaginal connecting duct extremely long and placed in many, narrow loops; stretched, leaving the posterior part of the ootype, to the upper part of the vagina, and goes back below the vagina to the lower part of the vagina, where the duct

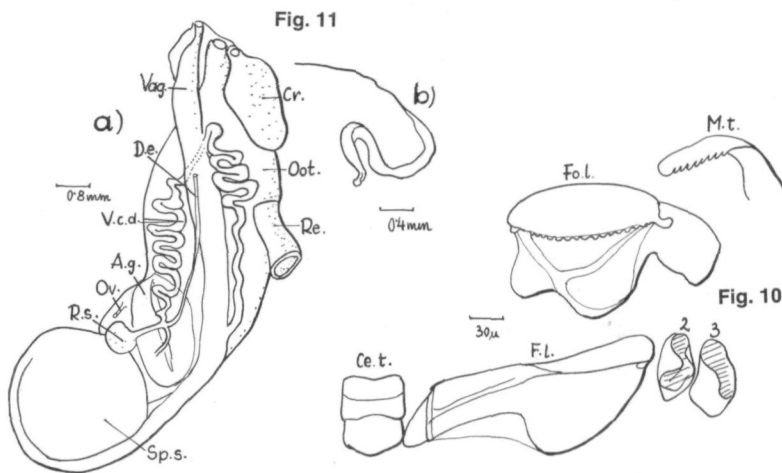


Fig. 10. *Neritina (Vittina) gagates*: Radula-teeth

Fig. 11. *Neritina (Vittina) gagates*: a) Female reproductive-system; b) Spermatophor

enters into the vaginal duct; ductus enigmaticus and crystal-sac are typically developed; the spermatophores—mostly 1 to 4 in the sac—have a nematode-like shape, one end is thicker, with a rounded top, the other end long and slender (Fig. 11a, b).

Ecological and biological remarks: *Neritina (Vittina) gagates* is, like all species of the subgenus *Vittina*, a characteristic form of the lower courses of running waters, occurring to the mouth-region, also in zones with brackish water from the return current during high-tide. The species was at the different stations associated with *Neritina pulligera stumphi* and *knorri*, *Neritilia consimilis*, *Septaria borbonica*, *Clithon spiniperda* and *Neritina auriculata* f. *mauriciae*. The frequency changed from sporadic to about 30 or more individuals/1¹/16 m², specially if many young specimens are present. The average frequency was about 5–10 ind./1¹/16 m² on stones and gravel in a current between 30 cm/sec—75 cm/sec.

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Mahé:	24.4° C—28° C	6.8—6.9	35—54 μ S	0.2 — 0.65° dH
Anjouan:	24.5° C—25.5° C	8.1—8.2	135—186 μ S	2.9 — 3.9° dH
Réunion:	21.7° C—26.6° C	7.4	77— 92 μ S	1.5 — 1.65° dH
Mauritius:	21.2° C—26.3° C	7.6—8.2	93—100 μ S	1.45— 4.25° dH
Range:	21.2° C—28° C	6.8—8.2	35—186 μ S	0.2 — 4.25° dH

These data indicate that *Neritina* (*Vittina*) *gagates* occurs from very soft, slightly acidic water to slightly hard water with alkaline reaction.

Geographical range: Madegassian Subregion: Seychelles, Comores, Nossi-Bé, Nossi-Komba, Madagascar, La Réunion, Mauritius, Rodriguez. CONOLLY (1939) reported the species also from the SE-coast of Africa and STARMÜHLNER (1969) stated that he has found shells, determined as *N. (V.) gagates* in the collections of the Naturhistorical Museum of Vienna, Section of Molluscs, collected by the Austrian NOVARA-Mission at the Nicobar-Islands in the Gulf of Bengal. REEVE (1855) has noted as habitat for *N. gagates* (species 47): Sumatra (on stones) from the collection of CUMING. Probably belong these shells to *N. (V.) variegata* LESSON, 1831: MARTENS (1879) wrote on page 279 as appendix to *N. gagates*, that BROTH has checked the types of LAMARCK with specimens of MARTENS and found, that under the description of LAMARCK (1822) both species, *N. gagates* and *N. variegata* are included! *N. (N.) variegata* is distributed widely from the Nicobar Islands to East in the Pacific to Tahiti (BENTHEM-JUTTING, 1956; STARMÜHLNER, 1976).

Subgenus: *Neritina* s. str.

6) *Neritina* (*Neritina*) *pulligera* (LINNÉ, 1767) *knorri* (RÉCLUZ, 1841)

Lit.: 1767 *Neritina pulligera* (LINNÉ, Syst. Nat., 12: 1253) — 1841 *Neritina knorri* (RÉCLUZ, Rev. zool. Cuv., 1841: 274) — 1840 *Neritina truncata* (SGANZIN, Mém. Mus. Hist. nat. Strasbourg, 3: 20) — 1840 *Neritina rara* (DUFO, Ann. Sci. nat. (2) 14: 195) — 1848 *Neritina iris* (MOUSSON, Mitth. naturf. Ges. Zürich, 1: 269) — 1849 *Neritina bruguieri* (SOWERBY, Thes. Conch., 2: 512; Pl. 114, Fig. 159) — 1849 *Neritina sanguinea* (SOWERBY, ibid.: 513; Pl. 114, Fig. 162) — 1879 *Neritina pulligera* (MARTENS, in M. & CH., Conch. Cab., 2 (10): 49; Pl. 9, Fig. 4—5; iris: 52; Pl. 9, Fig. 5—6; *knorri*: 55; Pl. 8, Fig. 4, 6; *bruguieri*: 59; Pl. 9, Fig. 11, 13; *sanguinea*: 61; *truncata*: 255) — 1881 *Neritina knorri* (CROSSE, J. de Conch., 29: 207) — 1888 *Neritina pulligera* (including: *rubella* MÜLLER, *larga* HOMBR. & JACQ., *conglobata* MARTENS, vars. *sulcata* T. WOODS and *canalis* MOUSSON (non *canalis* SOWERBY), further var. *knorri* RÉCLUZ (with the synonyms: *beckii* SOWERBY and *cryptospira* MARTENS), var. *ovalis* SOWERBY) (TRYON, Man. Conch., 10: 56; Pl. 18, Fig. 8—11; Pl. 19, Fig. 16, 18, 22, 24) — 1890 *Neritina knorri* (BOETTGER, Nachr.-Bl. dtsh. malak. Ges., 22: 98) — *Neritella pulligera* (BERGH, Morph. Jb., 16: 22; Pl. 3, Fig. 12) — 1910 *Neritina pulligera* v. *knorri* (KOBELT, Abh. senck. nat. Ges., 32: 93) — 1914 *Neritina pulligera* v. *knorri* (ROBSON, J. Linn. Soc., London, 32: 377) — 1919 *Neritina pulligera* v. *knorri* (ODHNER, Ark. Zool., 12: 43) — 1923 *Neritina* (*N.*) *pulligera* (BAKER, Proc. Acad. Nat. Sci. Philadelphia, 75: 149; Pl. 12, Fig. 17) — 1929 *Neritina pulligera* v.

knorri (DAUTZENBERG, Faune Col. Franc., 3: 526) — 1929 *Neritina pulligera* v. *knorri* (HAAS, Zool. Jb. (Syst.), 57: 427) — 1937 *Neritina pulligera* (ANDREWS, J. Morph., 61: 525; Pl. 5, Fig. 36) — 1937 *Neritina pulligera* (RIECH, Arch. Naturgesch. (N. F.), 6: 73; Fig. 18) — 1956 *Neritina pulligera* (BENTHEM-JUTTING, Treubia, 23 (2): 307; Fig. 24) — 1956 *Neritina pulligera* (FRANC, Mém. Mus. Nat. Hist. Nat., sér. A, Zool., 13: 25; Pl. 2, Fig. 23) — 1962 *Neritina bruguieri* (BARNACLE, J. Seych. Soc., 2: 57) — 1963 *Neritina pulligera* (BENTHEM-JUTTING, Nova Guinea, Zool., 20: 424) — 1969 *Neritina pulligera* f. *knorri* (STARMÜHLNER, Malacologia, 8 (1/2): 69; Fig. 73–84) — 1970 *Neritina pulligera* (STARMÜHLNER, Cah. ORSTOM, sér. Hydrobiol., 4 (3/4): 45; Fig. 30) *Neritina pulligera* (BRANDT, Arch. Moll., 105 (1/4): 14; Pl. 1, Fig. 10) — 1976 *Neritina pulligera* (STARMÜHLNER, Ann. Naturhist. Mus. Wien, 80: 531; Fig. 34, 35; Pl. 11, Fig. 104–110; Pl. 12, Fig. 123–128).

Localities: Sey : M : No. 3 (5 ind.); Co : A : No. 7 (16, mostly iuv.).

Shell: Descriptions of the widely varying shell of the *pulligera*-group are given by MARTENS (1879), TRYON (1888), BENTHEM-JUTTING (1956), STARMÜHLNER (1969, 1970 and 1976) and BRANDT (1974). The subspecies *knorri* is described by RÉCLUZ (1841), MARTENS (1879), TRYON (1888) and STARMÜHLNER (1969). The shell of subsp. *knorri* is smaller than *pulligera* s. str., the body whorl without the sutural ridge, but extending over the spire, which it completely covers; $1\frac{1}{2}$ whorls with dense fine and stronger growth striae, more prominent just below the suture; periostracum jet black, if it is scraped off (and by juvenile shells) a pattern of triangular patches is to be seen; aperture bluish with an orange band within the margin; columellar area violaceous, the edge with 15–16 fine denticles, the surface of the area very fine, but with dense granulations and irregular grooves (P. 2; Fig. 9a, b).

Sizes (in mm):

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Sey: M: No. 3	23.4	24.6	23.4	27	10.5
Co: A: No. 7 (iuv.!)	5	6.5	5	4	2

The measurements are from the largest specimens in the samples.

Operculum: Size (from a specimen with a shell-height: 23.4 mm): 10 mm × 7 mm; semilunar; nucleus at left hand base; from the nucleus brown-blackish, dense, fine and strong radiating growth striae; outside yellow-brownish; outer margin horny, brown-reddish; the peg on the inner surface short, slightly curved and connected with a thin ridge to the sickle-shaped rib, which is longitudinally grooved (Pl. 4; Fig. 19a, b).

Anatomical remarks: Descriptions of the anatomy are to be found in BAKER (1923); ANDREWS (1937); RIECH (1937) and STARMÜHLNER (1969, 1976). Radula: (from a specimen from: Sey : M : No. 3): central-tooth broader than high, first lateral with a broad, rounded projection on the outside of the cutting edge; the third lateral-tooth and the marginal teeth very fine denti-

culated (Fig. 12). Femal reproductive system: Spermatophor-sac (or Spermatheca) extremely large and globular with about 30–50 nematode-shaped spermatophors, one end broader than the other, which is filiform; receptaculum seminis with short duct, the vaginal connecting duct slender, slightly looped and stretched forward to the middle part of the vagina, wich is ampoule-shaped; from these parts the duct stretches along the vagina and enter into the lower part; ductus enigmaticus and crystal-sac are typically developed (Fig. 13a, b).

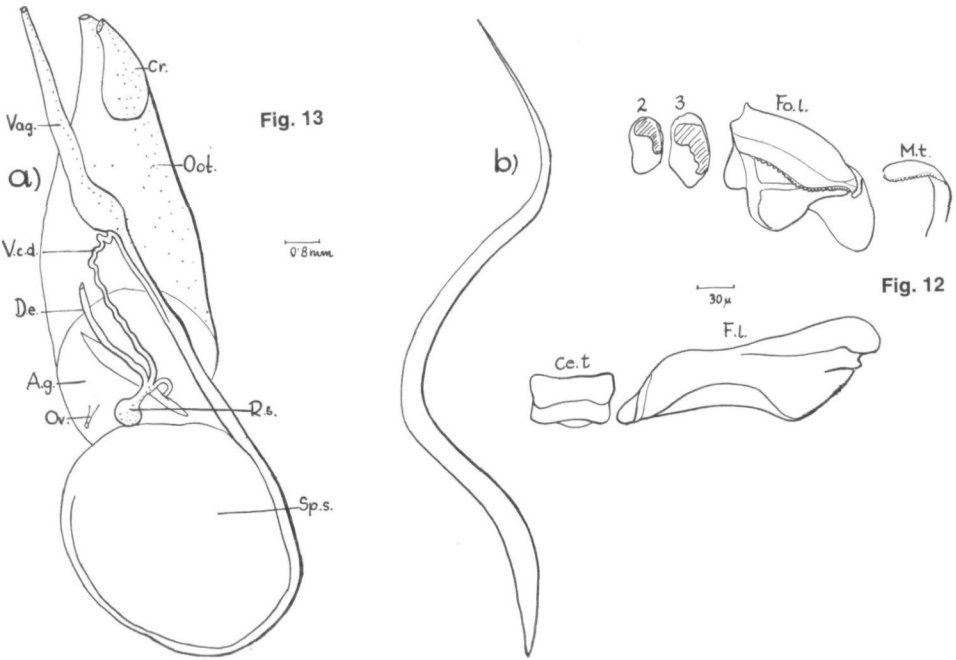


Fig. 12. *Neritina* (*N.*) *pulligera knorri*: Radula-teeth
Fig. 13. *Neritina* (*N.*) *pulligera knorri*: a) Female reproductive-system; b) Spermatophor

Ecological-biological remarks: The subspecies *knorri* occurs in the lower courses of the running waters, always in freshwater and upstream of the influence of brackish water from the return current during high-tide. The frequency on stones with a current between 30 cm and 75 cm/sec was sporadic; the species was associated with *Neritina pulligera stumpfi*, *Neritina* (*V.*) *gagates* and *Neritilia consimilis* at Mahé, also with *Septaria borbonica* and *Clithon spiniperda* at Anjouan.

Temperatures		pH	Chemistry	
			conductivity	total hardness
Mahé:	24.4° C	6.9	54 μS	0.65° dH
Anjouan:	24.9° C	8.2	135 μS	2.9 ° dH

Geographical range: *Neritina* (*N.*) *pulligera* with its different subspecies, variations or forms is distributed over the coasts of the whole Indo-Pacific area from SE-Africa, E-African Islands including Madagascar to the Andamans and Nicobars, over the Malay-Archipelago to the SE-Asien coast, Philippines and Moluccas, further to Aru, New Guinea, E-Australian coast and South-Pacific islands. The subspecies *knorri* is restricted to the coasts of the Eastern Indian Ocean, such as SE-Africa, Zansibar, Comores, Seychelles, Madagascar and Mascarene-Archipelago.

7) *Neritina* (*Neritina*) *pulligera* (LINNÉ, 1767) *stumpfi* BOETTGER, 1890

Lit.: (*Neritina* (*N.*) *pulligera* s. str. see under 6)).

1890 *Neritina stumpfi* (BOETTGER, Nachr.-Bl. dtsh. malak. Ges., 22: 99) — 1929 *Neritina pulligera stumpfi* (HAAS, Zool. Jb., 57: 428; Pl. 2, Fig. 27) — 1969 *Neritina* (*N.*) *pulligera* f. *stumpfi* (STARMÜHLNER, Malacologia, 8 (1/2): 70; Fig. 75—77).

Localities: Sey: M: No. 3 (11 ind.), No. 4 (18 ind.); Co: A: No. 8 (2 ind.), No. 10 (16 ind.), No. 13 (1 ind.), No. 17 (1 ind.).

Shell: Semiglobular; outside edge of the aperture nearly horizontal; aperture elliptical, without a upwards stretching groove such as in subspecies *knorri*; margin of the aperture reddish (without a bluish border such as in subsp. *knorri*); columellar area reddish to whitish (var. *leucostoma* BOETTGER, 1890); columellar edge with 8—10 very small denticles, only in the middle part; very densely granulated (Pl. 2; Fig. 10a, b).

Sizes (in mm):

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Sey: M: No. 3	17.2	24	17.2	17.2	10
	15.6	22.3	15.6	16.9	9
No. 4	14.8	21	14.8	14	8.5
	14.6	20.2	14.6	15	8
	12.4	17.4	12.4	12.8	7
Co: A: No. 8	14.4	19	14.4	13.1	6.4
	13.2	17.8	13.2	13.7	6.4
No. 10	11.3	15.4	11.3	10	6.5
No. 13	12	14.2	12	11	5.5
No. 17	12	16	12	12	7

The measurements are from the largest specimens in the samples.

Operculum: Size (from a specimen with shell-height of 17.2 mm): 12.5 mm × 7.5 mm; the coloration of the operculum is the most important difference of the subsp. *stumpfi* from all other forms or varieties of the *pulligera*-group: the outer surface is very dark brown, nearly blackish; from the nucleus stretch a yellowish arc-strip, which is divided Y-like; the other margin horny, reddish-brownish bordered; growth-striae fan-like; inner surface yellowish-

orange; peg short and blunt with a basal ridge to the sickleshaped rib, which has a longitudinal furrow on the outer and inner side (Pl. 4; Fig. 20a, b).

Anatomical remarks: No remarkable differences from the other forms of the *pulligera*-group; Radula: broad central-tooth, the first lateral-tooth with a short stalk and a small cutting edge on the outside; the third lateral tooth and the marginal teeth are serrated with many delicate denticles (Fig. 14). Female reproductive system: large distinct spermatophor-sac (or spermatheca) with about 30—50 very slender spermatophors of 8—10 mm lenght; the vagina is at the opening ampoule-shaped, thickened; the vaginal connection duct enters in the middle part of the vagina after making a loop; ductus enigmaticus and crystal-sac are typical (Fig. 15a, b).

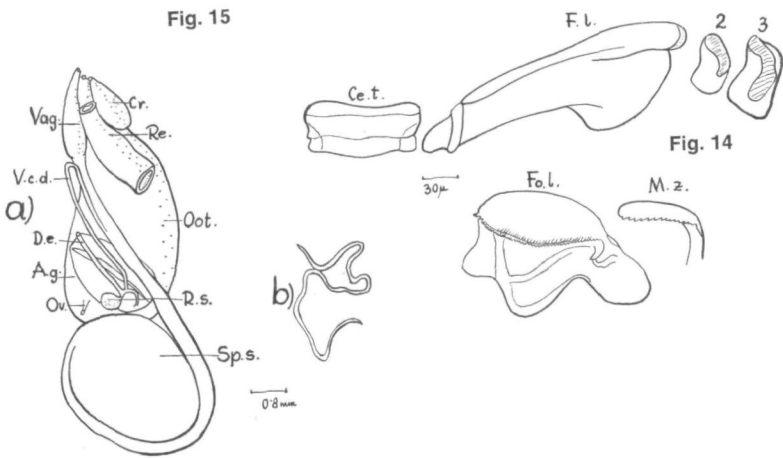


Fig. 14. *Neritina (N.) pulligera stumpfi*: Radula-teeth
Fig. 15. *Neritina (N.) pulligera stumpfi*: a) Female reproductive-system; b) Spermatophor

Ecological-biological remarks: The subspecies *stumpfi* occurs like all forms of the *pulligera*-group in the lower courses of the running waters, but always in freshwater, upstream of the influence of brackish water from the return current during high-tide. At Station Sey : M : No. 3, the River Mamelle the subsp. *stumpfi* was associated with the subsp. *knorri*, in other stations also with *Neritina (V.) gagates*, *Septaria borbonica*, *Neritilia consimilis* and rarely

	Temperatures		Chemistry	
		pH	conductivity	total hardness
Seychelles:				
Mahé:	24.4°—25.5° C	6.9	46—54 µS	0.33°—0.65° dH
Comores:				
Anjouan:	23.6°—26° C	7.7—8.1	122—216 µS	2.6° —3.7° dH
Range:	23.6°—26° C	6.9—8.1	46—216 µS	0.33°—3.7° dH

also with *Clithon spiniperda* and *Clithon chlorostoma* f. *comorensis*. The frequency was from sporadic to 3–5 ind./1/16 m².

Geographical range: The subspecies *stumpfi* of the *Neritina pulligera*-group is restricted in its occurrence in the lower courses of the running waters of the Seychelles (Mahé), Comores (Anjouan) and the island of Nossi-Bé, NW of the coast of Madagascar.

Genus: *Septaria* FÉRUSSAC, 1807

8) *Septaria borbonica* (BORY ST. VINCENT, 1803)

Lit.: 1803 *Patella borbonica* (BORY ST. VINCENT, Voy. 4 princ. Iles afr., 1: 287; Pl. 37, Fig. 2) — 1805 *Crepidula borbonica* (ROISSY, Hist. gén. part. Moll., in: BUFFON, édit. SONNINI, 5: 239) — 1807 *Septaria borbonica* (FÉRUSSAC, Essai d'une Méth. Conch.: 70) — 1816 *Navicella elliptica* (LAMARCK, Encycl. méth. (Vers.) Expl.: Pl. 456, Fig. 1) — 1822 *Navicella elliptica* (LAMARCK, Hist. nat. anim. s. vert., 6 (2): 181) — 1825 *Septaria elliptica* (part) (BLAINVILLE, Man. Conch.; 445; Pl. 36, Fig. 1; Pl. 48, Fig. 5) — 1826 *Navicella elliptica* (QUOY & GAIMARD, Voy. de l'Uranie: Pl. 71, Fig. 3) — 1827 *Septaria borbonica* (FÉRUSSAC, Bull. univ. Sci. nat., 10: 412) — 1832 *Navicella elliptica* (QUOY & GAIMARD, Voy. de l'Astroblabe, Zool., 2: 206; Pl. 58, Fig. 25–34) — 1838 *Navicella elliptica* (LAMARCK, Hist. nat. anim. s. vert., Ed. 2 (by DESHAYES), 8: 563) — 1840 *Septaria* or *Navicella elliptica* (DUFO, Ann. Sci. nat., 2^e sér., 14: 194) — 1843 *Navicella elliptica* (SGANZIN, Mém. Soc. hist. nat. Strasbourg, 3: 21) — 1843 *Navicella cumingiana* (RÉCLUZ, Proc. zool. Soc., London, 1843: 157) — 1849 *Navicella porcellana* (SOWERBY, Thes. Conch., 2: Pl. 127, Fig. 1, 2) — 1855 *Navicella porcellana* (REEVE, Conch. Icon.; Fig. 6, 10) — 1860 *Navicella porcellana* (MORELET, Sér. Conch., 2: 119; 126) — 1863 *Navicella porcellana* (DESHAYES, Cat. Moll. Réunion, p.E.: 81) — 1874 *Navicella porcellana* (CROSSE, J. de Conch., 22: 242; var. *elliptica*: 242) — 1877 *Navicella porcellana* (LIÉNARD, Cat. Moll. Maurice: 48) — 1878 *Navicella porcellana* (KOBELT, Jb. dtsh. malak. Ges., 5: 180) — 1881 *Navicella borbonica* (MARTENS, in M. & CH., Conch. Cab. (2), 10a: 10; 13; Pl. 1, Fig. 4–18) — 1881 *Navicella bimaculata* (CROSSE, J. de Conch., 29: 207) — 1881 *Navicella junghuhnii* (MARTENS, in M. & CH., Conch. Cab. (2), 10a: 23; Pl. 4, Fig. 13–15) — 1888 *Navicella (Cimber) borbonica* (TRYON, Man. Conch. (1), 10: 78; Pl. 27, Fig. 2–12) — 1889 *Navicella bimaculata* (BOETTGER, Nachr.-Bl. dtsh. malak. Ges., 21: 41) — 1890 *Navicella borbonica* var. *depressa* (BOETTGER, ibid., 22: 98) — 1892 *Septaria (Elara) suborbicularis* (BAKER, Proc. Rochester Ac. Sci., 2: 33) — 1898 *Septaria borbonica* (MARTENS, Mitt. zool. Samml. Naturkde. Mus., Berlin. 1 (1): 27) — 1908 *Septaria borbonica* (BOURNE, Proc. zool. Soc. London, 1908: 810; Pl. 46, Fig. 1–3; Pl. 52, Fig. 23) — 1910 *Navicella porcellana* (KOBELT, Abh. senck. nat. Ges., 32: 92) — 1921 *Septaria borbonicensis* (GERMAIN, Mém. Soc. zool. France, 1920, suppl.: 398) — 1929 *Septaria borbonica* (ANDREWS, J. Morph., 61: 525; Pl. 4, Fig. 23) — 1956 *Septaria borbonica* (BENTHEM-JUTTING, Treubia, — (2): 133; Fig. 32) — 1969 *Septaria (Septaria) borbonica* (STARMÜHLNER, Malacologia, 8 (1/2): 76; Fig. 85–152).

Localities: Sey: M: No. 6 (1 ind.), No. 7 (20 ind.); Co: A: No. 3 (1 iuv.), No. 7 (99 ind.), No. 8 (4 ind.), No. 9 (104 ind.), No. 10 (20 ind.), No. 11 (17 and many iuv.), No. 12 (15 and many iuv.), No. 13 (50 and many iuv.), No. 14 (333 ind.), No. 15 (many ind.), No. 17 (53 ind.); Mas: Ré: No. 8 (6 ind.), No. 16 (2 ind.), No. 18 (40 ind.), No. 19 (157, mostly iuv.), No. 20 (18 ind.); Mau: No. 5 (10 ind.), No. 11 (10 ind.), No. 13 (10 ind.), No. 15 (6 ind.), No. 19 (42 ind.), No. 20 (39 ind.), No. 21 (10 ind.), No. 22 (6 ind.), No. 23 (70 and many iuv.).

Shell: Descriptions and figures are given by MARTENS (1881); TRYON (1888); BENTHEM-JUTTING (1956) and STARMÜHLNER (1969): In size, shape, form and coloration widely varying and often confused with *Septaria porcellana* (LINNÉ, 1758). The specimens from our collections are also widely varying, mostly depending on the nature of the bottom, where the nearly sessil specimens were collected. Generally the symmetrical shells are cap-like and without

Sizes (in mm):

Localities	Lenght	Broad	Height	Col.area	Index	
					Br: L	H: L
Sey: M: No. 6	20.7	16.3	6.5	3	78.7%	31 %
No. 7	22	17	6.8	4	77 %	31 %
Co: A: No. 7	27.3	20	10	5.5	73 %	36.5%
No. 8	28.5	20.6	10	5.5	72 %	35 %
	27.6	20	10	4.2	72 %	36 %
No. 9	35	25.5	14	6.2	73 %	40 %
No. 10	28	21	10	4.5	75 %	35 %
No. 11 (eroded)	26.5	20.8	9.2	5	78 %	34.7%
No. 12 (eroded)	26	21.5	11	5	82 %!	42 %!
	25.6	19.2	9.7	4.4	75 %	37 %
No. 13	30.6	22	12.3	5.5	72 %	40 %
	28.4	21.6	11.3	4.8	76 %	40 %
	26.1	20.3	10.3	5	77 %	39 %
No. 14	32.6	23.8	13	6	73 %	40 %
No. 17	24	17.5	9.3	4	73 %	38.7%
Mas: Ré: No. 8	29.2	22.5	9.6	4.8	77 %	32 %
No. 16 (eroded)	21	17	7.4	3.8	80 %	35 %
	21	15.9	6	3.48	76 %	29.9%
No. 18 (eroded)	24	19.4	7.3	4.3	80 %	30 %
	27	19.5	8.3	5	72 %	30 %
No. 19	22.2	16.6	7	3.5	75 %	31 %
No. 20	17.5	13.5	5.6	3.8	77 %	32 %
Mau: No. 5 (eroded)	26	21	10.8	4	80 %	40 %
	27.4	18	9	3.6	65 %	32 %
No. 11	33.6	24	11.7	5.6	71 %	34 %
	32.2	24.5	12.4	5.2	76 %	38 %
	32	24	12.3	5.5	75 %	38 %
No. 13	24.4	17	7.8	3.7	69 %	32 %
No. 15	31	20.6	10.5	4.5	66 %	33.8%
	30.5	22	9.5	4.5	72 %	31 %
	28	19.3	9.5	3.8	69 %	34 %
No. 19	18	12.7	5.3	2	70.5%	29.4%
No. 20 (eroded)	20.4	16	7.9	3.5	78 %!	38.7%
	20.7	13.3	6.8	3.1	62.8%	32.8%
No. 21	22	16	6.3	3.8	72.7%	28.6%
No. 22	20	14	6	4.2	70 %	30 %
No. 23	18.2	14	5.6	3	77 %	30 %

The measurements are from the largest specimens in the samples.

whorls; the apex reaching the posterior margin of the shell and touching the plane of the aperture; it is always eroded by friction with the substrate (sometimes a little eroded by other causes). The width of the shell is generally greater and the posterior margin a little more pointed than in *S. porcellana*. The ground colour, covered by a dark periostracum, is yellowish-brown to green and ornamented with a network of darker threads, making an elegant pattern of triangular, oval or dot-shaped spots; irregular growth rings; the shells of the specimens of Mahé are extremely thin and fragile, depending on the extremely low content on mineral-salts (Calcium) in the rivers. (Pl. 2, Fig. 11 a, b; 12 a, b; 13 a, b).

The average indices are from:	Br : L	H : L
Seychelles (Mahé):	77.85%	31% broad and flat
Comores (Anjouan):	74.69%	38% broad and high
Mascarene (La Réunion):	76.71%	31.5% broad and flat
(Mauritius):	71.6%	33.55% narrow and flat

The average index of all on Indian Ocean Islands collected shells of <i>Septaria borbonica</i> :	75.21%	33.55% broad and flat
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Operculum: It lies in the soft part between foot and pallial organs; without function; size (of a specimen from Seychelles, Mahé, 22 mm length; (Sey : M : No. 6): posterior side: 8 mm, anterior side: 5 mm; rib: 0.8 mm; yellow-reddish, exterior somewhat shiney, interior lustreless; the protruded spur of the rib is broader and shorter than in the operculum of *Septaria porcellana* (LINNÉ, 1758) and *p. depressa* (LESSON, 1830) (Pl. 4, Fig. 21; 22a, b).

Anatomical remarks: Detailed studies on the anatomy and histology of *S. borbonica* were made by BOURNE (1908) and STARMÜHLNER (1969). **Radula:** central-tooth a little higher than broad, cutting edge concave posterior side somewhat broader than anterior side, first lateral tooth with a prominent protrusion on the outer cutting edge, third lateral tooth with many, delicate denticles on the cutting edge, the marginal-teeth with 10—12 denticles (Fig. 16). **Femal reproductive organs:** the spermatheca (or spermatophor-sac) is only a basal enlargement of the vaginal-duct (in *S. porcellana* (LINNÉ) it is globular and distinctly set aside from the vaginal duct (STARMÜHLNER, 1976: 540, 541; Fig. 391, 41a). In contrast to *S. porcellana* f. *depressa*, spermatophors were never found in the spermatheca of *S. borbonica* (BOURNE, 1908; ANDREWS, 1937; STARMÜHLNER 1969). Also the dissected females of our samples were without spermatophors. The dark coloured receptaculum seminis is divided in two parts, connected by a short, narrow median duct; the anterior sac passes over the narrow receptaculum duct. The vaginal connecting duct stretches to the median part of the vagina (it is longer and more slender as indicated by specimens from Madagascar by STARMÜHLNER (1969) (113; Fig. 137) than in *S. porcellana* f. *depressa* (STARMÜHLNER (1976): 540; Fig. 39a; 541; Fig. 41a). Proximal to entering the vaginal connecting duct, the vagina is

ampoule-shaped. The ductus enigmaticus and crystal-sac are typical developed. (Fig. 17).

Ecological-biological remarks: *Septaria borbonica* is a characteristic form of the strong current in the middle and lower courses. The snails are attached to the surface of rocks and boulders in a current-velocity of 50 cm/sec to more than 1 m/sec. The streamlined, cap-like shell, and the broad sucker-like foot are ideal adaptations to the strong current of a torrent or water-

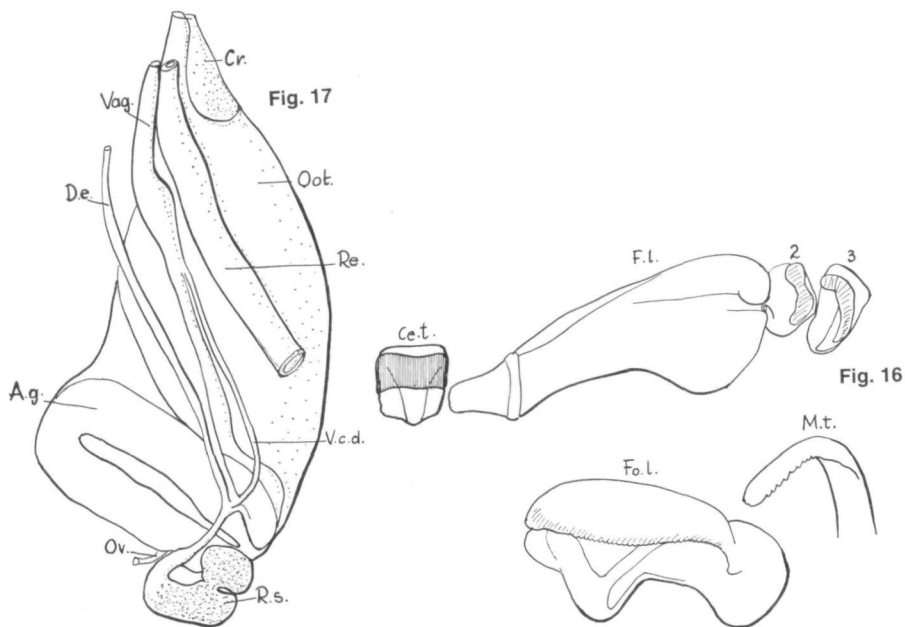


Fig. 16. *Septaria borbonica*: Radula-teeth

Fig. 17. *Septaria borbonica*: Female reproductive-system

fall. The specimens of the rivers of Mahé posses very thin shells, as a consequence of the very low content of mineral (specially Calcium-) salts in the extremly smooth and slightly acidic waters of these granitic island.

	Temperatures		Chemistry		
		pH	conductivity	total hardness	
Seychelles (Mahé):	26° C—28° C	6.6—6.8	33— 35 μ S	0.18°—0.2°	dH
Comores (Anjouan):	23.6° C—27.3° C	7.7—8.2	43—216 μ S	1° —3.7°	dH
Mascarene					
(La Réunion):	22.1° C—28.4° C	7.1—8.1	65— 92 μ S	1° —1.65°	dH
(Mauritius):	21.2° C—24.5° C	7.6—8.2	130—195 μ S	1.85°—2.65°	dH
Range:	21.2° C—28.4° C	6.6—8.2	33 —216 μ S	0.18°—3.7°	dH

In the localities of Anjouan, La Réunion and Mauritius many shells of females were covered with eggs. In some localities of Anjouan many young specimens were also attached to the shells, covering the surface of the shells. The species was associated with *Neritina* (V.) *gagates*, *Neritina pulligera stumpfi* and *knorri*, *Neritina* (*Neripteron*) *auriculata* f. *mauriciae*, *Clithon spiniperda*, *Clithon coronata* and *Neritilia consimilis*.

Geographical range: Madagascar, Comores, Seychelles, Mascarene Islands (La Réunion, Mauritius, Rodriguez). Following BENTHEM-JUTTING (1956), the species is also recorded from India, Malay Archipelago, Philippines and various Pacific Islands. It is doubtful if the records of *Septaria borbonica* from the coasts east of the East African islands, from India, Malay Archipelago are in fact *Septaria porcellana*, including f. *depressa*. All specimens described by STARMÜHLNER (1970) from New Caledonia and (1974) from various Pacific islands between New Guinea and Tahiti belong to *Septaria porcellana* f. *depressa*.

Subfamily: Neritiliinae

Genus: *Neritilia* MARTENS, 1879

9) *Neritilia consimilis* (MARTENS 1879)

Lit.: 1879 *Neritina consimilis* (MARTENS, in M. & CH., Conch. Cab. (2), 10a: 243; Pl. 23; Fig. 25, 26) — 1880 *Neritina* (*Neritilia*) *consimilis* (MARTENS, Mollusken, in MÖBIUS: Beitr. z. Meeresfauna d. Insel Mauritius: 213—1888 *Neritina* (*Neritilia*) *consimilis* (TRYON, Man. Conch., 10: 54; Pl. 18, Fig. 86) — 1910 *Neritina consimilis* (KOBELT, Abh. senck. nat. Ges., 32: 94) — 1921 *Neritina* (*Neritilia*) *consimilis* (GERMAIN, Mém. Soc. zool. France, 1920, suppl.: 394).

Localities: Sey: M: No. 3 (6 ind.); Co: A: No. 7 (5 ind.), No. 13 (15 ind.), No. 17 (1 ind.); Mas: Ré: No. 8 (5 ind.), No. 16 (5 ind.), No. 18 (87 ind.), No. 19 (24 ind.); Mau: No. 11 (1 ind.), No. 13 (5 ind.), No. 19 (250, mostly iuv.), No. 20 (53 ind.), No. 21 (7 ind.), No. 22 (12 ind.), No. 23 (110 & many iuv.).

Shell: MARTENS wrote in the description of the species, that the shells of the types of *N. consimilis* are very similar to the shells of *N. succinea* (RÉCLUZ, 1841). For this species RÉCLUZ, 1841 (Rev. zool., 1841: 343) has stated "doubtful Madagascar or Guadeloupe?". MARTENS believed that probably *N. succinea* of RÉCLUZ is from Madagascar. The only difference he found is that the operculum of *consimilis* has "nearly" no peg, such as in *succinea*. Our study of the operculum (see below) shows, that all investigated specimens from Mahé, Anjouan, Réunion and Mauritius have a distinct peg on the basal interior surface of the operculum, such as is described for *N. succinea* and also for the pacific species *N. rubida* (PEASE, 1867).

H. K. MIENIS (Zoolog. Museum, Mollusc Section, The Hebrew University, Jerusalem) who has checked the determination of our specimens, wrote to us 24 March 1977 in a letter: "I checked your material and found pegs on the operculum of all your *Neritilia* material. However, this peg is rather fragile and easily broken when separating it from the animal. It hardly leaves a scar."

Therefore, if it is true, that the real locality of the type-shell of RÉCLUZ's *N. succinea* is Madagascar and not Guadeloupe (French Antilles), the name *similis* would be a synonym of *succinea* RÉCLUZ, which has priority. Also, GERMAIN (1921) indicated in his monograph on page 394 that *N. consimilis* is nearly identical with *N. succinea* from Guadeloupe. His statement (taken from MARTENS, 1879) that the diameter of *consimilis* (type from River Créole, Mauritius) is a little smaller (3.5 mm) than *succinea* (4.3 mm) is not true; our full grown specimens (also from River Créole and other localities) all have a diameter between 4.2 mm to 5.5 mm. GERMAIN asked if perhaps *N. succinea* was transported accidentally from the (french) Guadeloupe to the (partly also french) Mascarene Islands.

But our collections show that the species is not only in the Mascarene rivers, it is also found at the Comores and Seychelles Islands. MIENIS, in a letter to the author, after checking the material of our mission to Madagascar 1958, also found *Neritilia* in the collections, overlooked by us. Another question, also raised by MIENIS in his letter (24 March 1977) after checking our collections, is if *N. consimilis* may be a synonym of *N. rubida* (PEASE, 1867) described from Polynesian islands, also occurring in Java, Celebes, Thailand, New Guinea (BRANDT, 1974). These species were investigated by STARMÜHLNER (1976) from material collected from Éfaté (New Hebrides) and Tahiti. After comparing the specimens it is seen that the two species are very closely related, but there are some little differences in the shell and anatomy.

The shells of our specimens are obliquely elliptical (and not transversely ovate such as in *N. rubida*), very fine and delicate striulated by growth striae,

Sizes (in mm):

Localities	Shell		Aperture		Col.area
	Height	Diameter	Height	Diameter	
Sey: M: No. 3	5	4	3.6	3	1
No. 7	5	3.5	3	3	1.2
Co: A: No. 7	4.6	4	no measurements!		
No. 13	3	2.3	no measurements!		
No. 17	5	4.5	no measurements!		
Mas: Ré: No. 8	4.8	4.3	3	2.6	1.5
No. 16	5	4.3	3	2.6	1.5
No. 18	4.5	3.9	3	2.5	1.2
No. 19	4.5	3	3	2.7	1
Mau: No. 11	4.8	4	3.2	3.5	1
No. 13	4.7	4	3	3.3	1
No. 19	4.2	3	2.3	2.5	0.7
No. 20	5.3	4.2	3.1	3.3	1.2
No. 21	4.4	3.5	2.6	2.8	1
No. 22	5.3	4.5	3.5	4	1.5
No. 23	4.9	3.9	3	2.8	1

The measurements are from the largest specimens of the samples.

translucent, yellowish with a reddish, brownish or blackish coating (iron-oxide); the spire slightly elevated, suture simple, last whorl flattened below; aperture obliquely and semi-elliptical (not as extended as in *rubida*); inside whitish to yellowish as also the delicate, wrinkled columellar area (if the soft body is shining through the shell, the columellar area is darker); the superior border of the aperture thin and straight, the exterior border arched and at the lower border, which is a little arched, gradually thickened; columellar edge straight, without any denticulation (Pl. 4; Fig. 23a, b).

Operculum: Size (from a specimen with a shell-diameter of 5 mm; Sey: M: 7): 2 mm × 1.3 mm; elliptical, inner border straight, outer border coating; as indicated above, a peg-like process was found on all investigated specimens; this process is slightly curved and on the inner flat surface, grooved; MARTENS (1879) noted a difference from *N. succinea* (and *N. rubida*), that the operculum of the type-specimen from the River Créole (coll. by Prof. K. MÖBIUS, 19. 10. 1874) is "without an appreciable vestige of peg and rib". MIENIS wrote in his letter of 24 March 1977, like noted above, to us: "However, this peg is rather fragile and easily broken, when separating it from the animal. It even hardly leaves a scar"; It is possible that by the specimen, described by MARTENS, as type, the fragile peg-like process was broken in the preparation (Pl. 4; Fig. 24a, b, c).

Anatomical remarks: Details on the anatomy of *Neritilia* were given by BAKER (1923, radula); ANDREWS (1937, female reproductive organs) and STARMÜHLNER (1976). The outside surface of the mantle is dark pigmented; Radula: extremely long; central tooth is lacking; first lateral prolonged, without a cutting edge, but a distinct bicuspid denticulation on the outer end, opposite a small intermediate tooth; the outer lateral possesses on the cutting edge 8–12 prominent denticles (STARMÜHLNER, 1976, counted for *N. rubida*: 12–14 denticles), the marginal-teeth with 5–6 denticles (*N. rubida*: 4–5 denticles) (Fig. 18). Female reproductive organs: spermatheca (or sperma-

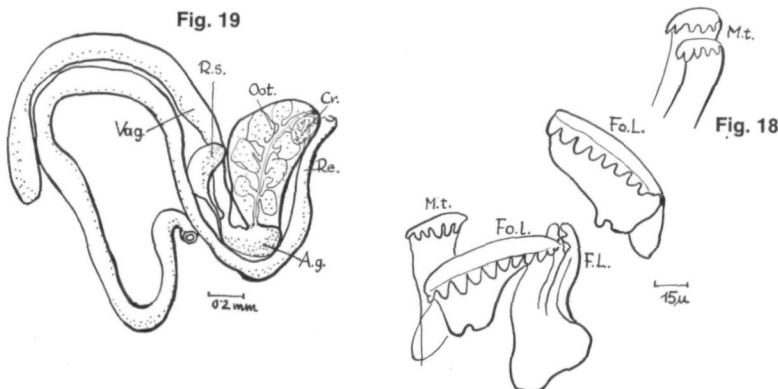


Fig. 18. *Neritilia consimilis*: Radula-teeth

Fig. 19. *Neritilia consimilis*: Female reproductive-system

tophor-sac) long and U-shaped, but much broader in *consimilis*, than the slender sac, figured by STARMÜHLNER (1976) for *N. rubida* (p. 549; Fig. 48). The sac is extended gradually to the vaginal-duct, which enters the albumen gland. The kidney-shaped receptaculum seminis enters with a short, but distinct duct, together with the vaginal duct, in the lumen of the albumen gland. In *Neritilia rubida* the sac-like receptaculum enters directly into the albumen gland (STARMÜHLNER, 1976). The capsule-gland (= ootype) is-as in *Neritilia rubida*-enormously developed. On the proximal side the crystal-sac is adjacent. The vagina opens through the central duct of the capsule gland, therefore there is only one female genital-pore in *Neritilia* (Fig. 19).

Ecological-biological remarks: Like the closely related species *N. rubida*, *N. consimilis* occurs exclusively in the lower courses of the running waters, mostly in pure freshwater, but also near the influence of brackish water from the return current during high-tide. The small snails are attached, mostly in groups, in small holes of rocks and boulders, as a rule very near the water surface. Protected by the the holes against the current, they occur in surface currents between 30 cm—50 cm/sec. The frequency fluctuates between 1 and 30 ind./d², mostly around 5—10 ind./dm². They were associated with *Neritina pulligera* (and his subspecies), *Neritina* (V.) *gagates*, *Clithon spiniperda*, *Clithon chlorostoma* f. *comorensis* and *Septaria borbonica*.

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Seychelles (Mahé):	24.4° C—28° C	6.8—6.9	33— 54 µS	0.2°—0.65° dH
Comores (Anjouan):	23.6° C—26° C	7.7—8.2	122—135 µS	2.5°—3.7° dH
Mascarene				
(Réunion):	22.1° C—26.6° C	7.1—7.4	69— 92 µS	1° —1.65° dH
(Mauritius):	21.7° C—24.5° C	7.8—8.2	96—195 µS	1.55°—2.65° dH
Range:	21.7° C—28° C	6.8—8.2	35—195 µS	0.2° —3.7° dH

In our collections from the months February to May 1974 were found many juvenile snails.

Geographical range: *Neritilia consimilis* is known from the E-African Islands, such as Seychelles-, Comores- and Mascarene-Archipelagos. It occurs also in Madagascar (after the revision of the material of the Madagascar-Mission 1958, by H. K. MIENIS). The closely related species *Neritilia rubida* is reported from Java, Celebes, Thailand, New Guinea and several Pacific islands, such as New Hebrides, Fiji, Samoa and Tahiti. From the Prince-island in the Gulf of Guinea (W-Africa) is described a *Neritilia manoeli* DOHRN, 1866 (MARTENS, 1879).

Order: Mesogastropoda
 Superfamily: Cyclophoracea
 Family: Viviparidae
 Subfamily: Bellamyinae
 Genus: *Bellamy*

10) *Bellamy bengalensis* (LAMARCK, 1822) f. *zonata* (HANLEY, 1860)

Lit.: 1822 *Paludina bengalensis* (LAMARCK, 1822, Hist. nat. anim. s. vert., 4 (2): 174) — 1838 *Paludina bengalensis* (LAMARCK, ibid., 8 (2^e édit. (DESHAYES): 513) — 1841 *Paludina bengalensis* (DELESSERT, Rec. Coqu.; Pl. 31; Fig. 2) — 1852 *Paludina bengalensis* (KÜSTER in M. & CH., Coch. Cab.: 17; Pl. 3, Fig. 15, 16) — 1860 *Paludina zonata* (HANLEY, in REEVE, Conch. Icon.: Fig. 34) — 1869 *Paludina bengalensis* v. *digona* (BLANFORD, Proc. zool. Soc. London, 1869: 445) — 1867 *Paludina bengalensis* (HANLEY & THEOBALD, Conch. Ind.: XVII; 32; Pl. 76, Fig. 8–10; Pl. 76, Fig. 5 = var. *gigantea* (= *P. gigantea* v. d. BUSCH, in REEVE, Conch. Icon.: Pl. 1; Fig. 7 = *P. bengalensis* v. *gigantea* NEVILL, loc. supra cit., fasc. E, 1877: 28 and Handlist Moll. Ind. Mus. Calcutta, 2, 1844: 21; also *P. bengalensis* in MORELET, Sér. Conch., 4: 303; *P. lineata* VALENCIENNES, Rec. obs. zool. anat. comp.: 256 and *P. elongata* SWAINSON, 1821, Zool. Ill., London, sér. 1: Pl. 98) — 1877 *Paludina bengalensis* v. *doliaris* (NEVILL, Cat. Moll. Ind. Mus. Calcutta, fasc. E: 28) — 1877 *Paludina zonata* (LIÉNARD, Cat. Moll. Maurice: 46) — 1877 *Paludina zonata* (NEVILL, Cat. Moll. Ind. Mus. Calcutta, fasc. E: 31) — 1880 *Paludina zonata* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresf. d. Ins. Mauritius: 210) — 1884 *Paludina zonata* (NEVILL, Handlist Moll. Ind. Mus. Calcutta, 2: 23) — 1910 *Paludina zonata* (KOBELT, Abh. senckenb. nat. Ges., 32: 94) — 1915 *Vivipara digona* (PRESTON, Fauna Brit. India ..., Moll.: 91) — 1921 *Vivipara zonata* (GERMAIN, Mém. Soc. zool. France, suppl. 1920: 335).

Localities: Mas: Mau: No. 18 (93 ind.), No. 22 (1 ind.), No. 25 (15 ind.).

Shell: Ovately conical, rather solid, with 5 to 5½ whorls, below the suture flatly angled, suture depressed; closely spiraled and linearly straited, especially on the underside of the last whorl; young shells wit a row of fine periostracum-hairs below the suture; umbilicus narrow and deep; 3–4 brown spiral-bands on the olive-green ground; aperture pyriformly broad-ovate, dark brown edged; apex mostly eroded, and surface of the whorls sometimes covered with filamentous algae (Pl. 5; Fig. 25).

Sizes (in mm):

Localities	Shell		Aperture	
	Height	Diameter	Height	Diameter
Mas: Mau: No. 18	25.5	18	13	10
No. 22	29	22.6	25.5	13.5
No. 25	23	18	12	10

The sizes are from the largest shells in the samples.

Operculum: Size (froma specimen with shell-height: 23 mm): 12 mm × 9 mm; (shell-height: 29 mm): 14 mm × 12 mm; broad-ovate, horny; with a subcentral nucleus, which is slightly impressed; concentric growth-rings (Pl. 5; Fig. 26).

Anatomical remarks: Detailed anatomical descriptions of different species of *Bellamyia* are given by SEWELL (1921); NEUMANN (1928); ROHRBACH (1937) and STARMÜHLNER (1974); Radula: central-tooth with a trapezoid outline, cutting-edge with 5+1+5 denticles; first lateral with 3+1+5; the inner marginal-tooth with 3+1+3 and the outer marginal-tooth with 10–12 equal pointed denticles (Fig. 20). The salivary glands, with two slender ducts, are united in the median line and posses ramified, lateral blind-sacs (Fig. 21).

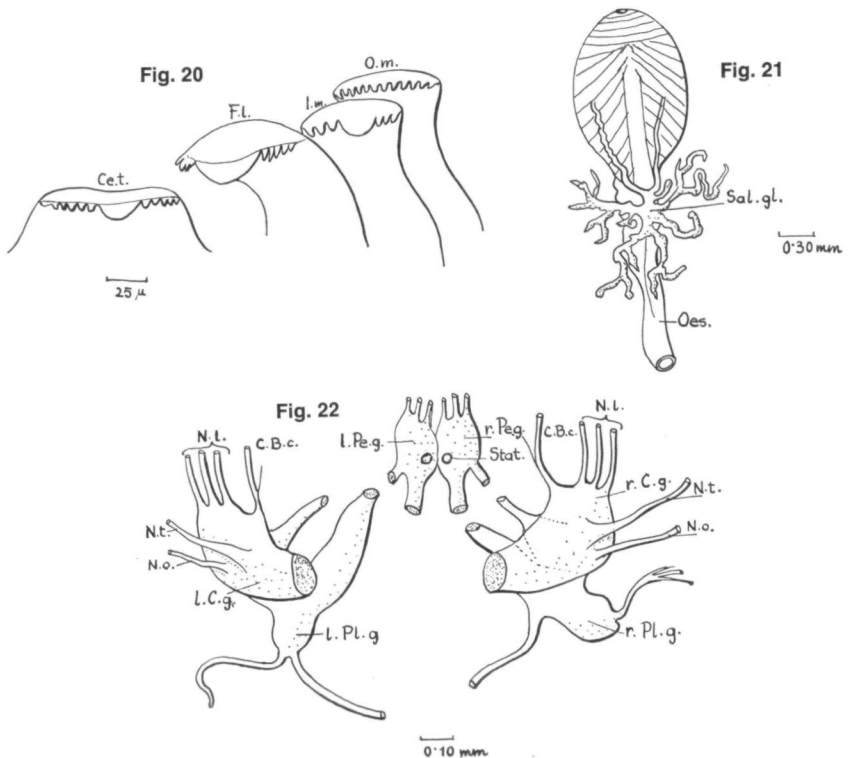


Fig. 20. *Bellamyia bengalensis* f. *zonata*: Radula-teeth

Fig. 21. *Bellamyia bengalensis* f. *zonata*: Salivary-glands

Fig. 22. *Bellamyia bengalensis* f. *zonata*: Central nervous-system

The central nervous-system is similar to Fig. 21, given by STARMÜHLNER (1974) for *B. dissimilis ceylanica*: Cerebral-ganglia long-oval in outline and united by a short, but broad commissure; from the outside to the inner area run the N. opticus, N. tentacularis and 4 (resp. 5) nerves to the mouth and lips and to the cerebrobuccal-connective; the pleural ganglia are approximate to the cerebral ganglia, being connected to them by very short connectives; the right pleural ganglion gives rise to the thick N. suprainestinalis, the left to the left pallial nerve and the N. subintetinalis; these nerves cross each other, and are separated by the oesophagus; the pedal ganglia are connected with thick connectives with the cerebral- and pleural ganglia (Fig. 22). The sexes

are separate and the females — like all Viviparidae — are viviparous; in the uterus of dissected females from No. 25, about 20–25 embryos were found; the anatomy of the female and male show no differences from the results of other *Bellamya*-species (STARMÜHLNER, 1974: 117; Fig. 22, 23).

Ecological-biological remarks: GERMAIN (1921) stated, that these species was introduced with waterplants from India to Mauritius by the Indian immigrants in the last century. The species is found in still-waters, such as tanks, ponds, but also creeks of rivers without current, abundant on waterplants, algae and muddy-sandy bottoms. In Mauritius the species was in creeks and borders of running waters only in the slow-flowing lower courses of the plains near the coast. They are associated with *Thiara scabra*, *Melanoides tuberculata*; frequency in the creeks of the River Rempart (Mau: No. 18) was 10–15 ind./1/16 m², in the pond of the Pamplemousses-Garden (Mau: No. 25), 1 ind./m².

Temperatures	Chemistry		
	pH	conductivity	total hardness
24.5° C—26.3° C	7.6—8.15	125—175 µS	1.8°—2.65° dH

Like all Viviparidae, *Bellamya bengalensis* f. *zonata* partially filter with the gill microplankton from the respiratory water current.

Geographical range: India; introduced to Mauritius (f. *zonata*).

Superfamily: Rissoacea

Family: Synceridae (= Assimineidae)

Subfamily: Syncerinae (= Assimineinae)

Genus: *Paludinella* PFEIFFER, 1841

11) *Paludinella hidalgoi* (GASSIES, 1869) f. *granum* (MORELET, 1882)

Lit.: 1869 *Hydrocena hidalgoi* (GASSIES, J. de Conch., 17: 18) — 1882 *Assiminea granum* (MORELET, J. de Conch., 30: 105; Pl. 4, Fig. 8, 198; Pl. 10, Fig. 15) — 1883 *Assiminea granum* = *hidalgoi* (MORELET, J. de Conch., 31: 208) — 1887 *Assiminea hidalgoi* (BOETTGER, Jahrb. malak. Ges., 14: 180) — 1910 *Assiminea granum* (KOBELT, Abh. senck. nat. Ges., 32: 94) — 1921 *Assemanina granum* (GERMAIN, Mém. Soc. zool. France; suppl., 1920: 375) — 1927 *Paludinella hidalgoi* (THIELE, Zool. Jb. (Syst.), 53: 118) — 1956 *Syncera hidalgoi* (BENTHEM-JUTTING, Treubia, 23 (2): 354; F. 67) — 1961 *Assiminea hidalgoi* ? (SOLEM, Fieldiana, Zool., 41 (3): 433) — 1962 *Assiminea granum* (BARNACLE, J. Seych. Soc., 2: 57) — 1970 *Paludinella hidalgoi* (STARMÜHLNER, Cah. ORSTOM, sér. Hydrobiol., 4 (3/4): 59; Fig. 51–54) — 1974 *Assiminea* (A.) *hidalgoi* (BRANDT, Arch. Moll., 105 (I/IV): 148; Pl. 11, Fig. 90) — 1974 *Syncera* (= *Assiminea*) cf. *hidalgoi* (STARMÜHLNER, Bull. Fish. Res. Stn., Sri Lanka, 25 (1/2): 129; Fig. 49, 50; Pl. 5, Fig. 48).

Locality: Mas: Ré: No. 24 (390 ind.).

Shell: Conical, yellow-brownish (young specimens with reddish post-nuclear whorls), shining and transparent, with a lighter zone below the suture;

very fine growth striae crossed by some very delicate, narrow, spiral wave-lines (enlargement: $50\times$!); BENTHEM-JUTTING (1956) and BRANDT (1974) state, that for these species there are 3–5 fine spiral lines on the three post-nuclear whorls typically; the specimens from the locality Ré: No. 24 are eroded from the embryonic whorls through 2 to $2\frac{1}{2}$ postnuclear whorls, therefore from the six whorls only the last 2.5 to 3 whorls can be recognized: BENTHEM-JUTTING (1956) wrote that these raised spiral lines fade away after the fifth whorl; umbilicus narrowly open or closed by the expanded columellar margin; aperture pyriform, angled above and well rounded below; peristome connected by a thin parietal callus; columella thickened, flat and somewhat expanded (Pl. 5; Fig. 27, 28).

Sizes (in mm):

Locality	Height	Shell		Aperture	
		Diameter	Height	Diameter	
Mas: Ré: No. 24 (eroded: 2.5 whorls)	2.2	1.5	0.9	0.7	

The measurements are from the largest specimen in the sample.

Operculum: Size (from a specimen with 2.2 mm height): 0.7 mm \times 0.45 mm; thin-corneous, paucispiral with excentric nucleus (Fig. 23).

Anatomical remarks: For *Paludinella* it is typical that the head forms a “flaplike fold” which covers the base of the rostrum (ABBOT, 1948: 281; BENTHEM-JUTTING, 1956: 351; Fig. 54; 362; BRANDT, 1974: 152). Our specimens were very contracted by fixation, therefore the fold or cape was not distinctly recognized, but it is a distinct groove on the base of the retracted rostrum (Fig. 25). The body and head with tentacles posses a black pigmentation, only the outer margin of the rostrum is lighter. STARMÜHLNER (1970) noted also a strong pigmentation for the specimens of *P. hidalgoi* from New Caledonia. The tentacles are very short, but not stubbed, the eyes are placed in the bases (Fig. 24). Radula: Figured by STARMÜHLNER (1970: 60; Fig. 52) for a specimen from New Caledonia. The specimens of Réunion have nearly identically radulae: central-tooth trapezoid with a short handle-like process on the base, laterally with short process, the formula of the denticles on the cutting-edge: 2+1+1 (2); the lateral with 2+1+2 denticles; between the base of the relatively short and broad lateral-tooth and the inner marginal-tooth there is a small accessory plate; inner- and outer-marginal-teeth with small “flanges”, wing-like lateral processes; the inner marginal: 3+1+1 denticles, the outer marginal: 11 denticles (Fig. 23). Male copulatory organ: the penis rises on the neck as a large and simple coiled duct (Fig. 25).

After the radula (central-tooth without any basal cusps) the species *hidalgoi* (including the f. *granum*) is — as indicated by THIELE (1927: 118) —

placed in the genus *Palludinella* and not in *Syncera* (= *Assimineae*) s. str., as it was done "tentatively" in the studies of BENTHEM-JUTTING (1956) and BRANDT (1974).

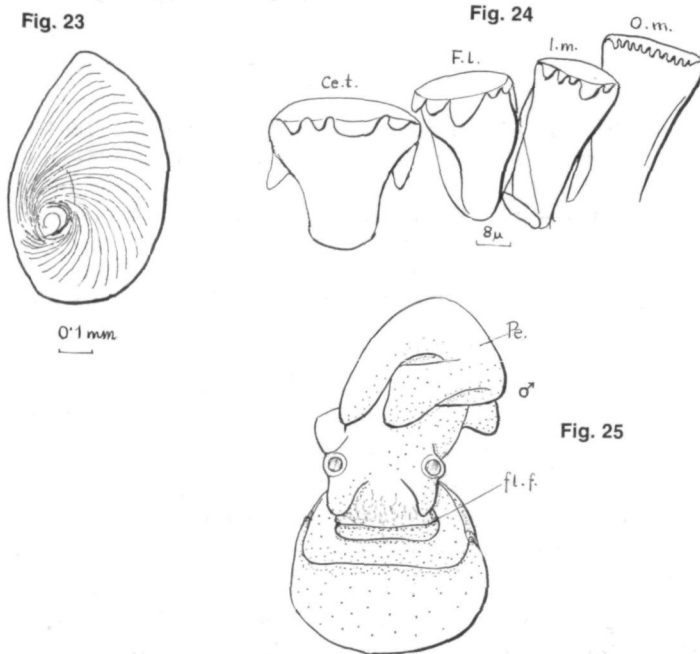


Fig. 23. *Paludinella hildalgori* f. *granum*: Operculum

Fig. 24. *Paludinella hildalgori* f. *granum*: Radula-teeth

Fig. 25. *Paludinella hildalgori* f. *granum*: Head and penis

Ecological-biological remarks: Found near the mouth region of the outflow of a source-pond in a brackish influenced coastal pond and swamp. On stones and among waterplants, such as *Potamogeton*, *Naja* and water-moss (cf. *Fissidens*) in dense populations about 5 ind./cm²(!) in a current of 30—50 cm/sec.

Temperatures	Chemistry		
	pH	conductivity	total hardness
21.2° C	8	1600 μS	10.7° dH

The high conductivity and total hardness indicate hard water with brackish influence. Also from other authors, such as BENTHEM-JUTTING (1956), BRANDT (1974) and STARMÜHLNER (1970) the species was recorded from the mouth-regions, especially brackish shores of the Indopacific coasts.

Geographical range: Indopacific shores between Mascarene-islands and Pacific islands (New Caledonia). BRANDT (1974) indicated a record from the coasts of Thailand (*Nipa*-palm swamps).

Genus: *Syncera* GRAY, 1821 (= *Assimineae* FLEMING, 1828)

12) *Syncera* (= *Assimineae*) *nitida* (PEASE, 1864)

Lit.: 1864 *Hydrocena nitida* (PEASE, Proc. zool. Soc. London, 1864: 574) — 1869 *Hydrocena nitida* (PEASE, J. de Conch., 17: 165; Pl. 7, Fig. 11) — 1884 *Assimineae nitida* (NEVILL, Handlist. Moll. Ind. Mus. Calcutta, 2: 71) — 1887 *Assimineae nitida* (BOETTGER, Jb. malak. Ges., 14: 192) — 1921 *Asseminia nitida* (GERMAIN, Mém. Soc. Zool. France; suppl. 1920: 376) — 1949 *Syncera nitida* (ABBOT, Occ. Pap. B. P. Bishop Mus., 19: 272; Fig. 7a–c) — 1956 *Syncera nitida* (BENTHEM-JUTTING, Treubia, 23 (2): 355; Fig. 68) — 1974 *Assimineae (Assimineae) nitida* (BRANDT, Arch. Moll., 105 (1/4): 148; Pl. 11, Fig. 91).

Locality: Sey: M: No. 8 (5 ind.).

Shell: Descriptions are given by PEASE (1864); GERMAIN (1921); BENTHEM-JUTTING (1956) and BRANDT (1974). The shells of our collections are the first record for the Seychelles: broad-conical; elevated spire with 5–6 regularly increasing whorls in size, somewhat convex; periphery subangular; shining and somewhat transparent; striated by delicate growth striae, crossed by more delicate, slightly wavy spiral striae (enlargement: more than $50\times$!); typically a subsutural raised spiral thread along the suture and a similar fine spiral thread along the very narrow or closed umbilicus; yellow-brownish; aperture little oblique, peristome connected by a thin parietal callus; basal and columellar margins thickened and a little expanded (Pl. 5; Fig. 29).

Sizes (in mm):

Locality	Height	Shell		Height	Aperture	
		Diameter	Diameter			
Sey: M: No. 8	2.3	1.5		1	0.6	

The measurements are from the largest specimen in the sample.

Operculum: Size (from a specimen with shell-height: 2.3 mm): $0.6\text{ mm} \times 0.4\text{ mm}$; corneous and paucispiral with an excentric nucleus (Fig. 26).

Anatomical remarks: Head, tentacles, mantle and upper surface of the intestine-sac dark pigmented; tentacles stubbed; Radula: central-tooth nearly squarish, the base slightly incised, cutting edge with $2+1+2$ denticles and on either side 3 basal cusps; lateral-tooth: $3+1+2$ denticles, an accessory plate is developed (in contrast to the details given by BRANDT, 1974: 148), inner marginal with 6, outer marginal with 13 cusps (Fig. 27). Male copulatory organ: the penis lies on the neck as a more slender, S-shaped appendix (Fig. 28).

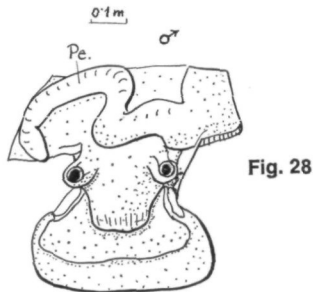
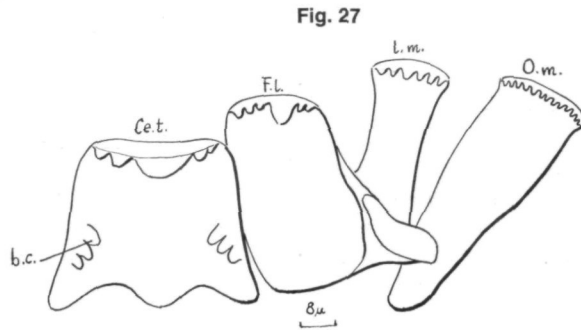


Fig. 26. *Syncera* (= *Assiminea*) *nitida*: Operculum

Fig. 27. *Syncera* (= *Assiminea*) *nitida*: Radula-teeth

Fig. 28. *Syncera* (= *Assiminea*) *nitida*: Head and penis

Ecological-biological remarks: The species is described from mangrove and *Nipal*-palm swamps in the coastal area of the Indian Ocean. At Mahé we found the specimens associated with *Melampus* cf. *caffra* juv. in the brackish zone of the mouth of the River Anse de la Mouche on dead corals.

Temperature	Chemistry: conductivity
32° C	more than 30.000 μ Siemens (brackish)

Frequency was about 5 ind./dm² in a current of 10–30 cm/sec.

Geographical range: Coasts of the Indopacific between Seychelles in the East, Mascarene-Islands (f. *nana* NEVILL, 1884) to the Society Islands in the West of the Pacific, northwards to Thailand, Hongkong and Philippines.

Subfamily: Omphalotropinae

Family: Omphalotropeae

Genus: *Omphalotropis* PFEIFFER, 1851

Subgenus: *Omphalotropis* s. str. (= *Eurytropis* KOBELT & MÖLLENDORF, 1898)

13) *Omphalotropis (Omphalotropis) globosa* (BENSON, 1852)

Lit.: 1852 *Cyclostoma globosum* (BENSON, in PFEIFFER, Proc. zool. Soc. London, 1852: 151) — 1852 *Omphalotropis globosa* (PFEIFFER, Proc. zool. Soc. London, 1852: 151) — 1852 *Omphalotropis globosa* (PFEIFFER, Conspectus: 49) — 1852 *Realia globosa* (GRAY, Cat. phaneropneumona or terr. operc. Moll. Coll. Brit. Mus.: 222) — 1852 *Cyclostoma globosum* (PFEIFFER, Monogr. pneumopomorum vivent, 1: 311) — 1853 *Cyclostoma globosum* (PFEIFFER, in M. & CH., Conch. Cab.: 296; Pl. 39, Fig. 14–16) — 1858 *Hydrocena globosa* (PFEIFFER, Monogr. Pneumopomorum vivent, 2: 164) — 1869 *Omphalotropis globosa* (PEASE, J. de Conch., 17: 141) — 1877 *Omphalotropis globosa* (LIENARD, Cat. Moll. Ile Maurice: 60) — 1878 *Omphalotropis globosa* (NEVILL, Handlist Moll. Ind. Mus. Calcutta, 1: 319) — 1880 *Omphalotropis globosa* (MARTENS, Moll., in MÖBIUS: Beitr. z. Meeresfauna d. Ins. Mauritius: 188) — 1898 *Omphalotropis globosa* (MARTENS, Mitt. zool. Samml. Mus. Naturkde. Berlin, 1 (1): 5) — 1898 *Omphalotropis (Eurytropis) globosa* (KOBELT & MÖLLENDORF, Nachrichtsbl. deutsch. malakozool. Ges., 1898: 149) — 1910 *Omphalotropis globosa* (KOBELT, Abh. senck. nat. Ges., 32: 94) — 1921 *Omphalotropis (Eurytropis) globosa* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 285) — 1927 *Omphalotropis*-Arten (THIELE, Zool. Jb. (Syst.), 53: 121) — 1956 *Omphalotropis*-Arten (BENTHEM-JUTTING, Treubia, 23 (2): 363; Fig. 56).

Locality: Mas: Mau: No. 2 (1 specimen).

Shell: Globose-conical; six whorls, separated by a distinct suture; last whorl broad globose, umbilicus open and with a weak spiral ridge; brown-reddish with whitish, cloud-like spots in vertical bands; aperture suboblique oval, white-yellowish (Pl. 5, Fig. 30).

Sizes (in mm):

Locality	Shell		Aperture	
	Height	Diameter	Height	Diameter
Mas: Mau: No. 2	5.5	3.5	2.5	2

Only one specimen was found.

Operculum: Size: 2.5 mm × 2 mm, thin-horny; paucispiral, nucleus excentrical, delicate, wave-like growth striae.

Anatomical remarks: Proboscis of the species of the genus *Omphalotropis* overlyed by a fold or "cape", like figured by ABBOT (1948) and cited by BENTHEM-JUTTING (1956). Radula: descriptions of radulae from species of *Omphalotropis* has given THIELE (1927). The radula of the *O. globosa*, recolte at Mauritius, very similar: central-tooth two times higher than broad with 4+1+4 denticles on the cutting edge, lateral with the formula 2+1+2 (3), inner marginal with 8, outer marginal broad, fan-like with about 35 bicuspid denticles (Fig. 30); Central nervous-system: thick oval cerebral-ganglia connected by a short commissure, dorsally rises the N. opticus, N. tentacularis and forward the cerebro-buccal-connective and two labial nerves; left pleural-ganglion with a distinct connective to the supaintestinalganglion; the right pleural-ganglion connected with the subintestinal-ganglion and a longer con-

nective to the suprainstestinal-ganglion; short but distinct connectives from the pleural- and cerebral-ganglia to the pedal-ganglia; statocysts with one statolith (Fig. 31). Male copulatory organ: penis arises on the neck with a broad, flattened base and with a long-furrow on the outside; the proximal end is short and finger-shaped (Fig. 29).

Ecological-biological remarks: The species of *Omphalotropis* are normally living outside of water. The occurrence in waterbiotopes is only

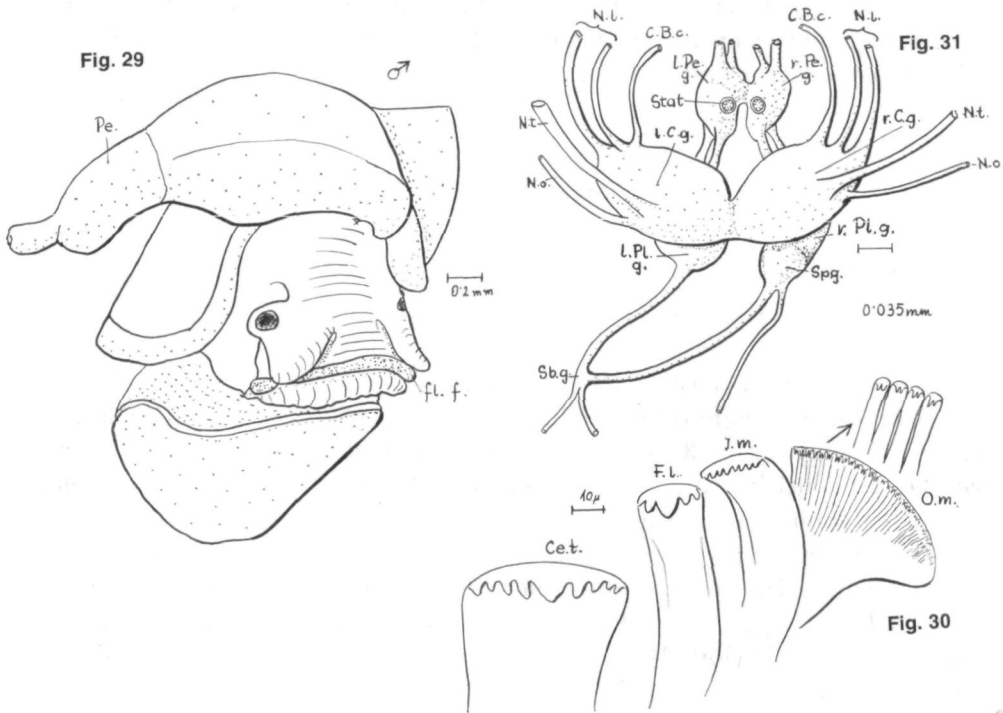


Fig. 29. *Omphalotropis globosa*: Head and penis

Fig. 30. *Omphalotropis globosa*: Radula-teeth

Fig. 31. *Omphalotropis globosa*: Central nervous-system

accidental, if specimens are living on plants etc. near the borders of running waters.

Geographical range: Genus with Indopacific range. *O. globosa* is recorded from Mauritius and Seychelles (Mahé).

14) *Omphalotropis* (*Omphalotropis*) *picturata* (ADAMS, 1867)

Lit.: 1867 *Omphalotropis picturata* (ADAMS, Proc. zool. Soc. London, 1867: 306; Pl. 19, Fig. 13) — 1870 *Omphalotropus picturata* (NEVILL, J. asiat. Soc. Bengal. 39 (2): 416) — 1877 *Omphalotropis picturata* ? (LIÉNARD, Cat. Moll. Maurice: 60) — 1878 *Omphalotropis picturata* (NEVILL, Handlist Moll. Ind. Mus. Calcutta, 1: 320) — 1880 *Omphalotropis picturata* (MARTENS, Moll., in MÖBIUS, Beitr. Meeresf. d. Ins. Mauritius: 188) —

1898 *Omphalotropis (Eurytropis) picturata* (KOBELT & MÖLLENDORF, Nachrichtsbl. deutsch. malakozool. Ges., 32: 94, 95) — 1921 *Omphalotropis (Eurytropis) picturata* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 284).

Locality: Mas: Ré: No. 3 (3 ind.).

Shell: According to GERMAIN (1921) very closely related to *O. variegata* (MORELET, 1866), and perhaps only a variety of these species. But *O. picturata* has only six whorls (*variegata*: seven whorls) and the size is smaller than in *variegata*; there are no spiral ridges, but very fine, dense growth-striae; reddish with broad irregularly broad zigzag-lines, withish spots without distinct borders; umbilicus open and surrounded by a white, not very prominent spiral ridge; aperture suboblique, oval (Pl. 5; Fig. 31).

Sizes (in mm):

Locality	Shell		Aperture	
	Height	Diameter	Height	Diameter
Mas: Ré: No. 3	4.2	3	2	1.5

The measurement is from the largest specimen in the sample.

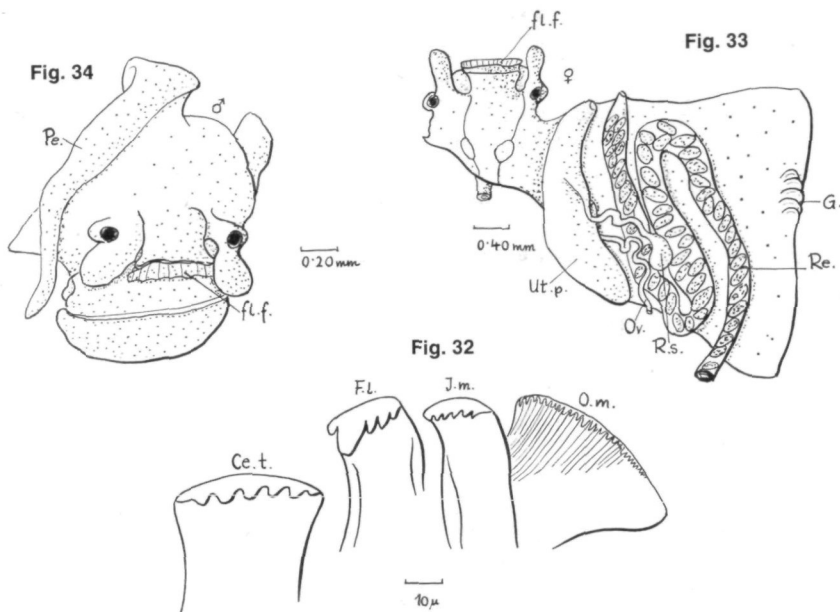
Operculum: Typical for the subgenus.

Anatomical remarks: Radula: central-tooth with six cusps; lateral with the formula 1+1+3; inner marginal with 6 and the broad outer marginal with 20—23 denticles (Fig. 32). Female reproductive system: slender, coiled oviduct enters in a broad sac-like uterine part, with the opening on the mantle edge; in the first third of the uterine-sac enters the duct of the receptaculum seminis, lying between the oviduct and the lower part of the rectum, which is full with densely packed, ovoid faeces (Fig. 33); Male reproductive organs: long, finger-shaped penis (Fig. 34). On the inner side of the mantle are five small folds as remainder of a gill (Fig. 33).

Ecological-biological remarks: As indicated by *O. globosa* the species of this genus are predominantly terrestrial and arboreal, but specimens, living near the borders of running waters are also to be found sometimes under water in the regions near the border. The three found specimens of *O. picturata* were crawling on stones along the border of a typical mountain torrent. The occurrence of some gill-folds shows also, the species must be able to respire under water. The specimens were found sporadically by a surface-current of 10—30 cm/sec.

Temperature	Chemistry		
	pH	conductivity	total hardness
18° C	7.85	62 μ S	1.25° dH

Geographical range: Mascarene Archipelago (La Réunion, Mauritius).

Fig. 32: *Omphalotropis picturata*: Radula-teethFig. 33. *Omphalotropis picturata*: Mantle cavity opened, to show the lower parts of the female genital-system and the rectumFig. 34. *Omphalotropis picturata*: Head and penis

15) *Omphalotropis* (*Omphalotropis*) *rangi* (FÉRUSAC, 1827) POTIEZ & MICHAUD, 1838)

Lit.: 1827 *Cyclostoma rangii* (FÉRUSAC, Bull. univ. Sc. nat., 10: 409) — 1838 *Cyclostoma rangii* (POTIEZ & MICHAUD, Gal. Moll. DOUAI, 1: 240; Pl. 24, Fig. 18, 19) — 1868 *Omphalotropis borbonica* (ADAMS, Proc. zool. Soc. London, 1868: 292; Pl. 28, Fig. 14) — 1870 *Omphalotropis borbonica* (NEVILL, J. asiat. Soc. Bengal, 29 (2): 415) — 1878 *Omphalotropis rangii* (NEVILL, Handlist Moll. Ind. Mus. Calcutta, 1: 320) — 1880 *Omphalotropis rangii* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresf. d. Ins. Mauritius: 189) — 1898 *Omphalotropis* (*Eurytropis*) *borbonica* (KOBELT & MÖLLENDORF, Nachrichtsbl. deutsch. malakozool. Ges., 1898: 151) — 1910 *Omphalotropis borbonicus* (KOBELT, Abh. senck. nat. Ges., 32: 95) — 1909 *Omphalotropis rangii* (KOBELT, ibid.: 95) — 1921 *Omphalotropis* (*Eurytropis*) *rangi* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 288; Pl. 6, Fig. 24; Pl. 6, Fig. 16).

Localities: Mas: Ro: No. 1 (1 ind.), No. 3 (1 ind.).

Shell: Oval-globular; spire conical with six whorls, the first five whorls slightly convex, the last whorl big, globular and with two spiral ridges below the suture and submedian; umbilicus, deep, funnel-shaped, surrounded by a withish spiral ridge; the first whorls with delicate, dense longitudinal striae, the last whorl with rows of dotted lines and distinct growth-striae; the first whorls red-brownish, last whorl below the suture yellowish, downwards to the submedian spiral-ridge light-brownish with yellowish, cloud-like or zigzag-like spots, below the spiral ridge dark brownish; aperture oval, border of the columella slightly reflected (Pl. 5, Fig. 32).

Sizes (in mm):

Localities	Shell		Aperture	
	Height	Diameter	Height	Diameter
Mas: Ro: No. 1	5.6	3.4	2.7	1.6
No. 3	5.8	3.5	2.8	1.7

The measurements are from the two found specimens.

Operculum: Typical for the subgenus. Anatomical remarks: No dissections were made.

Ecological-biological remarks: The specimens were found at the small island of Rodriguez by the Mission (1975) of the University of Lund (coll.: P. BRINCK & P. H. ENCKEL) in small streams in 250 m to 400 m altitude, SE of Port Mathurin. They were associated with *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana* and *Afrogyrus rodriguezensis*, but always sporadically. As in all species of the genus they are living mostly in humid terrestrial habitats, but according to RANG, in FÉRRUSAC (1827: 409): "surtout près des rivières".

Geographical range: Mascarene-Archipelago (La Réunion, Mauritius and — as the first record — Rodriguez).

Superfamily: Cerithiacea

Family: Thiariidae (= Melaniidae)

Subfamily: Paludominae

Tribe: Paludomeae

Genus: *Cleopatra* TROSCHEL, 1856

Subgenus: *Zanguebarica* FISCHER, 1881

16) *Cleopatra (Zanguebarica) ajanensis* (MORELET, 1860) f. *silhouettensis* (NEVILL, 1869)

Lit.: 1860 *Paludomus ajanensis* (MORELET, Sér. Conch., 2: 110; Pl. 6, Fig. 10) — 1869 *Paludomus ajanensis* var. *silhouettensis* (NEVILL, Proc. zool. Soc. London, 1869: 66) — 1870 *Philopotamis ajanensis* (BROT, Car. rec. species fam. Melaniidae: Amer. J. Conch., 6, app: 271) — 1880 *Paludomus baccula* (BROT, in M. & CH., Conch. Cab. (I), 25: 47 (= *baccula* REEVE, 1852 = *ajanensis* MORELET, 1860); Pl. 8, Fig. 4, 4a, 5, 6) — *Philopotamis ajanensis* and *Philopotamis* sp. (of NEVILL from Silhouette-island) (MARTENS, Moll. in MÖBIUS: Beitr. z. Meeresfauna d. Ins. Mauritius: 34) — 1921 *Paludomus ajanensis* v. *silhouettensis* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 435) — 1962 *Cleopatra ajanensis* (BARNACLE, J. Seych. Soc., 2: 57).

Locality: Sey: S: No. 1 (2 empty shells).

Shell: Ovoid-conical; our two shells from the collection G. LIONNET (Mahé) are with eroded apex and only three convex whorls with a distinct suture; dense spiral-striae, crossed by the growth striae and nodules on the crossing points; umbilicus closed; dark brownish, partly with a black coating and remainder of algal growth on the surface; aperture ovoid, on the top

pointed, below rounded, and slightly extended, distinct parietal callus (Pl. 6; Fig. 33a, b).

Sizes (in mm):

Locality	Height	Shell	Height	Aperture
		Diameter		Diameter
Sey: S: No. 1 (eroded)	9.5	6	5.3	4
(eroded)	9	5.7	5	3.6

The measurements are from the two empty shells of the collection.

Operculum: According to BROTH (1880): corneous, solid dark-reddish, outer border rounded; nucleus lateral (our specimens without operculum).

Anatomical remarks: Only empty shells; anatomical details from the species of *Cleopatra* from Madagascar are given by STARMÜHLNER (1969: 184).

Ecological-biological remarks: According to the collector Mr. G. LIONNET (Mahé), found in a torrent of the island of Silhouette, the River Maccabe, N of Grande Barbe.

Geographical range: *Cleopatra ajanensis* was first described from brackish waters of Raz Hofoun, near Cape Guardafui (NE-Somalia). The f. *silhouettensis* is known from Silhouette-island of the Seychelles Archipelago. Records from CUMING from Mahé are doubtful. *Paludomus baccula* was described by REEVE, but the locality, River Ganges in India, is according to BROTH (1880) very doubtful. But the described shell and the figure of REEVE from *baccula* is identical with *P. ajanensis*. The *Paludomus baccula* from River Ganges, figured by HANLEY & THEOBALD (1876) is quite another species than *P. baccula* of REEVE: the shell is much larger and also different in shape. Following the opinion of BARNACLE (1962) and our determination, the var. *silhouettensis* is a form of the East-African *Cleopatra ajanensis*. The genus *Cleopatra* is recorded in different species from Africa and Madagascar. The related genus *Paludomus* occurs in Ceylon, South-India and SE-Asia in three subgenera and several species.

Subfamily: Thiarinae

Tribe: Thiareae

Genus: *Thiara* BOLTON (RÖDING), 1798

Subgenus: *Plotia* (BOLTON) RÖDING, 1798

17) *Thiara* (*Plotia*) *scabra* (MÜLLER, 1774)

Lit.: 1774 *Buccinum scabrum* (MÜLLER, Hist. Verm., 2: 136) — 1779 *Buccinum scabrum* (SCHRÖTER, Gesch. d. Flußconch.: 299; Pl. 6, Fig. 13) — 1786 *Helix scabra* (CHEMNITZ, Conch. Cab., 9: 188; Pl. 136, Fig. 1259) — 1789 *Helix aspera* (GMELIN, Syst. Nat., éd. 13: 3656) — 1792 *Bulimus scaber* (BRUGIÈRE, Enc. Méth., vers, I: 350) — 1807 *Melania scabra* (FÉRUSAC, Essai méth. Conch.: 73 (non REEVE) — 1822 *Melania spinulosa* (LAMARCK, Hist. nat. anim. s. vert., 6 (2): 166) — 1829 *Melania mauriciae*

(LESSON, Voy. Coqu., Zool. 2: 358) — 1829 *Melania doreyana* (LESSON, *ibid.*: 358) — 1829 *Melania spinescens* (LESSON, *ibid.*: 363) — 1838 *Melania spinulosa* (LAMARCK, *Hist. nat. anim. s. vert.*, éd. 2 (DESHAYES), 8: 433) — 1838 *Melania scabra* (LAMARCK, *ibid.*: 443) — 1841 *Melania spinulosa* (DELESSERT, *Rec. Coqu., décr. LAMARCK: Pl. 30; Fig. 15*) — 1842 *Melanium granum* (BUSCH, in PHILIPPI, *Abb. & Beschr.*, 1, *Melania*, 4: Pl. 1; Fig. 7) — 1844 *Melania pugilis* (HINDS, *Ann. Mag. Nat. Hist.*, 14: 10 and Sulphur, 1844: 58) — 1847 *Melania scabrella* (PHILIPPI, *Abb. & Beschr.*, 1, *Melania*, 4: Pl. 4; Fig. 13) — 1849 *Melania spinulosa* (MOUSSON, *Land- & Süßw. Moll. Java*: 76; Pl. 11, Fig. 11, 12) — 1850 *Melania acanthica* (LEA, *Proc. zool. Soc. London*, 1850: 194) *Melania cochlea* (LEA, *ibid.*: 196) — 1850 *Melania denticulata* (LEA, *ibid.*: 194) — 1850 *Melania pagoda* (LEA, *ibid.*: 197) — 1855 *Plotia spinulosa* (ADAMS, *Gen. rec. Moll.*) — 1858 *Melania datura* (DOHRN, *Proc. zool. Soc. London*, 1858: 135) — 1859 *Melania elegans* (REEVE, *Conch. Icon.*: Pl. 26; Fig. 178) — 1860 *Melania pagoda* (REEVE, *ibid.*: Pl. 26; Fig. 182) — 1860 *Melania scabra* (REEVE, *ibid.*: Pl. 26; Fig. 183) — 1860 *Melania granum* (REEVE, *ibid.*: Pl. 33, Fig. 219) — 1860 *Melania rugosa* (BROT, *Rev. & Mag. Zool.*, 1860: 257) — 1860 *Melania myurus* (BROT, *ibid.*: 257; Pl. 27; Fig. 14, 15) — 1868 *Melania spinulosa* (BROT, *Matér. Mel.*, 2: 38; Pl. 2, Fig. 6; Pl. 3, Fig. 8) — 1872 *Melania spinulosa* (BROT, *ibid.*, 3: 19; Pl. 1, Fig. 15) — 1874 *Melania scabra* (BROT, in M. & CH., *Conch. Cab.*, 1 (24): 266; Pl. 27, Fig. 14, 15) — 1874 *Melania granum* (BROT, *ibid.*: 270; Pl. 27, Fig. 12) — 1874 *Melania myurus* (BROT, *ibid.*: 271; Pl. 28, Fig. 1) — 1874 *Melania acanthica* (BROT, *ibid.*: 278; Pl. 28, Fig. 10) — 1874 *Melania spinulosa* (CROSSE, *J. de Conch.*, 22: 240) — 1875 *Melania scabra* (MORELET, *ibid.*, 23: 29) — 1876 *Melania scabra* (HANLEY & THEOBALD, *Conch. Ind.*: XVI and 31; Pl. 73, Fig. 1–4) — 1877 *Melania spinulosa* (LIÉNARD, *Cat. Moll. Ile Maurice*: 44) — 1880 *Melania snellemanni* (SCHEPMAN, *Midd. Sumatra Exp.*: 15; Pl. 1, Fig. 5; Pl. 3, Fig. 9) — 1880 *Melania scabra* (MARTENS, *Moll.*, in MÖBIUS: *Beitr. Meeresfauna d. Ins. Mauritius*: 211) — 1881 *Melania bockii* (BROT, *J. de Conch.*, 29: 157; Pl. 6, Fig. 3) — 1884 *Melania savinieri* (MORELET, *J. de Conch.*, 32: 330; Pl. 7, Fig. 2) — 1884 *Melania (Plotia) scabra* (NEVILL, *Handlist Moll. Ind. Mus. Calcutta*, 2: 281) — 1890 *Melania subcancellata* (BOETTGER, *Ber. senck. nat. Ges.*, 1890: 151; Pl. 6, Fig. 4) — 1897 *Melania pingucicola* (MARTENS, in WEBER, *Erg. zool. Reise Niederl. Ostind.*, 4: 74; Pl. 4, Fig. 17–20) — 1897 *Melania scabra* with the var. *spinulosa*, *nodosocostata*, *angulifera* and *mutica* (MARTENS, *ibid.*: 62; Pl. 4, Fig. 6–12; Pl. 9, Fig. 8, 9) — 1897 *Melania granum* (MARTENS, *ibid.*: 65) — 1897 *Melania savinieri* (MARTENS, *ibid.*: 315) — 1898 *Melania scabra* (MARTENS, *Besch. Weichthiere Deutsch-O.Afr.*: 196) — 1904 *Melania varia* (BULLEN, *Proc. mal. Soc. London*, 6: 110) — 1910 *Melania mauriciae* (KOBELT, *Abh. senck. nat. Ges.*, 32: 94) — 1910 *Melania scabra* (KOBELT, *ibid.*: 94, 96) — 1914 *Melania intrepida* (FULTON, *Proc. mal. Soc. London*, 11: 163) — 1915 *Thiara (Plotia) scabra* (PRESTON, *Moll. Fauna Brit. Ind.*: 35) — 1921 *Melania (Plotia) scabra* (GERMAIN, *Mém. Soc. Zool. France; suppl.* 1920: 366) — 1928 *Melania sykesi* (DEGNER, *Treubia*, 10: 377) — 1931 *Melania (Plotia) scabra* (THIELE, *Handb. syst. Weichtierkde.*: 200) — 1934 *Melania zollingeri* (RENSCH, *Trop. Binnengew.*, 5: 233 — non *zollingeri* BROT, 1868) — 1934 *Melania scabra* (RENSCH, *ibid.*: 234) — 1937 *Thiara (Plotia) scabra* (RIECH, *Arch. Naturgesch. (N. F.)*, 6: 42; Fig. 1–5; 49) — 1938 *Thiara (Plotia) scabra* (WENZ, *Handb. Paläozool., Gastr.*, 1: 713; Fig. 2058) — 1948 *Thiara (Plotiopsis) scabra* (ABBOTT, *Bull. Mus. comp. Zoöl., Havard*, 100 (3): 191; Pl. 3, Fig. 12) — 1956 *Thiara scabra* (BENTHEM-JUTTING, *Treubia*, 23 (2): 393; Fig. 72, 88) — 1963 *Thiara scabra scabra* (BENTHEM-JUTTING, *Nova Guinea, Zool.*, 20: 466) — 1963 *Thiara scabra acanthica* (BENTHEM-JUTTING, *ibid.*: 467) — 1974 *Thiara (Plotia) scabra* (STARMÜHLNER, *Bull. Fish. Res. Stn. Sri Lanka*, 25 (1/2): 156; Fig. 147–149; Pl. 15, Fig. 146) — 1976 *Thiara scabra* (STARMÜHLNER, *Ann. Naturhist. Mus. Wien*, 80: 565; Fig. 70, 71; Pl. 15, Fig. 170–172).

Localities: Mas: Ré: No. 4 (42 ind.), No. 8 (257 & many iuv.), No. 9 (1 ind.), No. 11 (1 iuv.), No. 13 (5 ind.), No. 16 (94 ind.), No. 17 (89 ind.),

No. 19 (9 ind.), No. 21 (145 ind.), No. 23 (4 ind.); Mau: No. 1 (3 ind.), No. 3 (4 ind.), No. 5 (72 ind.), No. 6 (72, mostly iuv.), No. 7 (20, mostly iuv.), No. 8 (2 ind.), No. 9 (90 ind.), No. 10 (50 ind.), No. 11 (137 ind.), No. 12 (30 ind.), No. 13 (103 ind.), No. 14 (226 ind.), No. 15 (47 ind.), No. 16 (223 ind.), No. 17 (9 ind.), No. 18 (4 ind.), No. 19 (24 ind.), No. 20 (77 ind.), No. 21 (210 ind.), No. 22 (10 ind.), No. 23 (11 ind.), No. 25 (16 ind.); Ro: No. 1 (15 ind.), No. 3 (9 ind.), No. 4 (9 ind.).

Shell: The extremely variability of the shell of these species is expressed in the large number of synonyms in the literature. Elevated conical, with a high spire and a large, last whorl; surface of the whorls roughly striated in spiral direction, below the periphery, especially in the region of the umbilicus, the spiral striae form stronger ridges; the spiral striation is crossed by ribs in vertical direction; ab about the third of the distance between the suture and the periphery, the axial ribs form — more or less — prominent spines, pointing obliquely outward; these spines are of various strengths in different shells, varying between blunt knobs and sharp prickly needles, especially on young, immature shells; fresh shells are somewhat transparent and shining, the surface is eroded or coated by encrustations; 8—12 whorls, descending step-like, with distinct suture; periphery rounded below the spines; umbilicus closed; apex often eroded; yellowish-brownish to olive-brownish, with irregular reddish-brownish spots and flames, 2—3 spiral bands, but often absent; aperture almost oval, pointed above, rounded below; peristome not continuous, but connected by a white callus; basal margin somewhat channeled (Pl. 6; Fig. 34a, b, 35a, b, 36).

Sizes (in mm):

Localities	Shell		Aperture		Spines-Length
	Height	Diameter	Height	Diameter	
Mas: Ré: No. 4	17.6	7.9	7.5	4.5	knobs
No. 8	21.4	11	12	7	1.5
No. 9	13.3	6.6	5.5	3	0.5
No. 13 (iuv.)	9	4.5	4.3	4.3	0.5
No. 16 (eroded)	24.3	11.8	12.4	6.5	1—2
No. 17 (eroded)	19.5	9	9.3	5.4	1
No. 19 (eroded)	22.6	12.7	13	6.8	knobs
	20.6	10.9	10.6	6.7	knobs
	20.6	9.8	9.7	5.2	knobs
No. 23	16.2	7.8	7.7	4.5	knobs
No. 24 (eroded)	22.5	10.5	10.5	7	2
	21.2	10	10	6.5	2
	21	10.5	10.9	6.9	2
Mau: No. 1 (eroded)	16	8	7.2	4.4	knobs
No. 3 (eroded)	16.6	8.4	8	5	0.5—1
No. 5	19	9.5	9.3	6	knobs
No. 6	12.2	6.6	6.5	4	knobs
No. 7 (eroded)	10	5.8	5.2	3	knobs

Localities	Shell		Aperture		Spines-Length
	Height	Diameter	Height	Diameter	
No. 8 (eroded)	10.5	6	5.2	3.7	knobs
No. 9 (eroded)	11	6.5	5.3	3.5	knobs-1
No. 10 (eroded)	10.6	6.2	5.5	3	knobs
No. 11	23.8	11.4	11	8	1
No. 12	20	10.5	10	5.6	knobs
No. 13 (eroded)	19.6	9.4	9	5.4	knobs
No. 14 (eroded)	12.3	7.3	7.4	4.4	knobs
No. 15 (eroded)	15	8	7.7	4.5	knobs
No. 16 (eroded)	14.2	7.7	6.8	4	knobs
No. 17 (eroded)	9.4	5.5	5.1	2.8	0.3—0.4
No. 18 (eroded)	10	5.8	5	2.9	1
No. 19	17.5	8.2	7.5	5	1—1.5
No. 20 (eroded)	15.2	8	7.3	3.8	1
No. 21	21.8	10	9.7	7.6	2—3
No. 22 (eroded)	21.3	10.2	10	6.6	2
No. 23 (eroded)	22.2	10.5	10	6.8	2
No. 25	11.3	6.5	6.4	3.6	knobs
Ro: No. 1	9.3	5.1	4.3	2.5	knobs
No. 3	10	5.8	5	3	knobs-1
No. 4	19.7	9.5	8.6	5.2	knobs
	18.3	9.7	9	5.8	knobs

The measurements are from the largest specimens in the samples.

Operculum: Descriptions and figures are given by STARMÜHLNER (1974; p: 158; Fig. 147) and STARMÜHLNER (1976; p: 567; Fig. 70): horny, oval, blackish-brownish, excentric nucleus.

Anatomical remarks: No differences to the detailed descriptions to be found in RIECH (1937; p. 41—45; Fig. 1—5) and STARMÜHLNER (1974; 1976).

Ecological-biological remarks: Very frequent on the borders of running waters in low current and on sandy-muddy bottom with high content of organic matter; also in stillwaters with rich vegetation; sometimes they occur to the mouth-regions of streams with influence of brackish water (see STARMÜHLNER, 1976: 568). RIECH (1937) and STARMÜHLNER (1977) indicate that the spines are always distinctly developed in population of stillwater-biotopes, but also in localities with influence of brackish water. In populations from running waters with stronger current, the spines are well developed only in juvenile specimens; on the shells of older individues they are mostly knob-like and eroded till the base.

	Temperatures		Chemistry		
		pH	conductivity	total hardness	
La Réunion	21.3° C—26.6° C	7.4—8.6	52—250 (1600 μ S)	1°—5.2° (10.7° dH)	
Mauritius	19.4° C—25.7° C	7 —8.2	69—200 μ S	1°—4.25° dH	
Range	19.4° C—26.6° C	7 —8.6	52—250 (1600) μ S	1°—5.2° (10.7)° dH	

These data correspond with the statements, given by STARMÜHLNER (1974) for the occurrence of *Thiara scabra* in the streams of Ceylon and by STARMÜHLNER (1976) for rivers on Pacific islands. It is remarkable that the species was found in Réunion also in slightly brackish water (cond.: 1600 μ S, total hardness: 10.7° dH). The species was found mostly in a surface-current of 10–30 cm/sec, but also in stillwater without current. The frequency in the running waters of Réunion near the banks was between 5 and 30, sometimes to 50 (mostly juvenile) individuals/1/16 m². In the pond of N. 24, rich on submerged vegetation and organic debris, the density reaches on the muddy bottom 40–60 individuals/1/16 m²!

In the slow-running streams of Mauritius, in the middle and lower courses of the coastal plains, surrounded by plantations (fertilizer), and — in consequence — is found a rich growth on submerged waterplants, algae and organic material in the creeks. The density of the snails in these rivers was very high with 30–60, sometimes to more than 100 individuals/1/16 m² in a surface-current between 0–20 cm/sec. In rivers the species occurs up to a maximum surface-current of 30–50 cm/sec, but in such regions the density goes down to 1 ind./1/16 m².

Thiara scabra was associated with *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*, in one locality also with the introduced *Planorbella* (= *Helisoma*) *duryi* and a *Ferrissia (Pettancylus)* sp. In some localities of Mauritius also with *Gyraulus mauritianus* and *Bellamya bengalensis* f. *zonata*.

Geographical range: On the coasts of the Indopacific from the E-coast of Africa, Madagascar, Mascarenes, Ceylon over SE-Asia, Malay Archipelago, Philippines, Palau, Moluccas and New Guinea to the Bismarck-Archipelago. Solomon-, New Hebrides- and Fiji-Islands, New Caledonia, E-Australia and Samoa.

Genus: *Melanoides* OLIVIER, 1804

Subgenus: *Melanoides* s. str.

18) *Melanoides (Melanoides) tuberculata* (O. F. MÜLLER, 1774)

Lit.: 1774 *Nerita tuberculata* (MÜLLER, Hist. Verm., 2: 191) — 1779 *Strombus costatus* (SCHROETER, Flußconch., 373; Pl. 8, Fig. 14) — 1804 *Melanoides fasciolata* (OLIVIER, Voy. Emp. Ottom., 6: Pl. 31, Fig. 7) — 1822 *Melania truncatula* (LAMARCK, Hist. anim. s. vert., 6 (2): 167) — 1827 *Paludina (Melania) virgulata* (FÉRUSSAC, Bull. univ. Sc. nat., 10: 411) — 1831 *Melania terebra* (LESSON, Voy. Coqu., 2: 345) — 1834 *Melania virgula* (QUOY & GAIMARD, Voy. Astrolabe, Zool., 3: 141; Pl. 56, Fig. 1–4) — 1836 *Melania pyramis* (BENSON, J. asiat. Soc. Bengal, 5: 345) — 1837 *Melania adspersa* (TROSCHEL, Arch. Naturgesch., 1837: 175) — 1838 *Melania punctata* (POTIEZ & MICHAUD, Gal. Moll. Mus. DOUET, 1: 262; Pl. 27, Fig. 15, 16) — 1843 *Melania truncatula* (SGANZIN, Mém. Soc. hist. nat. Strasbourg, 3: 19) — 1847 *Melania pyramis* (BUSCH, in PHILIPPI, Abb. Besch.: 172; Pl. 4, Fig. 16) — 1847 *Melania suturalis* (PHILIPPI, ibid.: 173; Pl. 4, Fig. 6) — 1847 *Melania rivularis* (PHILIPPI, ibid.: 174; Pl. 4, Fig. 17) — 1848 *Melania unifasciata* (MOUSSON, Mitth. naturf. Ges. Zürich, 1: 269) — 1849 *Melania coarctata* (MOUSSON, Land- u. Süßw. Moll. Java: 67) — 1849 *Melania unifasciata* (MOUSSON, ibid.:

70; Pl. 11, Fig. 8) — 1849 *Melania inhonesta* (MOUSSON, *ibid.*: 71) — 1849 *Melania cylindracea* (MOUSSON, *ibid.*: 72; Pl. 11, Fig. 6, 7) — 1849 *Melania tuberculata* (incl. f. *virgulata* and f. *plicifera*) (MOUSSON, *ibid.*: 73; Pl. 11, Fig. 9) — 1850 *Melania juncea* (LEA, *Proc. zool. Soc. London*, 1850: 189) — 1850 *Melania turriculus* (LEA, *ibid.*: 190) — 1850 *Melania tigrina* (HUTTON, *J. asiat. Soc. Bengla*, 19: 658) — 1852 *Melania fasciolata* (RAYMOND, *J. de Conch.*, 3: 325) — 1853 *Melania fasciolata* (RAYMOND, *ibid.*, 4: 33) — 1855 *Melania judaica* (MOUSSON, *Malak. Bl.*, 2: 53; Pl. 2, Fig. 1–3) — 1858 *Melania layardi* (DOHRN, *Proc. zool. Soc. London*, 1858: 135) — 1859 *Melania coarctata* (REEVE, *Conch. Icon.*, 12: Pl. 5; Fig. 22; further: *Melania exusta*: Pl. 12; Fig. 74; *Melania tuberculata*: Pl. 13; Fig. 87 and Pl. 16; Fig. 110; *Melania punctulata*: Pl. 15; Fig. 100; *Melania crepidinata*: Pl. 17; Fig. 120; *Melania ornata*: Pl. 21; Fig. 146; *Melania inhonesta*: Pl. 33; Fig. 226; *Melania commersoni*: Pl. 35; Fig. 237) — 1860 *Melania tuberculata* (MORELET, *Ser. Conch.*, 2: 111) — 1860 *Melania obscura* (BROT, *Rev. Mag. Zool.*, 1860: Pl. 17; Fig. 9) — 1860 *Melania beryllina* (BROT, *ibid.*: 8; Pl. 17, Fig. 8) — 1861 *Melania rothiana* (MOUSSON, *Coqu. terr. fluv. ROTH, Palästine*: 61) — 1863 *Melania tuberculata* (DESHAYES, *Cat. Moll. Réunion p.E.*: 81) — 1864 *Melania matheroni* (GASSIES, *Faune Conch. Nouv. Calédonie*, 1: 96; Pl. 4, Fig. 5; further: *Melania lancea*: 97; *Melania mageni*: 95; Pl. 6, Fig. 10; *Melania canalis*: 98; Pl. 6, Fig. 2; *Melania montrouzieri*: Pl. 5; Fig. 10) — 1864 *Melania psorica* (MORELET, *J. de Conch.*, 12: 287) — 1865 *Melania rubropunctata* (TRISTRAM, *Proc. zool. Soc. London*, 33: 541) — 1870 *Melania javanica* (BROT, *Amer. J. Conch.*, 6: No. 200) — 1871 *Melania mariei* (GASSIES, *Faune Conch. Nouv. Calédonie*, 2: 159; Pl. 6, Fig. 15) — 1874 *Melania tuberculata* (JICKELI, *Fauna Land- u. Süßw. Moll. NO-Afrika*: 251; Pl. 3, Fig. 7 and Pl. 7, Fig. 36) — 1874 *Melania tuberculata* (BROT, in M. & CH., *Conch. Cab.*, 1 (24): 247; Pl. 26, Fig. 11; further: *Melania ornata*: 173; Pl. 21, Fig. 23; *Melania distinguenda*: 190; Pl. 21, Fig. 8; *Melania inhonesta*: 206; Pl. 23, Fig. 8; *Melania matheroni*: 211; Pl. 23, Fig. 8; *Melania denisoniensis*: 234; Pl. 25, Fig. 6, 6A; *Melania crepidinata*: 238; Pl. 25, Fig. 13; *Melania commersoni*: Pl. 244; Pl. 26, Fig. 1, 1a, 6; *Melania javanica*: 246; Pl. 26, Fig. 7; *Melania cylindracea*: 252; Pl. 27, Fig. 7; *Melania malayana*: 253; Pl. 26, Fig. 5; *Melania pareyssi*: 254; Pl. 27, Fig. 5; *Melania unifasciata*: 262; Pl. 27, Fig. 7; *Melania psorica*: 316; Pl. 33, Fig. 4, 4a) — 1876 *Melania rodericensis* (SMITH, *Ann. Mag. Nat. Hist.*, 17: 404) — 1877 *Melania tuberculata* (LIENARD, *Cat. Moll. Ile Maurice*: 44; 82) — 1877 *Melania virgulata* (LIENARD, *ibid.*: 44) — 1877 *Melania singularis* (TAPPARONE-CANEFRI, *Ann. Mus. Civ. Stor. Nat. Genova*, 9: 30; Pl. 1, Fig. 18) — 1880 *Melania tuberculata* (MARTENS, in MÖBIUS: *Beitr. Meeresf. d. Ins. Mauritius*: 211) — 1880 *Melania wilkinsoni* and *M. scalariformis* (TENNISON WOODS, *Proc. Linn. Soc. N. S. Wales*, 4: 25; Pl. 4, Fig. 4) — 1883 *Melania pellicens* (TAPPARONE-CANEFRI, *Ann. Mus. Civ. Stor. Nat. Genova*, 19: 30; Pl. 1, Fig. 18; further: *Melania dominula*: 31; Pl. 1, Fig. 16; *Melania petiti*: 37 — non PHILIPPI; *Melania nicobarica*: 38) — 1884 *Melania (Striatella) tuberculata* (NEVILL, *Handlist Moll. Ind. Mus. Calcutta*, 2: 239) — 1898 *Melania tuberculata* (MARTENS, *Beschr. Weicht. D. O. Afrika*, 193) — 1908 *Melania tuberculata* (DAUTZENBERG, *J. de Conch.* 56: 23; Pl. 2, Fig. 4, 5) — 1910 *Melania tuberculata* (KOBELT, *Abh. senck. nat. Ges.*, 32: 39; 94–96; Pl. 10, Fig. 5, 6) — 1912 *Melania tuberculata* (CONNOLLY, *Ann. S. Afr. Mus.*, 11 (3): 264) — 1914 *Melania (Striatella) tuberculata* (DAUTZENBERG & GERMAIN, *Rev. zool. afr.*, 4 (1): 62; Pl. 3, Fig. 3–8; var. *anomala*: Pl. 4, Fig. 7–10) — 1915 *Tiara (Striatella) tuberculata* (PRESTON, *Fauna Br. India, Moll.*: 15) — 1919 *Melania woodwardi* (MARTIN, *Samml. Geol. Reichsmus. Leiden*: 96) — 1921 *Melania (Melanoides) tuberculata* (GERMAIN, *Mém. Soc. Zool. France*, suppl. 1920: 368) — 1934 *Melania tuberculata truncatula* (RENSCH, *Zool. Jb. (Syst.)*, 65: 400; Fig. 2a–e) — 1934 *Melania tuberculata truncatula* (RENSCH, *Trop. Binnengew.*, 5: 228) — 1937 *Melania tuberculata truncatula* (RIECH, *Arch. Naturgesch. (N. F.)*, 6: 55) — 1938 *Melanoides (Melanoides) tuberculata* (WENZ, *Handb. Paläozool., Gastr.*, 1: 715; Fig. 2065) — 1948 *Thiara (Melanoides) tuberculata* (ABBOTT, *Bull. Mus. comp. Zoöl., Havard*, 100 (3): 289; Pl. 3, Fig. 13) — 1950 *Melanoides ningpoensis* (SUVATTI, *Fauna Thailand*:

61) — 1956 *Melanoides tuberculata* (BENTHEM-JUTTING, Treubia. 23 (2): 412; Fig. 69, 73, 91) — 1956 *Melania tuberculata tuberculata* (FRANC, Mém. Mus. Nat. Hist. Nat. Paris, Sér. A, Zool., 13: 56; Pl. 6, Fig. 7) — 1957 *Melanoides tuberculata* (STARMÜHLNER & EDLAUER, S. B. Öst. Akad. Wiss. (Math.-Nat. Kl.), 166: 452; Pl. 2, Fig. K; Pl. 3, Fig. 13) — 1962 *Thiara tuberculata* (BARNACLE, J. Seych. Soc., 2: 56) — 1963 *Melanoides tuberculatus* (BENTHEM-JUTTING, Nova Guinea, Zool. 20: 473) — 1969 *Melanoides* (*Melanoides*) *tuberculatus* (STARMÜHLNER, Malacologia, 8 (1/2): 224; Fig. 269–320) — 1970 *Melanoides tuberculatus* (STARMÜHLNER, Cah. ORSTOM, sér. Hydrobiol., 4 (3/4): 89; Fig. 129–132) — 1974 *Melanoides tuberculata* (BRANDT, Arch. Moll., 105 (1/4): 164; Pl. 12, Fig. 9–12) — 1974 *Melanoides* (*Melanoides*) *tuberculata* (STARMÜHLNER, Bull. Fish. Res. Stn. Sri Lanka, 25 (1/2): 159; Pl. 15, Fig. 150–153) — 1976 *Melanoides* (*Melanoides*) *tuberculata* (STARMÜHLNER, Ann. Naturhist. Mus. Wien, 80: 591; Pl. 17, Fig. 206).

Localities: Sey: M: No. 5 (25 ind.), No. 8 (153 ind.); Co: A: No. 3 (1 ind.), No. 5 (8 ind.); Mas: Ré: No. 8 (1 ind.), No. 17 (3 ind.), No. 24 (3 ind.); Mau: No. 1 (7 ind.), No. 2 (3 ind.), No. 3 (31 ind.), No. 4 (97 ind.), No. 5 (19 ind.), No. 6 (27 ind.), No. 7 (17 ind.), No. 8 (35 ind.), No. 9 (2 ind.), No. 10 (1 ind.), No. 11 (12 ind.), No. 12 (47 ind.), No. 13 (9 ind.), No. 14 (35 ind.), No. 15 (29 ind.), No. 16 (9 ind.), No. 17 (105 ind.), No. 18 (28 ind.), No. 19 (9 ind.), No. 20 (5 ind.), No. 23 (3 ind.), No. 25 (40 ind.); Ro: No. 1 (24 ind.), No. 3 (9 ind.).

Shell: Descriptions of the extremely variable shell of these species are given by BROTH (1874); GERMAIN (1921); RENSCH (1934); BENTHEM-JUTTING (1956); FRANC (1956); STARMÜHLNER (1957, 1970, 1974, 1976); BRANDT (1974) and many other authors: turreted with high spire and moderately large last whorl; 10–15 whorls, but the first often eroded; sometimes below the suture somewhat “shouldered”; whorls with spiral striae, well raised in the upper whorls, but mostly flattened on the later ones, crossed by vertical striae which can even be developed as coarse, sometimes undulating ribs; straw-yellow to olive with darker red-brown dots and flames, either irregularly distributed or arranged in vertical rows; umbilicus closed, sometimes bordered with a spiral band; aperture vertical-oval, pointed above, rounded below; peristome connected by a thin callus against the penultimate whorl (Pl. 6; Fig. 37, 38).

Sizes (in mm):

Localities	Shell		Aperture	
	Height	Diameter	Height	Diameter
Sey: M: No. 5 (eroded)	15.5	6.2	5.5	3.6
No. 8 (pigmy-population in brackish water)	8.3	4	2.5	1.5
	7.8	2.4	2	1
Co: A: No. 3 (eroded)	9.7	4.2	3.8	2.2
No. 5	12.5	4.7	4	2.5
Mas: Ré: No. 8 (iuv.)	9	4.2	3.8	1.8
No. 17 (iuv.)	6.5	2.8	1.3	0.9
No. 24 (eroded)	17.4	7	6.8	4

Localities		Shell		Aperture	
		Height	Diameter	Height	Diameter
Mau:	No. 1 (eroded)	23.8	10.3	10.3	5.8
	No. 2	19.6	7.8	7.5	4.1
	No. 3 (eroded)	20.8	8	7.5	4.7
		22	7.8	7.5	4.4
		20.8	8.1	7.8	4.8
	No. 4 (eroded)	23	8.5	7.4	4.7
	No. 5 (eroded)	18.7	8	7.8	4.2
		18.4	7.4	7.1	4
	No. 6 (eroded)	12.7	7.2	6.8	4
		17.3	6.5	6.1	3.7
		16.2	5.2	4.5	3
	No. 7 (eroded)	25.8	8.4	7.8	4.7
	No. 8 (eroded)	22	8.6	8	5
	No. 9	18.3	6.2	5.9	3.5
	No. 10 (iuv.)	10.5	4	3.2	2.2
	No. 11 (eroded)	19.3	7.3	7	4.5
		18.4	6.4	5.5	3.4
	No. 12	27.7	9	9	5
	No. 13 (eroded)	18.5	6.2	6	3.6
	No. 14 (eroded)	11.4	6.5	6	5
		14.7	6.1	5.4	3.8
		14.8	6.4	5.5	3.5
	No. 15 (eroded)	18.3	6.2	5.9	3.5
	No. 16 (eroded)	18.5	6.2	6	3.6
	No. 17 (eroded)	14.5	6.2	5.5	3.5
	No. 18 (eroded)	21.3	8.2	8	4.2
	No. 19 (eroded)	19.1	5.8	5.6	3.3
		13.7	6.3	6	3.8
	No. 20	22.8	8.2	8	4.5
	No. 23 (eroded)	22	8.4	7.8	5.9
	No. 25 (eroded)	17	7.3	7	4
Ro:	No. 1	10.2	3.7	3.1	1.9
	No. 3 (eroded)	12.5	4.8	4.4	2.2
		12.5	4.6	4.2	2

The measurements are from the largest specimens in the samples.

Operculum: Typically for the genus: horny, blackish-brown, nucleus excentric.

Anatomical remarks: Details of the anatomy of these, as all Thiaridae, viviparous and mostly parthenogenetic species, are given by RAMAMOORTHY (1949); STARMÜHLNER & EDLAUER (1957) and STARMÜHLNER (1969, 1970 and 1976). It is to note, that the specimens of the pigmy population from station Sey: M: No. 8 in brackish water with a maximal shell height of only 7—8.3 mm were full grown and mature with embryos in the brood-pouch!

Ecological-biological remarks: The ubiquitous species occur in nearly all freshwater biotopes from upper courses to the mouths in the border-

region of running waters and in stillwaters if the temperature is higher than 18° C and the current (in running waters) not more than 30—50 cm/sec. They prefer soft bottom, such as sand and mud with high content of organic matter. The snails feed on the growth, such as diatoms and other algae on bottom, but also on rotted vegetable and animal material.

The frequency on Mahé was extremely high only in the brackish water zone of the mouth-region: with a temperature up to 32° C the relatively density of a population of pigmy specimens was more than 1600 ind./1/16 m² sandy-muddy bottom, associated with *Paludinella hidalgoi* f. *granum* and *Melampus* cf. *cafra*. In the running waters of the island interior the species occurs only at one station with a pH: 7.2, conductivity: 116 µS and total hardness: 1.39° dH (temperature: 26.3° C). These station has had the highest value for conductivity and total hardness of all investigated stations in running waters of Mahé. After our observations these is depending on polluted water, coming from a village and plantations nearby. In all other rivers with much lower values *Melanoides tuberculata* does not occur!

On the islands of Anjouan (Comores) and La Réunion (Mascarene) with steep slopes and typically rocky torrents, with strong currents and waterfalls, *Melanoides tuberculata* occurs only rarely on the borders or in pools and creeks between cascade zones, localities with low current, and soft bottom.

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Anjouan	22.5° C—26.3° C	8 — 8.4	142—180 µS	3.1° — 3.5° dH
La Réunion	23.2° C—27.5° C	7.4—8.6	92—240 µS	1.65°—5° dH
Range	22.5° C—27.5° C	7.4—8.6	92—240 µS	1.65°—5° dH

The highest frequency and density for this species occur in the middle to lower courses of Mauritius. In these localities the medium current lies between 10 and 30 cm/sec, rarely up to 50 cm/sec; they have a rich vegetation of algae and submerged water plants; the bottom (sand, mud) is covered with thick organic layers. This high primary production is caused by the influence of fertilizers from surrounding sugar-cane and other plantations. In the region of the borders with a current between 0—20 cm/sec the density was between 30 to 90, sometimes up to 120 ind./1/16 m². The density goes down when the current is stronger than 30 cm/sec to only 1—2 ind./1/16 m² with a current of 50 cm/sec.

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Mauritius	19.4° C—26.3° C	6.6—8.2	66—200 µS	1°—4.25° dH

In the upper courses with relatively low temperature (19.4° C—19.9° C) low chemical values (pH: 6.6—7.6; conductivity: 66—97 μ S; total hardness: 1° dH), stronger currents, rocky bottom and low primary production, the frequency and density are only 1—2 ind./1/16 m². In the headwaters with slightly acidic waters and a total hardness below 0.5° dH, this species and all other gastropods are absent!

Melanoides tuberculata was associated at Mahé with *Gyraulus* cf. *mauritanus*, at Anjouan with *Lymnaea* (*Radix*) *natalensis* and *Ceratophallus* sp. At Réunion and Mauritius the species was found together with *Thiara scabra*, *Lymnaea* (*Radix*) *mauritaniana*, and *Physa borbonica* (at one locality also with the introduced *Planorbella* (= *Helisoma*) *duryi*).

Geographical range: From S-Europe, Lower Asia, and N-Africa to Middle, SE-, and S-Africa; Madagascar and E-African Islands; SE and S-Asia, the Malay Archipelago, Philippines, Moluccas, New Guinea, Bismarck-Archipelago, Solomons, New Hebrides, New Caledonia, E-Australia, Fiji, Samoa, Tahiti and W-Carolines. On some islands it was probably brought in passively by man through paddy-culture and water plants.

Family: Potamididae

Subfamily: Potamidinae

Genus: *Terebralia* SWAINSON, 1840

Subgenus: *Terebralia* s. str.

19) *Terebralia* (*Terebralia*) *palustris* (LINNÉ, 1767)

Lit.: 1767 *Strombus palustris* (LINNÉ, Syst. Nat., ed. 12: 1213) — 1874 *Pyrazus palustris* (TAPPARONE-CANEFRI, Mem. Reale Acc. Sci. Torino (2) 28: 41) — 1897 *Potamides palustris* (MARTENS, in WEBER, Erg. Reise O-Indien, 4: 176; Pl. 9, Fig. 24, 25) — 1899 *Potamides palustris* (MARTIN, Samml. Geol. Reichsmus. Leiden (N. S.), 1: 210; Pl. 32, Fig. 478) — 1902 *Potamides palustris* (MARTENS, RUMPHIUS, Gedenkb.: 120) — 1914 *Potamides palustris* (KONINGSBERGER, Java zoöl. biol. Part 10: 446) — 1914 *Potamides palustris* (LESCHKE, Mitt. naturh. Mus. Hamburg, 31: 259) — 1919 *Potamides palustris* (MARTIN, Samml. Geol. Reichsmus. Leiden, 93: 130; 132) — 1925 *Potamides palustris* (OOSTINGH, Meded. Lanb. Hooges., 29 (1): 46) — 1929 *Potamides palustris* (BENTHEM-JUTTING, Treubia, 11: 86) — 1931 *Potamides palustris* (OOSTINGH, Arch. Moll., 63: 194) — 1956 *Terebralia palustris* (BENTHEM-JUTTING, Treubia, 23 (2): 444; Fig. 111) — 1974 *Terebralia palustris* (BRANDT, Arch. Moll., 105 (1/4): 194; Pl. 14, Fig. 57, 58).

Locality: Sey: M: No. 8 (93 ind.).

Shell: Descriptions by BENTHEM-JUTTING (1956), and BRANDT (1974): high-turreted, thick; brownish-black, with indistinct lighter spiral bands or vertical flames; sculpture with strong, obtuse and irregularly placed axial ribs, which are crossed by four, 2—4 mm broad spiral sulci; they divide the axial ribs into several spiral rows of distinct tubercles, very closely on the base of the last whorl; old periods of arrested growth are marked by a thick varix; 13—20 whorls with flat sides, apex often eroded, umbilicus closed; aperture oval, brownish and glossy within, with short siphonal canal at the base, columella with two spiral folds (Pl. 7, Fig. 39).

Sizes (in mm):

Locality	Height	Shell	Height	Aperture
		Diameter		Diameter
Sey: M: No. 8	117	34	34 (+sipho: 10)	34

The measurements are from one of the larger specimens in the samples.

Operculum: Size (from a specimen with a shell-height of 117 mm): 50 to 60 mm in diameter); corneous, horny-brownish; nucleus central, multi-spiral, outside borders thin and translucent (Pl. 7, Fig. 40 a, b, c).

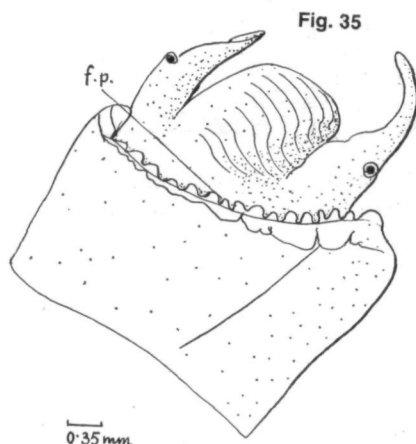


Fig. 35. *Terebralia palustris*: Head and mantle-border

Anatomical remarks: The mantle edge fringed by 15–16 finger-shaped processes; the head is prolonged to a short snout, tentacles long extended; the eyes lie on the base (Fig. 35). In the mantle cavity from left to right: the osphradium is a long ridge along the gill, which consists of many triangular blades; a thick layer indicate the hypobranchial gland which is bordered on the right side by the wide rectum, filled with many cigar-shaped faeces; on the transition from the right mantle-roof to the mantle-floor the female open genital-groove is extended, bordered by two folds (Fig. 36). This groove corresponds with the open “pallial-oviduct”, described for *Cerithium* by JOHANSSON (1953), for *Potadoma* by BINDER (1959) and *Melanatria* by STARMÜHLNER (1969). Radula: central-tooth with the formula: $3/4+1+3$, the median tooth very broad and trapezoid; the lateral with $1+1+2$ denticles, the median cusp prominent; inner marginal with $1+1+2$ and outer marginal with $3+1$ cusps, both with “flanges” on the outsides (Fig. 37). Central nervous system: cerebral-ganglia ovoid in shape and connected by a short and thick commissure; from the dorsal side arise the N. opticus and N. tentacularis and

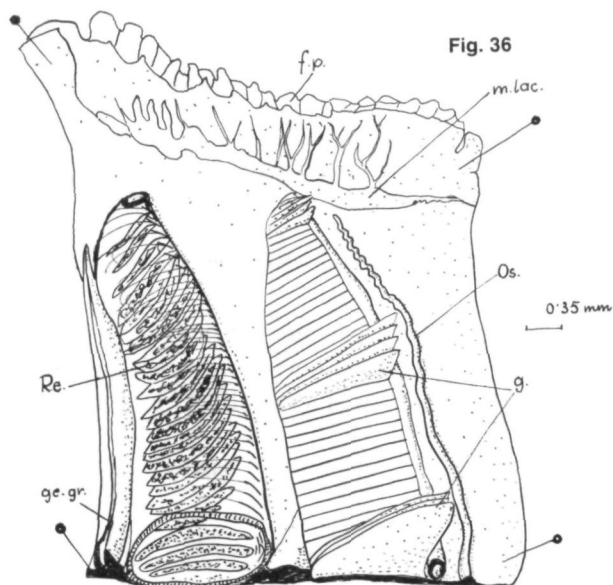


Fig. 36. *Terebralia palustris*: Mantle cavity opened to show (from right to left): Osphradium, gill, rectum filled with faeces and female genital-groove

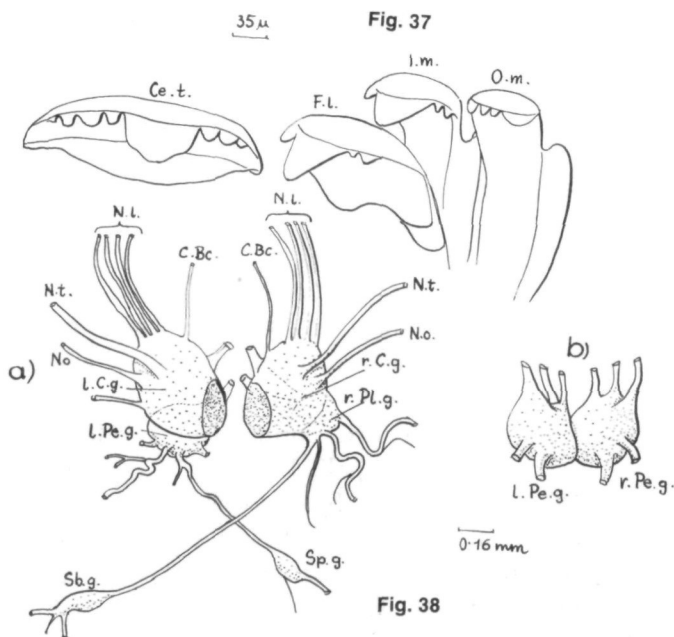


Fig. 37. *Terebralia palustris*: Radula-teeth

Fig. 38. *Terebralia palustris*: a) Central nervous-system, b) Pedalganglia

near the anterior side four labial nerves and the cerebrobuccal-connective; the pleural-ganglia are connected to the outside of the cerebral-ganglia and arise the pallial nerves and the pleuro-supra, especially the pleuro-subintestinal-connectives which cross each another. A N. zygomaticus is developed and arises from the left pallial-ganglion; the pedal-ganglia, connected with short connectives to the cerebral- and pleural-ganglia are globiform and give rise to three prominent pedal-nerves (Fig. 38a, b). The central nervous-system of *Terebralia* is very similar to the conditions found in *Melanatria* (STARMÜHLNER, 1969).

Ecological-biological remarks: *Terebralia palustris* was found in brackish pools (temperature: more than 30° C; conductivity: more than 16.000 µSiemens) near the mouth of the River Anse de la Mouche, some hundred meters inside the W-coast of Mahé. The snails were crawling on the sandy-muddy bottom and feeding on the thick layer of diatoms and blue-algae, covering the ground.

Geographical range: Brackish coastal area of the Indopacific: E-Africa to N-Australia, Philippines and Thailand.

Subclass: EUTHYNEURA

Order: Basommatophora

Superfamily: Ellobiacea (= Actophila)

Family: Ellobiidae

Subfamily: Melampodinae

Genus: *Melampus* MONFORT, 1810

Subgenus: *Melampus* s. str.

20) *Melampus (Melampus) lividus* (DESHAYES, 1830)

Lit.: 1830 *Auricula livida* (DESHAYES, Enc. méth., Vers, 2: 91) — 1837 *Melampus lividus* (BECK, Ind. Moll.: 106) — 1838 *Auricula livida* (LAMARCK, Hist. nat. anim. s. vert., 2^e éd., 8: 338) — 1844 *Auricula livida* (KÜSTER, in M. & CH., Conch. Cab. (2): 44; Pl. 6, Fig. 21—25) — 1848 *Auricula livida* (KRAUSS, Südaf. Moll.: 81) — 1854 *Melampus lividus* (ADAMS, Proc. zool. Soc. London, 1854: 10) — 1856 *Melampus lividus* (PFEIFFER, Mon. Auric. viv.: 40) — 1857 *Melampus lividus* (PFEIFFER, Cat. Auric. Brit. Mus.: 29) — 1860 *Melampus lividus* (MORELET, Sér. Conch., 2: 94) — 1863 *Melampus lividus* (DESHAYES, Cat. Moll. Réunion, p.E.: 83) — 1877 *Melampus lividus* (LIÉNARD, Cat. Moll. Ile Maurice: 58) — 1878 *Auricula livida* (SOWERBY, in REEVE, Conch. Icon.; Pl. 7; Fig. 58) — 1878 *Melampus lividus* (NEVILL, Handl. Moll. Ind. Mus. Calcutta: 217) — 1880 *Melampus lividus* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresfauna Ins. Mauritius: 208) — 1882 *Melampus lividus* (MORELET, J. de Conch., 30: 101) — 1898 *Melampus lividus* (MARTENS, Besch. Weichth. Deutsch O-Afr.: 264) — 1910 *Melampus lividus* (KOBELT, Abh. senck. nat. Ges., 32: 94—96) — 1912 *Melampus lividus* (CONNOLLY, Ann. S-Afr. Mus. 11 (3): 227) — 1921 *Melampus lividus* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 240) — 1962 *Melampus lividus* (BARNACLE, J. Seych. Soc., 2: 56).

Locality: Co: G.Co: No. 1 (1 ind.).

Shell: Spire with eight whorls; the first whorls "Chinese hat-shaped"; dark yellowish, near the suture brownish, on the base of the spire with a typically red-brownish spot, like indicated for these species by KÜSTER (1844:

45); on the right side of the aperture with seven to eight transversal folds, three parietal teeth and one fold on the spire.

Sizes (in mm):

Locality	Shell		Aperture	
	Height	Diameter	Height	Diameter
Co: Gr.Co: No. 1	14.1	8.6	11	1.7

The measurements are from the single, not full grown specimen.

Anatomical remarks: The single specimen collected was not dissected.

Ecological-biological remarks: Like all species of *Melampus* a typical form of the brackish coastal area. Our specimen was found on the coastal wall of the "Hotel Coelacanth" in Moroni (Grand Comore).

Geographical range: Coasts of SE-Africa, Comores, Seychelles, Mascarene, Madagascar and recorded also from the Nicobars.

Subgenus: *Micromelampus* MÖLLENDORF, 1898

21) *Melampus* (*Micromelampus*) cf. *caffer* (KÜSTER, 1844) iuv.

Lit.: 1844 *Auricula caffa* (KÜSTER, in M. & CH., Conch. Cab. (2): 36; Pl. 5, Fig. 7) — 1844 *Auricula caffa* (KRAUSS, S.-Afr. Moll.: 82) — 1854 *Melampus ater* (ADAMS, Proc. zool. Soc. London, 1854: 10) — 1856 *Melampus caffer* (PFEIFFER, Mon. Auric. viv.: 40) — 1857 *Melampus caffer* (PFEIFFER, Cat. Auric. Brit. Mus.: 29) — 1858 *Melampus ater* (ADAMS, Gen. rec. Moll., 2: 243) — 1860 *Melampus caffer* (MORELET, Sér. Conch., 2: 94) — 1869 *Melampus caffer* (NEVILL, Proc. zool. Soc. London, 1869: 66) — 1871 *Melampus caffer* (MARTENS & LANGKAVEL, Südseeconch.: 56; Pl. 3, Fig. 11) — 1877 *Melampus caffer* (LIÉNARD, Cat. Moll. Ile Maurice: 81) — 1878 *Auricula caffa* (SOWERBY, in REEVE, Conch, Icon.: Pl. 7; Fig. 53) — 1878 *Melampus caffer* (NEVILL, Handl. Moll. Ind. Mus, Calcutta, 2: 216) — 1880 *Melampus caffer* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresfauna Ins. Mauritius: 208) — 1883 *Melampus caffer* (TAPPARONE-CANEFRI, Ann. Mus. Civ. Storia Nat. Genova, 19: 229) — 1884 *Melampus caffer* (GARRETT, J. Ac. nat. Sc. Philadelphia, 9: 89) — 1890 *Melampus caffer* (MÖLLENDORF, Ber. senck. naturf. Ges., 1890: 254) — 1912 *Melampus caffer* (CONNOLLY, Ann. S.-Afr. Mus., 11 (3): 226) — 1921 *Melampus caffer* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 247).

Locality: Sey: M: No. 8 (10 ind.).

Shell: Only immature, not full grown shells were found: the spire mamillary, embryonic whorls smooth; below the suture, spiral lines, crossed by the growth lines, making square-like folds (older shells only with delicate growth-lines); six to seven whorls of chestnut-brownish colour; very young shells, below the suture, with one yellow spiral band, the middle part with two spiral bands without distinct borders; in the lower third a fourth spiral band; with older, but still not full grown shells, the spiral bands are very difficult to distinguish; aperture narrow, parietal-area on the upperside bordered by one parietal-fold, below three smaller folds and one blunt tooth; outside area of the inner aperture with three upper and two under withish folds, connected by a small callus.

Sizes (in mm):

Locality	Height	Shell		Aperture	
		Diameter		Height	Diameter
Sey: M: No. 8	4.5	3		3.3	0.6

The measurements are from the largest of the immature shells.

Anatomical remarks: No dissection was made.

Ecological-biological remarks: *Melampus* cf. *caffra* iuv. was collected, together with *Paludinella hidalgoi* f. *granum* on dead corals in the mouth region of the River Anse de la Mouche. This locality is covered with brackish water during high tide and with freshwater during low tide; temperature: 32° C; surfacecurrent: 30–50 cm/sec.

Geographical range: Indopacific coasts: SE-Africa, Madagascar, Comores, Seychelles, Mascarene, Ceylon, Andaman and Nicobar-Islands, New Guinea, New Caledonia, Loyalty-Islands, Tahiti.

Superfamily: Lymnaeacea

Family: Physidae

Genus: *Physa* DRAPARNAUD

Subgenus: *Physa* s. str.

22) *Physa borbonica* FÉRUSAC, 1827

Lit.: 1827 *Physa borbonica* (FERUSSAC, Bull. univ. Sc. nat., 10: 408–1838) *Physa nana* (POTIEZ & MICHAUD, Gal. Moll. DOUAI, 1: 225; Pl. 22, Fig. 15, 16) — 1843 *Physa borbonica* (SGANZIN, Mém. Hist. nat. Strasbourg, 3: 18) — 1860 *Physa borbonica* (MORELET, Sér. Conch., 2: 97; Pl. 6, Fig. 5) — 1869 *Physa seychellana* (MARTENS, Moll., in DECKEN: Reisen in O-Afr., 3: 60; Pl. 6, Fig. 5) — 1878 *Physa borbonica* (NEVILL, Handl. Moll. Ind. Mus. Calcutta: 230) — 1880 *Physa borbonica* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresfauna Ins. Mauritius: 209; var. *nana*: 209; Pl. 19, Fig. 11, 12) — 1886 *Physa seychellana* (CLESSIN, in M. & CH., Conch. Cab. (2): 343; Pl. 48, Fig. 8) — 1910 *Physa borbonica* (KOBELT, Abh. senck. nat. Ges., 32: 94, 95) — 1921 *Bullinus (Isidora) borbonicensis* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 233; var. *nana*: 234).

Localities: Mas: Ré: No. 1 (81 ind.), No. 2 (70 ind.), No. 3 (90 iuv.), No. 4 (8 ind.), No. 5 (16 ind.), No. 6 (22 ind.), No. 7 (7 ind.), No. 8 (2 ind.), No. 9 (23 ind.), No. 10 (24 ind.), No. 11 (1 ind.), No. 12 (26 ind.), No. 13 (11 ind.), No. 14 (24 ind.), No. 15 (13 ind.), No. 17 (20 ind.), No. 18 (1 iuv.), No. 21 (3 ind.), No. 22 (14 ind.); Mau: No. 1 (6 ind.), No. 2 (5 ind.), No. 3 (2 ind.), No. 4 (many ind.), No. 5 (many ind.), No. 6 (80 ind.), No. 7 (17 ind.), No. 8 (many ind.), No. 9 (many ind.), No. 10 (many ind.), No. 11 (many ind.), No. 12 (2 ind.), No. 14 (1 ind.), No. 15 (2 ind.), No. 16 (10 ind.), No. 17 (12 ind.), No. 20 (1 ind.).

Shell: As lefthanded shell described as *Physa* it was placed by GERMAIN (1921) without study on the anatomy to the lefthanded African genus *Bullinus (Isidora)* from the family of Planorbidae. But our study of the anatomy shows that these species really is a representative of the lymnaeid genus *Physa*, as it was described (after the shell) by FÉRUSAC (1827). The variation of the shell

in size and shape is — like in many freshwater-gastropods — very marked. A small form of the species is *f. nana* POTIEZ & MICHAUD, 1838.

The shell is normally thin, fragile and transparent; spire elevated with about 4—5 whorls, the first sometimes eroded, the body-whorl big and bulging; white to brownish-yellowish, shining, sometimes with a milky, whitish band on the suture; very fine, dense growth-striae, crossed by also very delicate spiral grooves (enlargement: $50\times$!). Aperture oval, peristome turned over an enclose a fine slit of the umbilicus, on the inner side of the margin with a white, callus-lip (Pl. 7, Fig. 41).

Sizes (in mm):

Localities		Shell		Aperture	
		Height	Diameter	Height	Diameter
Mas: Ré:	No. 1	11.4	6.3	7.5	3.6
	No. 2 (<i>f. nana</i>)	7.5	5	5.8	3
	No. 3 (<i>f. nana</i>)	7	4	4.5	2.2
	No. 4 (<i>f. nana</i>)	6.8	3.7	4	1.8
	No. 5 (<i>f. nana</i>)	6.8	3.7	4	1.8
	No. 6 (<i>f. nana</i>)	7.7	4.1	4.9	2.3
	No. 7 (<i>f. nana</i>)	7.9	4.7	5.2	3.1
	No. 8 (<i>f. nana</i>)	5.6	3	3.2	1.6
	No. 9 (<i>f. nana</i>)	6.5	3.9	4	2.4
	No. 10 (<i>f. nana</i>)	6.4	3.7	4.1	2.2
	No. 11	9	5	6	2.5
	No. 12 (<i>f. nana</i>)	5.5	2.8	3	1.6
	No. 13 (<i>f. nana</i>)	7.7	4.3	5.2	2.6
	No. 14 (<i>f. nana</i>)	7.2	3.8	4.6	2.2
	No. 15 (<i>f. nana</i>)	7.6	4	4.3	2.4
	No. 17 (<i>f. nana</i>)	7.4	4	4.9	2.5
	No. 18 (iuv.)	3	no measurements!		
	No. 21	10.2	6	7.2	4
	No. 22 (<i>f. nana</i>)	7.5	4.3	5	2.9
Mas: Mau:	No. 1 (<i>f. nana</i>)	5.3	3.1	3.6	1.7
	No. 2 (<i>f. nana</i>)	5.2	3	3.5	1.8
	No. 3 (<i>f. nana</i>)	5	3	3.4	1.5
	No. 6 (<i>f. nana</i>)	7.8	4.5	5.2	2.7
	No. 7 (<i>f. nana</i>)	5.4	3.4	4.1	2
	No. 12 (<i>f. nana</i>)	6.5	4	4.4	2
	No. 14 (<i>f. nana</i>)	4.5	2.8	3.4	1.6
	No. 15	10.8	6.3	8.2	4.1
	No. 16 (<i>f. nana</i>)	5.2	3	3.5	1.8
	No. 17	9.3	5.3	6.8	3
	No. 20 (<i>f. nana</i>)	5	2.9	3.3	1.5

The measurements are from the largest specimens of the samples.

Anatomical remarks: The study of the soft-bodies from the specimens of our samples shows, that all specimens from La Réunion and Mauritius with

a left-handed "*Physa*-like" shell are really typically for the genus *Physa* and not for the African genus *Bulinus*. These genus has also a left-handed turreted shell, but is anatomically a genus of the family Planorbidae.

The mantle on the outside has an irregularly pattern of white-yellowish spots on a dark blue ground-pigmentation; the mantle edge is lighter and possesses-typically for the genus *Physa*- four finger-shaped processes on the right and three similar processes on the left corner (Fig. 39). In life these "mantle-tentacles" lie over the outside of the shell. In the left corner of the

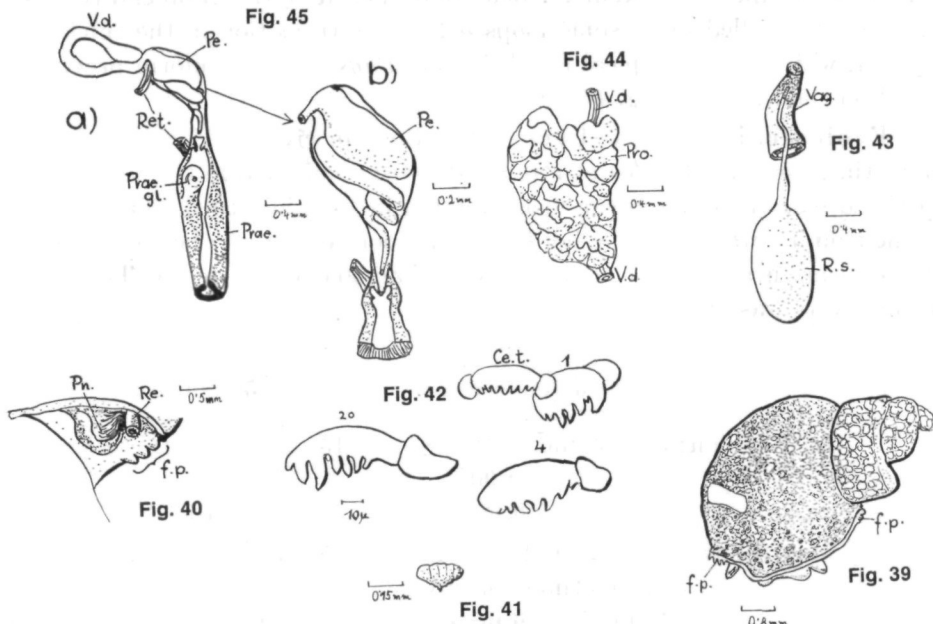


Fig. 39. *Physa borbonica*: Soft-body with pigmentation

Fig. 40. *Physa borbonica*: Pneumostom and finger-shaped processes

Fig. 41. *Physa borbonica*: Jaw

Fig. 42. *Physa borbonica*: Radula-teeth

Fig. 43. *Physa borbonica*: Receptaculum seminis and vagina

Fig. 44. *Physa borbonica*: Prostata-gland

Fig. 45. *Physa borbonica*: a) Lower part of vas deferens, coiled penis and praeputium with praeputial-gland; b) coiled penis

mantle, beside the three processes open the anus and, as thickened fold, the pneumostom (Fig. 40). The jaw is very small, acute triangular, with 5—6 longitudinal ribs (Fig. 41). Radula: broad and typical for the genus *Physa*: central-tooth three times more broad than high, and with eight acute cusps, on the outside with circle-shaped "flanges"; the laterals with six to seven prominent denticles and also with circle-shaped to oval "flanges"; the marginals sickle-shaped with a short handle-shaped "flange" and seven to eight well developed cusps (Fig. 42). The salivary glands are connected as a half-circle below the rise of the oesophagus from the pharyngeal bulb. The central nervous

system consists of long-ovoid cerebral-ganglia united by a distinct, small commissure; the pleural-, parietal-ganglia and the abdominal (or visceral-) ganglion are connected, in the form of a half-circle; nearby are the cerebral-ganglia and the pleural-ganglia with short connectives to the globoid pedal-ganglia.

Genital-organs: on the femal part open the ovoid receptaculum with a distinct slender duct in the pigmented, lower part of the vagina (Fig. 43); the male duct possesses the vas deferens, a prostata gland, consisting of densely packed, short and thick tubule, which are branched on the blind end (Fig. 44); the penis lies rolled up in some loops before the transition in the thick praeputium, which has — typical for the genus *Physa* — a globiform praeputial-gland on the left side (Fig. 45a, b).

Ecological-biological remarks: Both in rivers of La Réunion and Mauritius, the small f. *nana* of *Physa borbonica* dominated in the samples. The species occurs from the upper (from 1200 m in Réunion) to the lower courses of the running waters on the borders or in pools and creeks between cascade-zones, if the current does not exceed more than 30 cm—50 cm/sec. The density in the rivers was:

	0—30 cm/sec	30—50 cm/sec
La Réunion: 30—60 ind./1/16 m ² (sometimes: 90— 120 ind./1/16 m ²)	15—30 ind./1/16 m ² to sporadic	
Mauritius: 60—120 ind./1/16 m ² (sometimes: up to 180 ind./1/16 m ² !)	15—30 ind./1/16 m ² to sporadic	

They prefer, like the associated species *Lymnaea (Radix) mauritiana*, *Gyraulus mauritanus*, *Planorbella (Helisoma) duryi*, *Melanoides tuberculata* and *Thiara scabra*, sandy-muddy bottom, dense vegetation of algae and submerged water-plants and rotted organic material.

	Temperatures	Chemistry			
	pH	conductivity	total hardness		
La Réunion:	15.2° C—24° C	6.95—8.8	24—258 μS	0.45°—5.75° dH	
Mauritius:	19.4° C—24.5° C	6.6 —8.2	66—220 μS	1° —4.25° dH	
Range:	15.2° C—24.5° C	6.6 —8.8	24—258 μS	0.45°—5.75° dH	

These found values shows that *Physa borbonica* occurs in a very widespread range of ecological conditions. On the average the density of *Physa borbonica* (only in the upper courses of Mauritius in a temperature below 20° C with

5 to 10 ind./1/16 m²) in the running waters of Mauritius (specially in the middle courses and the transitions to the lower courses with an immense production on algae and submerged water-plants in the slow-flowing parts) are higher than in the faster flowing streams of the steep sloped island La Réunion. In the lower parts of the lower courses and in the mouth-region, — typical habitat of the different species of Neritidae, — *Physa borbonica* is, like *Lymnaea (Radix) mauritiana*, gradually disappearing. In one locality — Mas: Ré: No. 5 — *Physa borbonica* (and *Lymnaea (Radix) mauritiana*) were found on irrigated rocks in a hygropetric habitat. At many localities the species was observed in copulation and on stones and submerged water-plants spawns were deposited (April–May, 1974).

Geographical range: Mascarene Archipelago: La Réunion, Mauritius. Reported also from the Seychelles by MARTENS (1869), but not found by our mission on the islands of these Archipelago.

Family: Lymnaeidae

Subfamily: Lymnaeinae

Genus: *Lymnaea* LAMARCK, 1799

Subgenus: *Radix* MONTFORT, 1810

23) *Lymnaea (Radix) natalensis* KRAUSS, 1848

Lit.: 1848 *Limnaeus natalensis* (KRAUSS, Südafr. Moll.: 85) — 1866 *Limnaeus natalensis* var. *exsertus* (MARTENS, Malak. Bl., 1866: 191; Pl. 3, Fig. 8, 9) — 1868 *Limnaea orophila* (MORELET, Voy. WELWITSCH, Angola Benguela: 87; *Limnaea sordulenta*: 87) — 1872 *Limnaea natalensis* (REEVE, Conch. Icon.: Pl. 7; Fig. 46) — 1883 *Limnaea (Stagnalana) caillaudi* (BOURIGNAT, Ann. Sci. nat. zool. Paris, 15: 89; *L. (Raffrayana) raffrayi*: 93) — 1883 *Limnaea africana* (BOURIGNAT, Hist. Malac. Abyssinie: 95) — 1886 *Limnaeus natalensis* var. *exsertus* (MARTENS, in M. & CH., Conch. Cab., 1 (17): 400) — 1888 *Limnaea jouberti* (BOURIGNAT, Ann. Sci. nat. zool., 10: 7) — 1892 *Limnaea nyansae* (MARTENS, Sitz. Ber. Ges. naturf. Fr. Berlin, 1892: 16) — 1894 *Limnaea elmeteitensis* (SMITH, Proc. zool. Soc. London, 1: 167) — 1897 *Limnaea (Radix) undussumae* (MARTENS, Besch. Weichth. Deutsch-O.-Afr., 4: 135) — 1919 *Lymnaea natalensis* (GERMAIN, Bull. Mus. Hist. nat. Paris, 25: 179) — 1936 *Lymnaea natalensis* (HAAS, Abh. senck. naturf. Ges., 431: 1) — 1951 *Lymnaea natalensis* (HUBENDICK, Kungl. Svenska Vet. Ak. Handl., 3 (1): 158; Fig. 71, 78, 80, 86, 87, 170, 345, 346, 248).

Localities: Sey: M: No. 2 (many ind. of cf. *natalensis*, KRAUSS, 1848); Co: A: No. 1 (6 ind.), No. 2 (110 ind.), No. 4 (1 ind.), No. 5 (72 iuv.).

Shell: Considering the great intraspecific variation in form, size and shape of the shells (as in all species of *Lymnaea*, especially in subgenus *Radix*) GERMAIN (1919) and HUBENDICK (1951) have reduced the great number of forms and species of *Lymnaea*, described from Africa South of Sahara to only one species. Accordingly, after HUBENDICK's studies on a large number of specimens, concerning *Lymnaea natalensis* KRAUSS, 1848, he write on page 158: "... the systematical independence of which is problematical."

The specimens found at Mahé (Seychelles) have a fragile oblong shell with only three whorls, rapidly increasing; the body whorl big and slightly convex; yellowish, translucent; fine and dense growth lines; aperture ovoid,

top acute, base rounded; a columellar fold is present, as is a narrow umbilical chink (Pl. 7; Fig. 43). These specimens are determined as cf. *natalensis* and were probably introduced; *Lymnaea* was never before reported from the Seychelles. The slender-oblong shells of the specimens found in different localities of running waters on Anjouan (Comores) have an acute spire of four to four and half whorls; yellowish, translucent and with dense, very delicate growth-striae, sometimes crossed by fine spiral-grooves; bulging body-whorl (Pl. 7; Fig. 42a, b).

Sizes (in mm):

Localities	Shell		Aperture		Ratio-Index	
	Height	Diameter	Height	Diameter	D : H	Sp : H
Sey: M: No. 2	11	6.4	9.2	5.2	58%	17%
	10.8	6.3	8.9	4.6	58%	17.6%
Co: A: No. 1	9	5	6.7	3.3	55.5%	26%
	10	5	7	4	50%	30%
	10.4	5.5	7.4	4	52.8%	29%
	13.7	7.9	9.7	6	57.6%	29%

The measurements are from the largest specimens in the samples.

Anatomical remarks: Outside the mantle is dark blue with white-yellowish, circle-shaped spots; mantle-border yellow-greyish to dark blue with small irregularly black dots (Fig. 46); Central nervous-system: cerebral-

Fig. 46

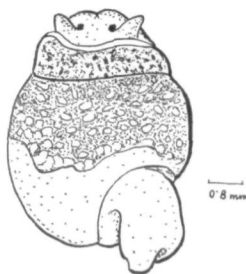


Fig. 48

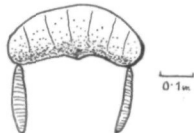


Fig. 49

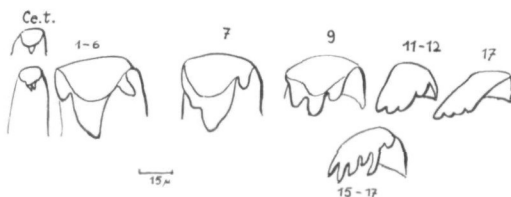


Fig. 47

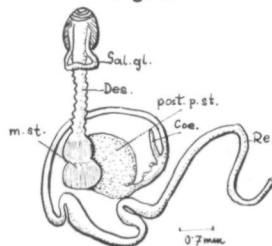


Fig. 46. *Lymnaea (Radix)* cf. *natalensis* (from Mahé, Seychelles): Soft body with pigmentation

Fig. 47. *Lymnaea (Radix)* cf. *natalensis* (from Mahé, Seychelles): Intestine

Fig. 48. *Lymnaea (Radix)* cf. *natalensis* (from Mahé, Seychelles): Jaw

Fig. 49. *Lymnaea (Radix)* cf. *natalensis* (from Mahé, Seychelles): Radula-teeth

ganglia oblong connected by a moderately, slender commissure; from the dorsal side arise the N. tentacularis and N. opticus; on the frontal side the cerebrobuccal-connective and the two labial nerves; the pleural-, parietal-ganglia and the abdominal-ganglion as half-circle below the cerebral-commissure; pallial- and cerebral-ganglia connected with short connectives to the large pedal-ganglia; on their surface the statocysts with many statoliths (Fig. 50). Intestine: salivary glands half-circle-shaped connected to moderately long oesophagus; stomach divided into a anterior part, muscle-part and a sac-shaped posterior part with the openings of the digestive gland-ducts and a short coecum (Fig. 47); jaw: semilunar-shaped, inner edge slightly concave with one or two median cusps (Fig. 48, 54); radula: about 24—30 teeth in each half row; central tooth slightly asymmetrical, one cusp, sometimes bicuspid; the laterals with three prominent cusps, the marginals with four to five acute denticles (Fig. 49, 55). Genital organs: praeputium and penis sheath nearly of the same length; praeputium with two muscular-pillars; velum and sarcobelum are normally developed, the penis reaches in the distal third of the penis sheath

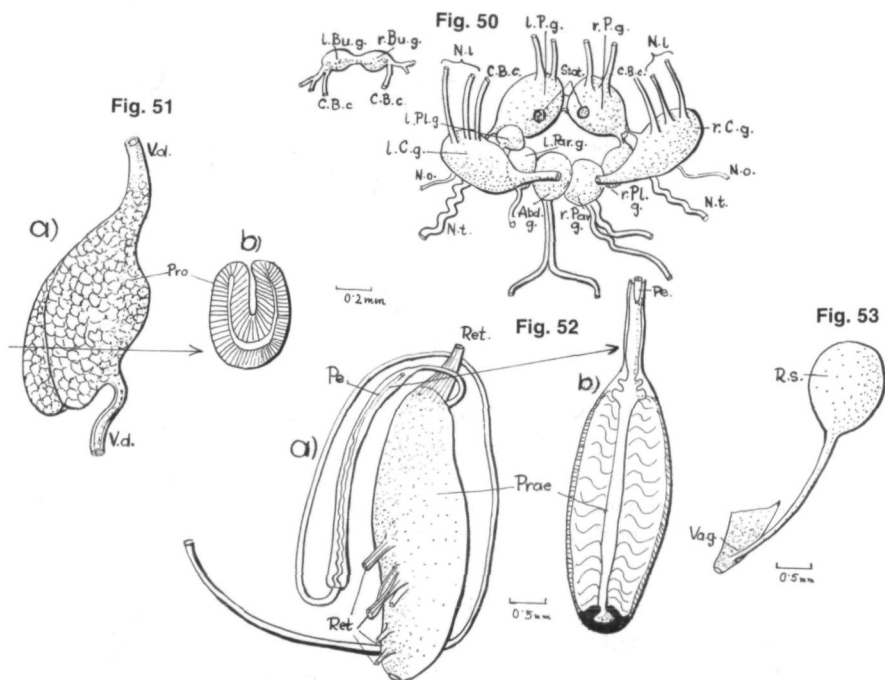


Fig. 50. *Lymnaea (Radix) cf. natalensis* (from Mahé, Seychelles): Central nervous-system

Fig. 51. *Lymnaea (Radix) cf. natalensis* (from Mahé, Seychelles): a) Prostata-gland; b) Cross-section through the prostata-gland

Fig. 52. *Lymnaea (Radix) cf. natalensis* (from Mahé, Seychelles): a) Vas deferens, penis and praeputium; b) Longitudinal-section of the praeputium end the end of the penis

Fig. 53. *Lymnaea (Radix) cf. natalensis* (from Mahé, Seychelles): Receptaculum seminis and lower part of the vagina

(Fig. 52a, b; 57a, b), but never in the lumen of the praeputium, as *Lymnaea* (*Radix*) *natalensis* *hovarum*! As indicated by HUBENDICK (1951) the prostata has one fold directed inwards, but it does not occupy the whole lumen (Fig. 51a, b; 56); the globiform receptaculum seminis is connected with the end of the vagina by a long and slender duct (Fig. 53).

Ecological-biological remarks: On Mahé (Seychelles) *Lymnaea* (*Radix*) cf. *natalensis* was found rarely on the borders of pools, filled with flood waters, the temperature was about 25° C; pH: 6.5, conductivity: 35 µSiemens

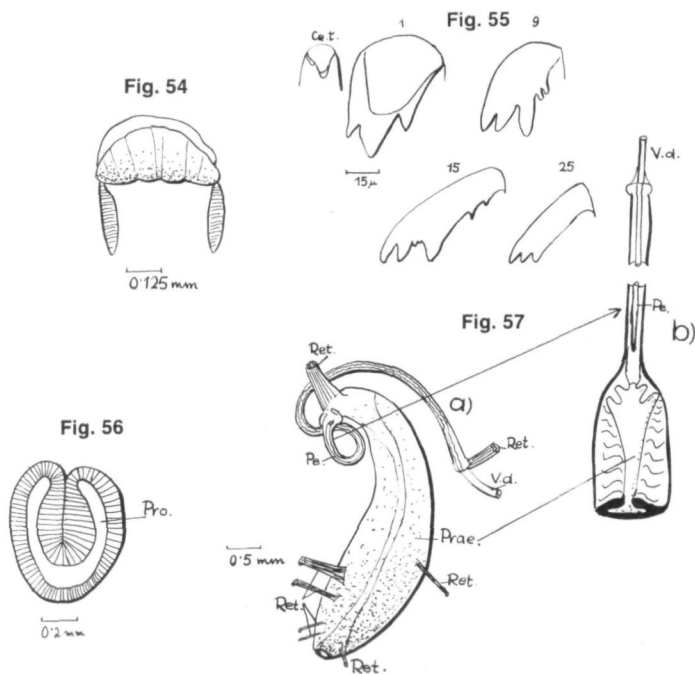


Fig. 54. *Lymnaea* (*Radix*) *natalensis*: Jaw

Fig. 55. *Lymnaea* (*Radix*) *natalensis*: Radula-teeth

Fig. 56. *Lymnaea* (*Radix*) *natalensis*: Cross-section through the prostata-gland

Fig. 57. *Lymnaea* (*Radix*) *natalensis*: a) Lower part of the vas deferens, penis and praeputium; b) Longitudinal-section of the praeputium and penis

and total hardness: 0.15° dH. At Anjouan *Lymnaea* (*Radix*) *natalensis* was in greater density only in stillwater habitats, such as water-tanks filled with water from a brook (60 to 100 individus/1/16 m²), in pools, filled with flood water near the borders of rivers and in sprayed water of a mineral-source flowing in a mountain-river. In these localities were found also spawn and young specimens in March, 1974. In running waters *Lymnaea* (*Radix*) *natalensis* was always sporadic to observe, living near the borders in a surface-current of only 10–20 cm/sec (the majority of the running waters of Anjouan are torrents with strong currents).

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Anjouan	22.2° C—26.3° C	7.9—8.4	117—180 µS	3.5° dH
(sprayed water				
of a mineral-source:	22.2° C	6	1600 µS(!)	53° dH(!)

In some localities of Anjouan *Lymnaea (Radix) natalensis* was associated with *Ceratophallus* sp. and *Melanoides tuberculata*.

Geographical range: Africa, S of the Sahara; in number of oases of the Sahara and in the Nile drainage area as far as Northern Egypt, Yemen and Oman; probably the Cape Verde islands and Tenerife. Our collections from the Seychelles and the Comores are the first records for these islands; it is presumed that on these islands the species was introduced passively by man or water-birds.

23a) *Lymnaea (Radix) natalensis* KRAUSS, 1848 ssp. *hovarum* TRISTRAM, 1863

Lit.: 1863 *Lymnaea hovarum* (TRISTRAM, Proc. zool. Soc. London, 1863: 61) — 1882 *Lymnaea electa* (SMITH, ibid., 1882: 385; Pl. 22, Fig. 12, 13) — 1882 *Lymnaea hovarum* (SMITH, ibid.: 385) — 1894 *Lymnaea suarezensis* (DAUTZENBERG, J. de Conch., 42: 110; Pl. 4, Fig. 3) — 1910 *Lymnaea electa* (KOBELT, Abh. senck. nat. Ges., 32: 90) — 1914 *Lymnaea hovarum* (ROBSON, J. Linn. Soc., London, 32: 380) — 1920 *Lymnaea hovarum* (GERMAIN, Bull. Mus. Hist. nat., 26: 160) — 1929 *Lymnaea (Radix) natalensis* (HAAS, Zool. Jb. (Syst.), 57: 412; Pl. 2, Fig. 11—13) — 1951 *Lymnaea natalensis* (HUBENDICK, Kungl. Svenska Vet. Ak. Handl., 3: 82; 158; Fig. 186, 193, 276, 298/46, 347n) — 1953 *Lymnaea natalensis* (GRJÉBINE & MENACHÉ, Mém. Inst. Sci. Madagascar (A), 8: 87) — 1956 *Lymnaea hovarum* (RANSON, OMS Conf. Afr. Bilh., Brazzaville (34): 25) — 1958 *Lymnaea hovarum* (BRYGOO, Arch. Inst. Pasteur, Madagascar, 26: 75) — 1969 *Radix (Radix) hovarum* (STARMÜHLNER, Malacologia, 8 (1/2): 244; Fig. 321—352).

Locality: Mad: No. 1 (some individues).

Shell: Descriptions are given by TRISTRAM (1863); SMITH (1882); DAUTZENBERG (1894); HUBENDICK (1951) and STARMÜHLNER (1969). It varies in size and shape, like all shells of the genus *Lymnaea (Radix)*. There are all transitions between the forms of Madagascar to the forms of Africa belonging to the *natalensis*-group (Pl. 7; Fig. 44).

Sizes (in mm):

Locality	Shell		Aperture		Ratio-Index	
	Height	Diameter	Height	Diameter	D : H	Sp : H
Mad: No. 1	13.1	8.2	9.5	6.5	62.5%	27.5%

The measurements are from the largest specimen in the sample.

Anatomical remarks: A detailed study of anatomy and histology of *Lymnaea (Radix) natalensis hovarum* was given by STARMÜHLNER (1969) who

studied many specimens from different localities of Madagascar. The specimens of the collection of BRINCK & ENCKELL (Swedish Mission 1973) from the Saharena-River, Prov. Diego Suarez, N-Madagascar, show no differences: the mantle surface is yellowish spotted on a dark blue ground, the mantle border possesses dark, irregular spots on a light ground of marble pattern; jaw: half-moon-shaped (Fig. 58); radula: central-tooth slightly asymmetrical, one prominent central cusp and each side a very small lateral cusp; laterals tri-

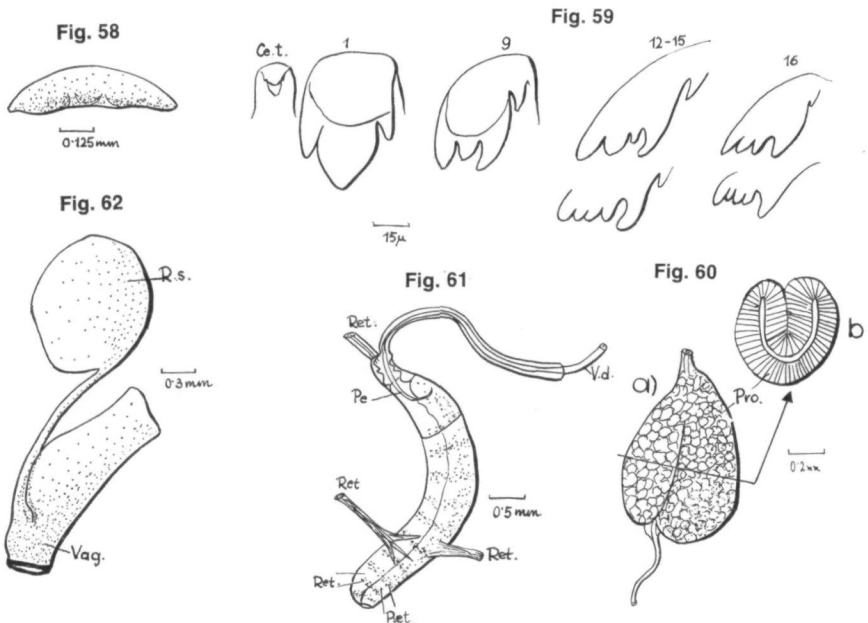


Fig. 58. *Lymnaea (Radix) natalensis hovarum*: Jaw

Fig. 59. *Lymnaea (Radix) natalensis hovarum*: Radula-teeth

Fig. 60. *Lymnaea (Radix) natalensis hovarum*: a) Prostata-gland; b) Cross-section through the prostata-gland

Fig. 61. *Lymnaea (Radix) natalensis hovarum*: Lower part of the vas deferens, penis and praeputium

Fig. 62. *Lymnaea (Radix) natalensis hovarum*: Receptaculum seminis and lower part of the vagina

cuspid, from teeth 9—10 with four cusps and the marginals with four to five denticles of different size (Fig. 59); genital organ-system: receptaculum seminis globiform and with a long slender duct (Fig. 62); prostate gland unfolded (Fig. 60a, b); the most important difference to *natalensis* s. str., as indicated before by RANSON (1956) and STARMÜHLNER (1969) is the long penis, which projects always with its free top in the upper third of the praeputium (Fig. 61).

Ecological-biological remarks: According to STARMÜHLNER (1969) found in Madagascar in all limnetic habitats, such as border of lakes, ponds,

irrigation-channels, rice-fields and sandy-muddy banks and borders of running waters, as in Mad: No. 1 (River Saharena).

Geographical range: The subspecies *hovarum* of the African *Lymnaea* (*Radix*) *natalensis*-group is known from the whole island of Madagascar, but mainly recorded from the central highland.

24) *Lymnaea* (*Radix*) *mauritiana* MORELET, 1875

Lit.: 1875 *Limnaea mauritiana* (MORELET, J. de Conch., 23: 33) — 1877 *Limnaea rufescens* (LIÉNARD, Cat. Moll. Maurice: 58) — 1880 *Limnaea mauritiana* (MARTENS, Moll. in MÖBIUS: Beitr. Meeresfauna Ins. Mauritius: 33; Pl. 19, Fig. 9, 10) — 1910 *Limnaea mauritiana* (KOBELT, Abh. senck. nat. Ges., 32: 94) — 1921 *Limnaea* (*Radix*) *mauritanensis* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 227; Fig. 21) — 1951 *Lymnaea mauritiana* (HUBENDICK, Kungl. svensk. Ak. Vet. Handl., 3: 106; Fig. 278, 290; 167; Fig. 358).

Localities: Mas: Ré: No. 2 (19 ind.), No. 4 (46 ind.), No. 5 (50 ind.), No. 7 (61 ind.), No. 8 (33 ind.), No. 10 (30 ind.), No. 11 (55 ind.), No. 12 (14 ind.), No. 13 (62 ind.), No. 14 (51 ind.), No. 17 (58 ind.), No. 18 (2 iuv.), No. 20 (1 ind.), No. 23 (45 ind.); Mau: No. 1 (4 ind.), No. 2 (13 ind.), No. 3 (17 ind.), No. 4 (67 ind.), No. 5 (19 ind.), No. 6 (119 ind.), No. 7 (62 ind.), No. 8 (20 ind.), No. 9 (4 ind.), No. 10 (5 ind.), No. 11 (some ind.), No. 12 (13 ind.), No. 14 (9 ind.), No. 15 (42 ind.), No. 16 (some ind.), No. 17 (27 ind.), No. 20 (some ind.); Ro: No. 1 (20 ind.), No. 3 (2 ind.), No. 4 (4 ind.).

Shell: Descriptions are given by MORELET (1875); GERMAIN (1921) and HUBENDICK (1951): the shells vary a great deal: the ratio-index between height and maximal diameter and between the height of the spire and height of the shell differs, as well as different details in the shell form; generally the shell is long-ovate with a prominent, somewhat obtuse spire, consisting of three to four whorls separated by a shallow suture; the pointed apex is mostly reddish, the other parts horny-yellowish, slightly transparent; very fine, delicate growth-striae, which are only on the body-whorl, a little more prominent; on the upper whorls the growth striae are crossed by fine spiral-grooves; a columellar fold is usually developed, no umbilical chink occurs (Pl. 7, Fig. 45, 46, 47, 48, 49, 50, 51, 51).

Sizes (in mm):

Localities	Shell		Aperture		Ratio-Index	
	Height	Diameter	Height	Diameter	D : H	Sp : H
Mas: Ré: No. 2	11.6	6.7	8.4	5	58%	28%
No. 4	9	4.4	6	3.3	49%	34%
	8.5	5	6.4	4.3	59%	25%
No. 5 (river)	8	4	5	2.6	50%	37.5%
(hygropetric)	10.2	5.7	7	3.9	56%	32%
(hygropetric)	10.1	5.7	6.3	3.4	57%	38%
(hygropetric)	10	5.2	6.2	3.2	52%	38%

Localities	Shell		Aperture		Ratio-Index	
	Height	Diameter	Height	Diameter	D : H	Sp : H
No. 7	12.5	6.6	9.3	4.5	53%	26%
No. 8	11	6	8	4.5	54%	27%
No. 10 (eroded)	9	5.4	6	3.5	60%	34%
No. 11 (river)	8.5	4.8	6	3.5	56%	30%
(hygropetric)	12	6.4	9.4	5.2	53%	22%
(hygropetric)	11	6	8	4.8	54%	28%
No. 12	10.6	5	7	3.4	47%	34%
No. 13	11.8	6.4	8.9	4.3	54%	25%
	11	6	7.5	4	54%	32%
No. 14	12.7	7.6	10	5.6	60%	22%
No. 15	11.7	7	9	5.7	60%	23%
	11.4	6.2	8.6	4.5	54%	25%
No. 17	13.1	7.4	10	5.8	56%	24%
No. 18 (iuv.)	7	3.8	4.2	2.5	54%	40%(!)
No. 20 (iuv.)	5.6	no measurements!				
No. 23	19	11.5	15	7.5	60%	22%
	15	9	12.5	6	60%	17%
	12.3	6.8	9	4	55%	27%
Mau: No. 1 (eroded)	10.6	5.6	7.3	4.3	53%	31%
No. 2 (eroded)	8	4	5	2	50%	37.5%
(eroded)	7.3	4.7	5.3	3.5	64%	27.4%
No. 3	9	4.3	5.6	2.8	47%	38%(!)
No. 4 (eroded)	11	5.4	7.8	4.3	49%	30%
No. 5 (eroded)	8.6	4.8	5.7	3.3	55%	34%
No. 6 (eroded)	10.5	6	7.8	3.9	57%	26%
	11	5.7	7.4	4	52%	33%
	10.5	5.5	7.7	3.6	52%	27%
No. 7 (eroded)	8.4	4.8	5.8	3.7	57%	31%
No. 8 (eroded)	10.6	5.5	7.2	4.2	51%	32%
No. 9 (eroded)	9.1	5	6	3	55%	34%
No. 10 (eroded)	7	4.3	4.5	2.5	61%	36%
No. 12	10	5.3	7.9	4	53%	21%
No. 13	8	4.7	5.5	2.7	58%	32%
No. 15 (eroded)	14.3	7.5	10	5	52%	30%
	9.6	4.7	6.5	4	50%	33%
No. 17	9.2	5	6.8	4	54%	27%
Ro: No. 1	12.5	7	9.4	4	56%	25%
No. 3 (eroded)	9.5	5	6.2	3.5	52%	35%
No. 4	18.8	8.5	14.4	6	45%	23.5%

The ratio-index of *Lymnaea (Radix) mauritiana* from our samples changes by:

Diameter : Height = 45% to 64%; average: about 53.3%

Spire : Height = 17% to 40%; average: about 30%

The measurements are from the largest specimens in the samples.

Anatomical remarks: Some details are given by HUBENDICK (1951: 106; Fig. 278, 290 and 167). Outer mantle surface dark blue with rounded,

yellowish spots, mantle border blackish (Fig. 63); jaw: halfmoon-shaped, inner edge concave (Fig. 64); radula: central-tooth asymmetrical with a prominent central cusp and a small denticle on the left side; laterals tricuspid, sometimes the first with incisived cusps, from 8/9th tooth, two central and two lateral cusps, from the 13th tooth to the marginals (about 25 teeth each half-row) with three central and two to three small lateral cusps (Fig. 65); genital organ-system: receptaculum seminis with a long and slender duct, dark blue

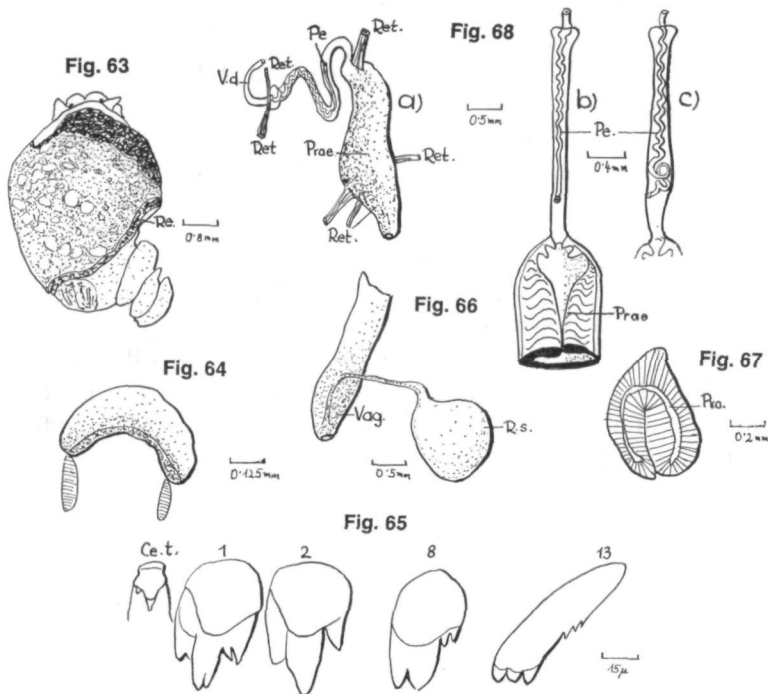


Fig. 63. *Lymnaea (Radix) mauritiana*: Soft body and pigmentation

Fig. 64. *Lymnaea (Radix) mauritiana*: Jaw

Fig. 65. *Lymnaea (Radix) mauritiana*: Radula-teeth

Fig. 66. *Lymnaea (Radix) mauritiana*: Receptaculum seminis and lower part of the vagina

Fig. 67. *Lymnaea (Radix) mauritiana*: Cross-section through the prostata-gland

Fig. 68. *Lymnaea (Radix) mauritiana*: a) Lower part of the vas deferens, penis and praeputium; b) Longitudinal-section of the upper part of the praeputium and penis; c) penis

pigmented like the lower part of the vagina (Fig. 66); the prostate with one large fold (Fig. 67); the penis is coiled within the penis sheat and does not enter in the proximal chamber of the thick and pigmented praeputium, with two muscle pillars (Fig. 68a, b, c).

Ecological-biological remarks: *Lymnaea (Radix) mauritiana* is, with *Physa borbonica*, *Thiara scabra* and *Melanoides tuberculata*, one of the most frequent freshwater-gastropods in the still- and running waters of the

Mascarene-Archipelago. In brooks, rivers and streams they occur from 1200 m (Réunion), 750 m (Mauritius) in the border-regions or pools and creeks between cascade-zones, where the current lies between 0 and 30 cm/sec. Sometimes the snails are found in a surface-current of 50 cm to maximal 75 cm/sec, but in such localities they are attached below the stones or on the sides, protected against the stronger current and always in a much lower density, than in habitats with slow current and sandy-muddy botten and rich vegetation:

	0—30 cm/sec	30—50 cm/sec	50—75 cm/sec
La Réunion: 20—60 ind./1/16 m ² (sometimes up to 120 ind./1/16 m ²)		5—20 ind./1/16 m ²	sporadic
Mauritis: 30—60 ind./1/16 m ² (sometimes up to 120—180 ind./1/16 m ²)		5—20 ind./1/16 m ²	sporadic

The highest density was counted in the middle courses and transitions to the lower courses, if the rivers cross the cultivated areas with plantations and villages nearby. In such parts, influenced by fertilizers and organic sewage, a high production of algae and submerged water-plants is the base for an enormous development of water snails.

	Temperatures		Chemistry	
		pH	conductivity	total hardness
La Réunion:	18.2° C—24° C	7.4—8.8	102—258 µS	1.1°—8.8° dH
Mauritius:	19.4° C—25.7° C	6.6—8.2	66—220 µS	1° —4.25° dH
Range:	18.2° C—25.7° C	6.6—8.8	66—258 µS	1° —8.8° dH

In the upper courses of the running waters of Mauritius with a very low content of mineral-salts and very soft, slightly acidic water the frequency of *Lymnaea (Radix) mauritiana* is very low and in the headwaters with a pH of 6, a conductivity below 50 µSiemens and a total hardness of only 0.3° dH the species does not occur, as in all other freshwater-gastropods!

In some localities many young specimens, spawn and specimens in copulation were found in April (La Réunion) and May (Mauritius). The species was also found on wet rock localities with a very thin water-film or sprayed water.

Geographical range: Mascarene Archipelago: La Réunion, Mauritius, Rodriguez.

Family: Planorbidae

Subfamily: Planorbinae

Genus: *Planorbella* HALDEMAN, 1842

25) *Planorbella* (= *Helisoma*) *duryi* (WETHERBY, 1979)

Lit.: 1879, *Planorbis* (*Helisoma*) *duryi* (WETHERBY, J. Cincinnati Soc. Nat. Hist., 2: 93–100; fig. 4) — 1979 *Helisoma duryi* (FRANDSEN & MADSEN, Acta Tropica, 36: 67–84).

Locality: Mas: Ré: No. 17 (71 ind.).

Shell: The found shells are dicoidal with a slight tendency to be pseudo-dextral, moderately large, the base much less concave or almost flat; periphery rounded, narrowly and irregularly striated by growth striae; last whorl occasionally of irregular shape, with inflations and constrictions; the specimens from La Réunion with five whorls, rapidly increasing in diameter, the last whorl large and dilated towards the aperture; brown yellowish, corroded shells whitish; aperture broad sickle-shaped; peristome rounded and without an angle, sharp and not continuous (Pl. 8, Fig. 53a, b). These shells we have determined for *Indoplanorbis exustus* (DESHAYES, 1834), but the Danish Bilharziasis Laboratory (F. FRANDSEN), which has studied material from Réunion also by dissections found out, that the shells are belonging to *Planorbella* (= *Helisoma*) *duryi*. The shells of these two species are nearly identically and the determination is only possible after the genital organs.

Sizes (in mm):

Locality	Height	Shell		Aperture	
		Diameter		Height	Diameter
Mas: Ré: No. 17	7	14.7		5	8.5

The measurements are from the largest specimens in the sample.

Anatomical records: The soft bodies of the specimens from La Réunion were decomposed; a dissection was not possible, only jaw and radula could be prepared: jaw: middle portion wide and low, striated on its outer face

Fig. 69

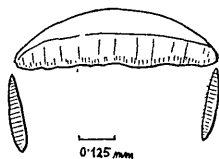
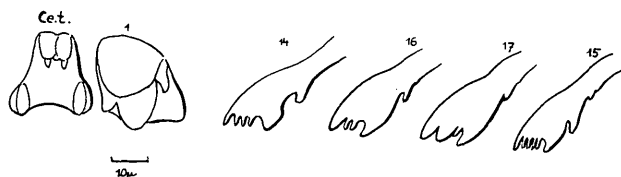


Fig. 69. *Planorbella* (= *Helisoma*) *duryi*: Jaw

and slightly bent downwards at the end (Fig. 69); radula: about 23–25 teeth on each of half row; central tooth with broad base, concave incised, cutting edge small, bicuspid; first laterals tricuspid, the marginals with four to six central denticles and 1–2/3 cusps on the outer side (Fig. 70).

Fig. 70

Fig. 70. *Planorbella* (= *Helisoma*) *duryi*: Radula-teeth

Ecological-biological remarks: *Planorbella duryi* was never before recorded in waters of La Réunion; it must be introduced after a letter-information of F. FRANDSEN passively (waterplants). Our specimens were found in the lower course of the River St. Denis, near the capital of the island. The surroundings are scrub and plantations but also some suburb-villages; therefore influence of organic sewage is presumed. This deposit of organic mud on the borders and a very rich development of algae and water-plants form the base for a rich development of freshwater-gastropods.

Planorbella duryi was found in a density of 50 to 60 individus/1/16 m² in the zones of the banks and pools (0–30 cm/sec) and with about 5 to 30 individus/1/16 m² in parts with a surface-current of 30–50 cm/sec. Adult specimens were often in copula, and spawn was found on stones and water plants. The species was associated with *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica* and *Ferrissia* (*Pettancylus*) sp.

Temperature	Chemistry		
	pH	conductivity	total hardness
23.2° C	8.4	105 µS	2.5° dH

Geographical range: The "locus typicus" of *Planorbella duryi* are the Everglades in Florida, USA. After information of the Danish Bilharziasis Laboratory these species is introduced (accidentally or by men, waterplants waterbirds) in many subtropical and tropical countries and islands (Mauritius, COURTOIS, 1973 in FRANDSEN & MADSEN, 1979: 70).

Genus: *Gyraulus* CHARPENTIER, 1837

26) *Gyraulus mauritianus* (MORELET, 1876)

Lit.: 1876 *Planorbis mauritianus* (MORELET, J. de Conch., 24: 91; Pl. 3, Fig. 7) — 1880 *Planorbis mauritianus* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresfauna Ins. Mauritius: 210) — 1882 *Planorbis mauritianus* (MORELET, J. de Conch., 30: 104) — 1910 *Planorbis mauritianus* (KOBELT, Abh. senck. nat. Ges., 32: 94) — 1921 *Planorbis* (*Gyraulus*) *mauritanensis* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 231).

Localities: Sey: M: No. 1 (62 ind.), No. 4 (1 ind.), No. 5 (1 ind.); Mas: Mau: No. 3 (1 ind.), No. 6 (35 ind.), No. 16 (3 ind.).

Shell: Descriptions are given by MORELET (1876); GERMAIN (1921). After checking our specimens, D. S. BROWN (Dept. of Zoology, Exper. Taxonomy, British Museum), specialist for African Planorbidae, wrote to us (letter from 22. 1. 1976): "It was quite a surprise to find that MORELET's *Planorbis mauritianus* is a true *Gyraulus* ...". Also GERMAIN (1921) has found, that the shells of *mauritianus* are closely related to the variable oriental species *Gyraulus saigonensis* (CROSSE & FISCHER, 1863) a synonym of *Gyraulus convexiusculus* (HUTTON, 1849 = *G. compressus*, HUTTON, 1834).

The specimens of Mahé are nearly identically with the shells (and anatomy) of the specimens from the localities of Mauritius: compressed, subconvex on the upper side and concave below (if the aperture is left!); spire with three to four whorls, separated by deep sutures; the last whorl large, convex on the periphery; fragile, translucent, yellowish, sometimes with a red-brownish coating; fine, delicate growth-striae, crossed by very fine spiral-striae (enlargement: $50\times$!); aperture slightly oblique, oval-rounded (Pl. 8; Fig. 54a, b; 55a, b).

Sizes (in mm):

Localities	Maximal Diameter	Minimal Diameter	Height
Sey: M: No. 1	3.6	no measurements!	1
No. 4	2.6	no measurements!	
No. 5	2.7	no measurements!	
Mas: Mau: No. 3	3.4	2.9	0.95
No. 6	3.5	2.9	1
No. 16	3	2.5	0.8

The measurements are from the largest specimens in the samples.

Anatomical remarks: Mantle surface with two dark blue longitudinal stripes, which have lateral branches; in the upper whorls the digestive gland and intestine shine through the translucent, unpigmented skin (Fig. 71a, b; 78); the pseudobranch on the left side is a small lobe with a free, rounded margin; on the inner surface the anal-aperture on the right side of the channel-shaped mantle lobe (Fig. 72; 79); the long-stretched kidney with its excretory duct shows external folds (Fig. 73); jaw: composed of large plates, concave curved on the cutting edge (Fig. 74); radula: about fifteen teeth in each half row: central tooth bicuspid; first laterals (no. 1—10) tricuspid with prominent denticles, sometimes the third denticle divided in two small cusps; the marginals with $1/2+1+2$ cusps (Fig. 75; 80); genital organ-system: receptaculum seminis globular and with a short duct to the lower part of the vagina (Fig. 76; 81); prostate is composed of seven unbranched diverticula, arising from a common duct which is branched from the vas deferens (Fig. 82); the vas deferens enters a penis sheat from the same distances as the praeputium, and

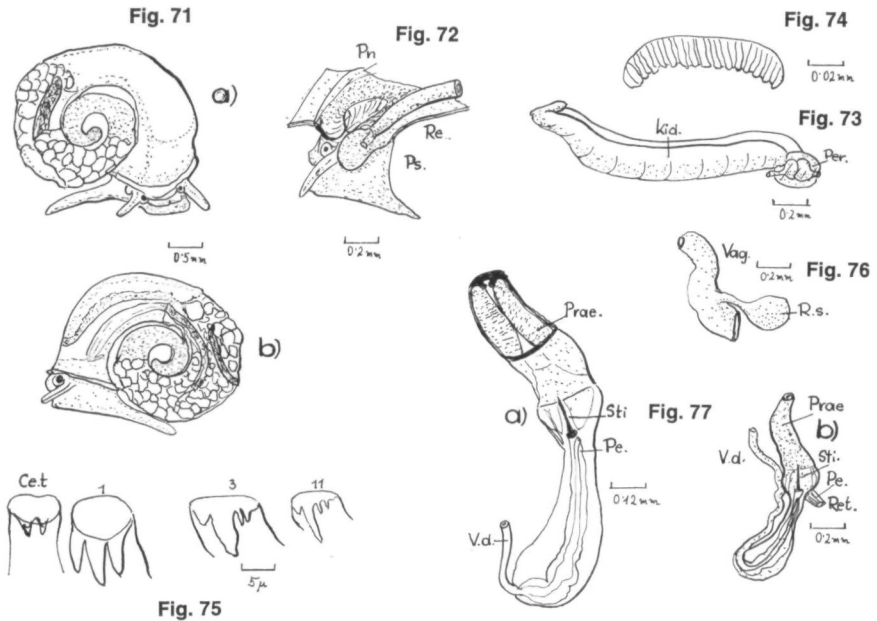


Fig. 71. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): a) soft body; b) soft body

Fig. 72. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): Pseudobranch, rectum and pneumostome

Fig. 73. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): Pericard and kidney

Fig. 74. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): Jaw

Fig. 75. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): Radula-teeth

Fig. 76. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): Receptaculum seminis and lower part of the vagina

Fig. 77. *Gyraulus* cf. *mauritianus* (from Mahé, Seychelles): a) Lower part of the vas deferens, penis with stilet and praeputium (partly in longitudinal-section); b) Lower part of the vas deferens, penis with stilet and praeputium

is only slightly smaller than the praeputium with two muscle pillars; the penis has a prominent stilet with a rounded base, the male aperture lies immediately proximal to the stilet (Fig. 77a, b; 83a, b).

Ecological-biological remarks: *Gyraulus* cf. *mauritianus* was found in the rivers of Mahé (Seychelles) only in parts which are slightly polluted by organic sewage near villages and plantations. On the borders with a current of 0–30 cm/sec they were found on muddy stones — in one station together with *Melanoides tuberculata* — from sporadic to a density of 15 individus/1/16 m².

In similar habitats occurs the species in the slow-flowing streams of Mauritius, especially if the influence of organic sewage is evident. The density was mostly sporadic, high in only one locality with about 50 to 60 individus/1/16 m². They are mostly associated with *Thiara scabra*, *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana* and *Physa borbonica*.

	Temperatures	Chemistry		
		pH	conductivity	total hardness
Mahé (Seychelles):	23.5° C—26.3° C	6.6—7.2	46—116 μ S	0.33°—1.39° dH
Mauritius	20.9° C—23.8° C	7 —8.2	69—155 μ S	1° —2.8° dH
Range:	20.9° C—26.3° C	6.6—8.2	46—155 μ S	0.33°—2.8° dH

Geographical range: Endemic for Mauritius; probably passively introduced in Mahé (Seychelles) by water plants, where our collections are the first record. *Gyraulus mauritianus* is near related to the widely distributed oriental-oceanic species *Gyraulus convexiusculus* with many forms.

Genus: *Afrogyrus* BROWN & MANDAHL-BARTH, 1973

Subgenus: *Afrogyrus* s. str.

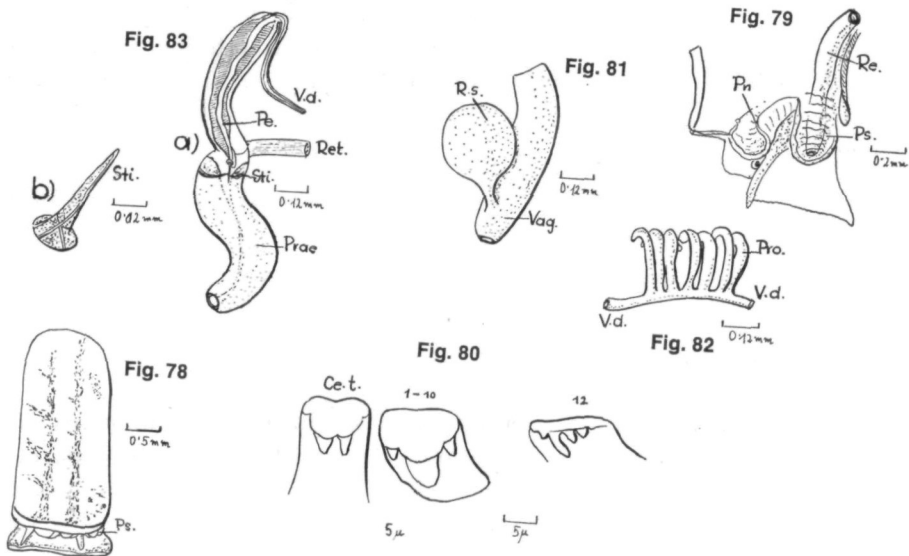


Fig. 78. *Gyraulus mauritianus*: Soft body with pigmentation

Fig. 79. *Gyraulus mauritianus*: Pseudobranch, rectum and pneumostome

Fig. 80. *Gyraulus mauritianus*: Radula-teeth

Fig. 81. *Gyraulus mauritianus*: Receptaculum seminis and lower part of the vagina

Fig. 82. *Gyraulus mauritianus*: Prostata-gland

Fig. 83. *Gyraulus mauritianus*: a) Lower part of the vas deferens, penis with stilet and praeputium; b) stilet

27) *Afrogyrus* (*Afrogyrus*) *rodriguezensis* (CROSSE, 1873)

Lit.: 1874 *Planorbis rodriguezensis* (CROSSE, J. de Conch., 21: 144) — 1874 *Planorbis rodriguezensis* (CROSSE, ibid., 22: 232; Pl. 8, Fig. 8) — 1880 *Planorbis rodriguezensis* (MARTENS, Moll., in MÖBIUS: Beitr. Meeresf. Ins. Mauritius: 210) — 1886 *Planorbis rodriguezensis* (CLESSIN, in M. & CH., Conch. Cab., 2 (17): 216) — 1910 *Planorbis rodriguezensis* (KOBELT, Abh. senck. nat. Ges., 32: 96) — 1921 *Planorbis* (*Gyraulus*) *rodriguezensis* (GERMAIN, Mém. Soc. zool. France; suppl. 1920: 232).

Localities: Mas: Ro: No. 1 (26 ind.), No. 2 (5 ind.), No. 3 (3 ind.).

Shell: D. S. BROWN (Dept. of Zoology, Exper. Taxonomy; British Museum) an expert on African Planorbidae, wrote to us (22nd November 1976) checking the specimens of the samples, collected by P. BRINCK & P. H. ENCKELL (Swedish-Mission 1973) at Rodriguez: "It was quite a great surprise to find . . . whereas CROSSE's *Planorbis rodriguezensis* is an true *Afrogyrus*. "The new genus *Afrogyrus* with two subgenera *Afrogyrus* s. str. and *Hovorbis* were created by BROWN & MANDAHLE-BARTH, 1973 (Proc. malac. Soc. London, 40: 290; Fig. 3i, j, k) from the development of the penial stylet.

Descriptions of the shell are given before by CROSSE (1873, 1874) and by GERMAIN (1921). The specimens of the Swedish-Mission — collections have a lentil-shaped, depressed shell with a large sinked upper surface but nearly plane below (aperture seen from left side!); three-three and half whorls rapidly increasing, separated by distinct sutures; body-whorl big and rounded, ascending to the aperture (seen from the left side) which is oblique and transverse-oval; delicate dense, sometimes slightly ribbed growth-lines; translucent, yellowish, aperture withish, borders united by a fine callus (Pl. 8; Fig. 56).

Sizes (in mm):

Localities	Maximal Diameter	Minimal Diameter	Height
Mas: Ro: No. 1	4.2	3.6	1.4
No. 2	3.6	3	1.2
No. 3	3.2	2.6	0.9

The measurements are from the largest specimens in the samples.

Anatomical remarks: Head, tentacles and mantle outside-surface dark blue pigmented, except the mantle-border and the translucent parts of the kidney (Fig. 84); pseudobranch a small lobe with a free, rounded margin, on the inner surface the anal aperture, on the right side, the channel-shaped mantle fold at the pneumostome (Fig. 85); salivary glands: sausage-shaped and connected behind in a half-circle; jaw: composed by many cuticular-plates, the free cutting-edge slightly concave and serrated (Fig. 86); radula: about 17—18 teeth on each half-row: central tooth distinct bicuspid; laterals from 2 to 9/10 also bicuspid, the inner cusp much larger than the outer denticle; marginals with three to four denticles in the formula 1+1+1/2 (Fig. 87); genital organ-system: receptaculum seminis globular and with a short, relatively thick duct to the lower part of the vagina (Fig. 88); the prostate-gland on the male tract with ten unbranched diverticula; penis-sheat and penis of about the same length, the distal part of the sheat somewhat enlarged, the penis possesses on its top a very small, simple stylet, the opening is lateral just behind the base of the stylet (Fig. 89a, b).

Ecological-biological remarks: The specimens from the collections of the Swedish Mission 1973 were associated with *Thiara scabra*, *Melanoides*

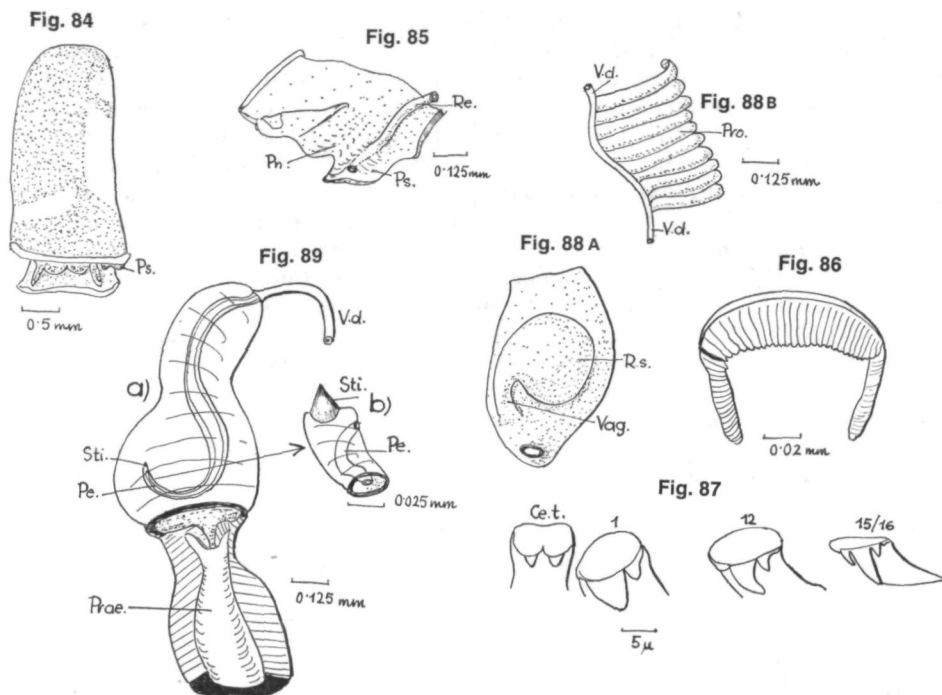


Fig. 84. *Afroggyrus (Afroggyrus) rodriguezensis*: Soft-body with pigmentation

Fig. 85. *Afroggyrus (Afroggyrus) rodriguezensis*: Pseudobranch, rectum, and pneumostom

Fig. 86. *Afroggyrus (Afroggyrus) rodriguezensis*: Jaw

Fig. 87. *Afroggyrus (Afroggyrus) rodriguezensis*: Radula-teeth

Fig. 88A. *Afroggyrus (Afroggyrus) rodriguezensis*: Receptaculum seminis and lower part of the vagina

Fig. 88B. *Afroggyrus (Afroggyrus) rodriguezensis*: Prostata-gland

Fig. 89. *Afroggyrus (Afroggyrus) rodriguezensis*: a) Lower part of the vas deferens, penis and praeputium (partly in longitudinal-section); b) Distal part of the penis with penis-opening and short stilet

tuberculata, *Lymnaea (Radix) mauritiana*, and in two stations also with *Omphalotropis rangi*. The altitude of the stations was 250 m and 400 m. No other datas were given on the labels.

Geographical range: The species is endemic for the small island of Rodriguez in the East of Mauritius. The range of the genus *Afroggyrus*, subgenus *Afroggyrus* s. str. includes, following BROWN & MANDAHLE-BARTH, 1973: "most of Africa as these snails are doubtless often overlooked."

Subgenus: *Hovorbis* BROWN & MANDAHLE-BARTH, 1973.

28) *Afroggyrus (Hovorbis)* cf. *crassilabrum* (MORELET, 1860)

Lit.: 1860 *Planorbis crassilabrum* (MORELET, Sér. Conch., 2: 96; Pl. 6, Fig. 8) — 1860 *Planorbis trivialis* (MORELET, ibid.: 97; Pl. 6, Fig. 7) — 1863 *Planorbis (Nautilina) caldwelli* (TRISTRAM, Proc. zool. Soc. London, 1863: 51) — 1878 *Planorbis crassilabrum*

(KOBELT, Jb. dtsch. malak. Ges., 5: 180; *Planorbis trivialis*: 180) — 1879 *Planorbis trivialis* (MORELET, J. de Conch., 27: 312; *Planorbis crassilabrum*: 312) — 1881 *Planorbis crassilabrum* (CROSSE, ibid., 29: 202) — 1882 *Planorbis trivialis* (MORELET, ibid., 30: 197) — 1883 *Planorbis hildebrandti* (MARTENS, Jb. dtsch. malak. Ges., 10: 83) — 1886 *Planorbis crassilabrum* (CLESSIN, in M. & CH., Conch. Cab. 17: 150; Pl. 22, Fig. 6; *Planorbis trivialis*: 196; Pl. 29, Fig. 7) — 1891 *Planorbis* sp. (VOELTZKOW, Zool. Anz., 14: 217) — 1894 *Planorbis alluaudi* (DAUTZENBERG, J. de Conch., 42: 101; Pl. 4, Fig. 2; *Planorbis simpliculus*: 101; Pl. 4, Fig. 1) — 1905 *Planorbis madagascariensis* (pars) (ANCEY, ibid., 53: 320) — 1909 *Planorbis trivialis* (GERMAIN, Arch. Zool. Exp. Gén. (5), 1: 121) — 1910 *Planorbis (Tropidiscus) trivialis* (KOBELT, Abh. senck. nat. Ges., 32: 90; *Planorbis (Tr.) crassilabrum*: 90) — 1910 ?*Planorbis dixonii* (NEWTON, Ann. Mag. nat. Hist. (8), 5: 8; Pl. 1, Fig. 6, 7) — 1916 *Planorbis (Tropidiscus) trivialis* (GERMAIN, Ann. Pal., 10: 39; Pl. 5, Fig. 9) — 1918 *Planorbis (Planorbis ?) hildebrandti* (GERMAIN, Bull. Mus. Hist. nat., 24: 46; *Planorbis (Tropidiscus) trivialis*: 48; *Planorbis (Tr.) simpliculus*: 49; *Planorbis (Tr.) alluaudi*: 50; *Planorbis (Gyraulus ?) crassilabrum*: 50) — 1929 *Planorbis (Planorbis) trivialis* (HAAS, Zool. Jb. (Syst.), 57: 419) — 1935 *Planorbis (Gyraulus) crassilabrum* (GERMAIN, Ann. Sci. Nat. (10), 18: 442; *Planorbis (Planorbis) trivialis*: 442) — 1953 *Planorbis trivialis* (GRJÉBINE & MENACHÉ, Mem. Inst. Sci. Madagascar (A), 8: 87; *Planorbis crassilabrum*: 87) — 1956 *Anisus crassilabrum* (RANSON, OMS Conf. Afr. Bilh. Brazzaville (34): 6; Fig. 4) — 1958 *Anisus crassilabrum* (BRYGOO, Arch. Inst. Pasteur, Madagascar, 26: 66) — 1969 *Anisus (Anisus) crassilabrum* (STARMÜHLNER, Malacologia, 8 (1/2): 307; Fig. 420–451) — 1973 *Afrogyrus (Hovorbis) trivialis* (BROWN & MANDAHL-BARTH, Proc. malac. Soc. London, 40: 292; Fig. 3k, 4c, d).

Locality: Co: G.Co: No. 1 (46 ind.).

Shell: After examining the shell (and the anatomy) of the specimens from Grand Comore, Dr. D. S. BROWN (Dept. of Zoology, Exper. Taxonomy, British Museum) wrote (22 November 1976) to us: "the snails from Grand Comore are interesting because the bluntly angular shell seems different from the carinate shells from Madagascar which I regard as *trivialis*." After checking the material of *Afrogyrus* from the collection of the Austrian Mission 1958 to Madagascar (STARMÜHLNER, 1969) D. S. BROWN wrote, that he also found, as stated by STARMÜHLNER (1969), all transitions in the shells from non-carinate to carinate in the madegassian specimens of *Afrogyrus*. The species name for these varying Madegassian species-group, occurring also on the Comoro-Islands, therefore shall be given as *Afrogyrus (Hovorbis) crassilabrum* (this species name is given by MORELET, 1860 one page (96) before *trivialis* (97) and has priority).

The new genus *Afrogyrus* and the subgenus *Hovorbis* were created by BROWN & MANDAHL-BARTH, 1973. As cited above, *Afrogyrus* is distinguished from all other Planorbidae (with the exception of *Armiger*) by the possession of a very small, simple stylet. Subgenus *Hovorbis* with one species *Afrogyrus (Hovorbis) crassilabrum* MORELET, 1860 (by BROWN & MANDAHL-BARTH: *trivialis* MORELET, 1860) has a comparatively large shell, completing five whorls with four to nine diameter; the depressed last whorl is bluntly (f. *crassilabrum* s. str.) with transitions to angulated with a fringe of periostracum (f. *trivialis*); fine, delicate growth-striae, fragile, translucent, yellowish; aperture oblique (Pl. 8, Fig. 57).

Sizes (in mm):

Locality	Shell		Aperture	
	Maximal Diameter	Minimal Diameter	Height	Diameter
Co: Gr.Co: No. 1	4.5	3.8	1	1.2

The measurements are from the largest specimen in the sample.

Anatomical remarks: According to BROWN & MANDAHL-BARTH, 1973 the most important characteristic of the subgenus *Hovorbis* is the short basal projection of the penial stylet; also found on the specimens of Grand Comore (Fig. 90a, b); on the female duct of Madegassian specimens BROWN & MANDAHL-BARTH have never observed "neither a receptaculum seminis (= spermatheca) nor a duct though a vaginal swelling is present". STARMÜHLNER (1969) has described and figured from a Madegassian specimen a receptaculum with a very short duct. BROWN & MANDAHL-BARTH, 1973 have checked some specimens from the Madegassian material of the Austrian Mission 1965 and have found only a vaginal swelling. Examining the specimens from Grand Comore

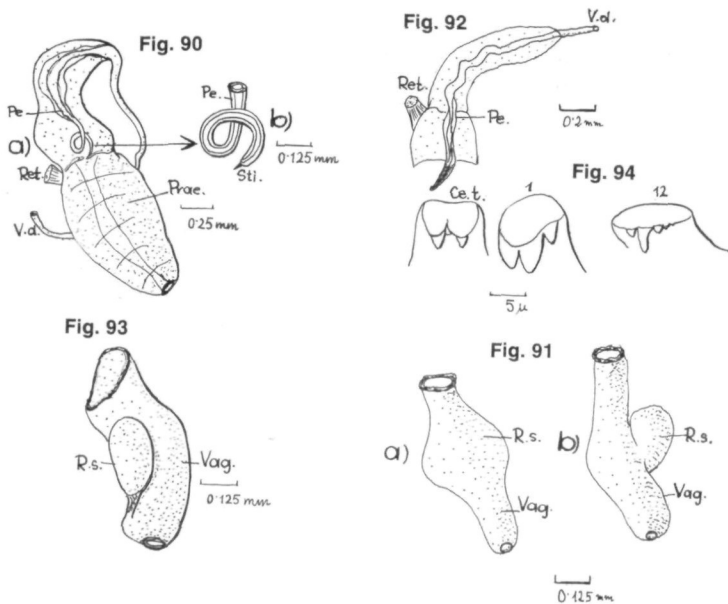


Fig. 90. *Afrogyrus (Hovorbis) crassilabrum*: a) Lower part of the vas deferens, penis and praeputium; b) Distal part of the penis with penis-opening and stilet

Fig. 91. *Afrogyrus (Hovorbis) crassilabrum*: a) Receptaculum seminis and vaginal-swelling; b) Receptaculum seminis on the lower part of the vagina

Fig. 92. *Ceratophallus* sp., Lower part of the vas deferens, penis without distinct sclerotisation and with terminal opening in the proximal part of the praeputium

Fig. 93. *Ceratophallus* sp.: Receptaculum seminis and lower part of the vagina

Fig. 94. *Ceratophallus* sp.: Radula-teeth

we found sometimes a vaginal swelling, but in some specimens also a separate oval receptaculum but without a distinct duct, close to the vagina. It seems there are transitions between a simple vaginal swelling and a separate sac-shaped appendage. This would explain that sometimes only a vaginal swelling was found, but other specimens had a separate receptaculum, but close to the vaginal duct (Fig. 91a, b).

The mantle surface were slightly dark blue pigmented; the pseudobranch is simple with a free border, on the right with the pneumostome-fold; radula: 17—18 teeth half-row: central-tooth symmetrical, bicuspid; laterals tricuspid (formula: 1+1+1) to the 9/10th tooth; the marginals with four cusps of different sizes.

Ecological-biological remarks: Collected in a cistern of a village near Moroni filled with rain-water; the cemented walls were covered with filamentous green-algae; chemistry: pH: 8.1 — conductivity: 118 μ Siemens — total hardness: 2.58° dH.

Geographical range: Madagascar, Nossi-Bé; Grand Comore (probably passively introduced?).

Genus: *Ceratophallus* BROWN & MANDAH-BARTH, 1973.

29) *Ceratophallus* sp.

Lit.: 1973 *Ceratophallus*: new genus (BROWN & MANDAH-BARTH, Proc. malac. Soc. London, 40: 287; as type-species: *Planorbis natalensis* KRAUSS, 1848; Pl. 5, Fig. 9).

Localities: Co: A: No. 5 (12 ind.), No. 6 (18 ind.).

Shell: The new genus *Ceratophallus* was created by BROWN & MANDAH-BARTH, 1973 (type-species: *Planorbis natalensis* KRAUSS, 1848: Pl. 5, Fig. 9) and is distinguished from all other Planorbidae by an anatomical characteristic, by the long progressively sclerotized distal part of the penis, through which the vas deferens passes to the near terminal male aperture. The flat discoidal shell of the specimens found in Anjouan have a flattened underside and an almost horizontal last whorl; very fine, delicate growth-striae; three to four whorls, translucent, yellowish; aperture oblique, basal margine slightly projected (Pl. 8, Fig. 58a, b).

Sizes (in mm):

Localities	Maximal Diameter	Minimal Diameter	Height
Co: A: No. 5 (iuv.)	2.4	2.1	0.6
No. 6	4.3	2.7	0.8

The measurements are from the largest specimens in the samples.

Anatomical records: BROWN wrote in a letter (22nd November 1976): ... "the snails from Anjouan I think are a small form of *Ceratophallus* (lacking obvious sclerotisation on the penis, but having a clearly terminal opening)."

Our dissections confirm this statement (Fig. 92). On the female duct an ovoid receptaculum seminis with a short duct to the lower part of the vagina is developed (Fig. 93). The outside of the mantle is translucent and only slightly pigmented; head and tentacles are dark blue; on the small rounded pseudo-branch lies the anal-aperture on the inner surface and at the right the pneumostome-lobe; the radula with about 17 teeth each half-row: central-tooth bicuspid; the laterals tricuspid and the marginals with the formula: $1+1+2/3$ (Fig. 94).

Ecological-biological remarks: The snails were found in localities with nearly no current, in creeks near the borders of rivers and in flooded pools adjacent to the rivers, rich with filamentous algae. They were associated with *Lymnaea (Radix) natalensis* and *Melanoides tuberculata*.

Temperatures	Chemistry		
	pH	conductivity	total hardness
24° C—26.3° C	6.8—8.4	180—225 μ S	3.5°—5.5° dH

Geographical range: According to BROWN & MANDAHLE-BARTH (1973) the geographical range of *Ceratophallus* includes Eastern Africa from Eritrea to Cape Province. The type species *Ceratophallus natalensis* has according to the authors an extensive range, found in a variety of habitats including temporary pools. In Eritrea the species is so variable that BROWN (1965) suggested the existence of a species-group and he thinks that a further analysis of variation over a greater geographical area is desirable. It is probably that the specimens from Anjouan also belong to the *natalensis*-group.

Family: Ferrissidae

Genus: *Ferrissia* WALKER, 1903

Subgenus: *Pettancylus* IREDALE, 1943.

30) *Ferrissia (Pettancylus)* sp.

Lit.: 1964 Studies on Ancyliidae. The Subgroups (HUBENDICK, Medd. Göteborgs Mus. Zool. Avd., 137, Ser. B, 9 (6): 72pp.) — 1969 *Ferrissia (Ferrissia) modesta* (STAR-MÜHLNER, Malacologia, 8 (1/2): 362; Fig. 506—560).

Localities: Mas: Ré: No. 17 (35 ind.); Mau: No. 4 (5 ind.).

Shell: B. HUBENDICK (Naturhistoriska Museet Göteborg) who has studied intensively the Ancyliidae of the world (but he has not critically worked out the African Ancyliidae) has checked our material and wrote to us (28 Octobre 1976): "... the one from Mauritius is free from distinct characteristics ... I really cannot say anything about that one. The one from La Réunion is a little more distinctive. It is comparatively elongate and tall. It has a radial sculpture-apart from the apical micro-sculpture-which is somewhat reminiscent of the one in *Gundlachia radiata* GUILDING from West Indies. The

Réunion-species is of course a clear *Ferrissia*, however. To me it does not seem to fit with the description of STARMÜHLNER (1969) on *Ferrissia modesta* CROSSE, occurring in Madagascar. I have not critically worked out the African Ancyliidae and therefore I cannot give any clear-cut answer."

The shells of station Ré: No. 17 are elongated oval; front side broad rounded, back side more narrow; apex on the left side and with very fine radial sculpture; irregularly stairlike growth-striae; translucent, fragile, grey-whitish (Fig. 95). The small shells of Mau: No. 4 are yellowish, covered with a reddish-brown coat; leftside apex dense and delicate radially striated (Fig. 96).

Sizes (in mm):

Localities	Maximal Diameter	Minimal Diameter	Height
Mas: Ré: No. 17	3	1.9	1.1
Mau: No. 4	2	1	0.7

The measurements are from the largest specimens in the samples.

Anatomical remarks: Dissected were some specimens from the station Ré: No. 17: Mantle translucent, the inner organs shine through; one irregularly dark blue spot lies in the anterior part between the two anterior adductor-muscles. A similar spot was described and figured by HUBENDICK (1967: 21; Fig. 75, 76) for *Ferrissia (Pettancylus) neozelandica* and also by STARMÜHLNER (1976: 627; Fig. 158) for a *Ferrissia (Pettancylus)* sp. from Tahiti. Intestine: the salivary glands are connected, the slender oesophagus is proximally extended to the anterior part of the stomach, then following is muscle-stomach and the posterior part of the stomach with an appendix and the apertures of the digestive gland-ducts; the intestine, embedded in the large digestive gland, forms a long stretched loop and with the rectal part of the left side of the body opens on the outside of the pseudobranch lobe; the kidney, connected by a short reno-pericardial-duct with the pericard, runs at first behind and goes forward following a narrow loop, forms an S-shaped loop, runs with the renal-duct again behind and opens below the pseudobranch lobe (Fig. 97, 98). The jaw: typically reversed, U-shaped and composed of small cuticular plates (Fig. 99); radula: 14 teeth in each half-row; central-tooth bicuspid, lateral-teeth tricuspid, and the marginals with three prominent cusps in the front and three to four more delicate, but acute cusps on the outer side (Fig. 100): this type of radula corresponds with the description and figure of *Ferrissia modesta* from Madagascar, given by STARMÜHLNER (1969: 366; Fig. 513). The genital-system were not dissected.

Ecological-biological remarks: The snails of the station Ré: No. 17 were found in a lower course on stones with a surface-current of 50 cm — 1 m/sec in a high density of about 200 to 250 individuals/1/16 m², associated with *Thiara scabra*, *Lymnaea (Radix) mauritiana*, *Physa borbonica* and *Planorbella* (= *Heli-*

soma) duryi. The specimens of Mauritius were found sporadically — on stones in a surface — current of 50 cm/sec, associated with *Melanoides tuberculata*, *Lymnaea (Radix) mauritiana* and *Physa borbonica* — in the transition zone between upper and middle courses of rivers.

Temperatures	Chemistry		
	pH	conductivity	total hardness
Mas: Ré: No. 17: 23.2° C	8.4	105 μ S	2.5° dH
Mau: No. 4: 21.2° C	6.65	116 μ S	1.85° dH

Geographical range: In consequence of the impossibility of an exact determination of the specimens of *Ferrissia (Pettancylus)* found at La Réunion and Mauritius, no statement of the biogeographic relation can be given at moment. It is possible that *Ferrissia* was introduced passively, like other freshwater snails of the Mascarene-Islands.

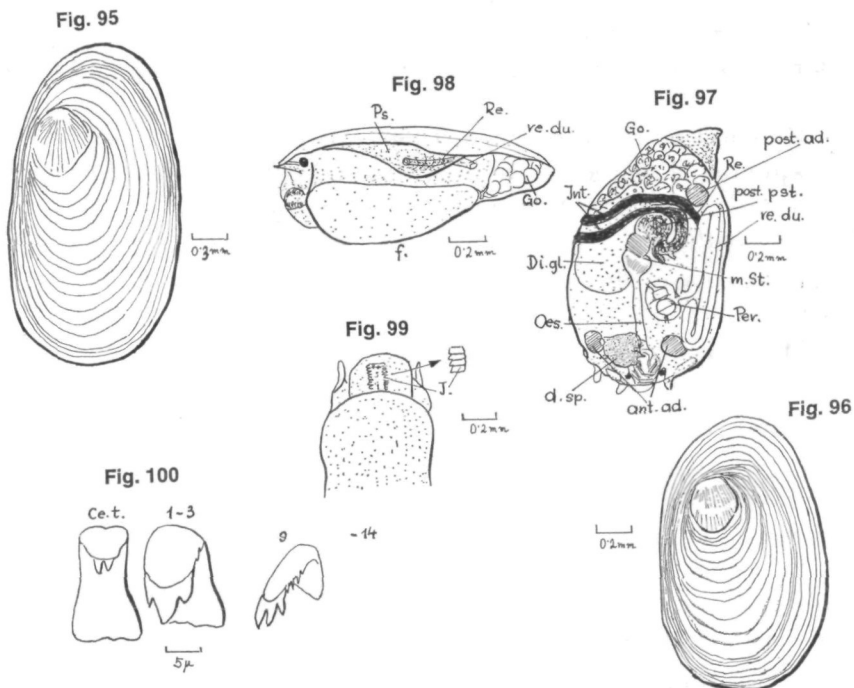


Fig. 95. *Ferrissia (Pettancylus)* sp.: Shell from station Mas: Ré: No. 17

Fig. 96. *Ferrissia (Pettancylus)* sp.: Shell from station Mas: Mau: No. 4

Fig. 97. *Ferrissia (Pettancylus)* sp.: Translucent soft-body, seen from the upper-side

Fig. 98. *Ferrissia (Pettancylus)* sp.: Soft-body seen from the left side: pseudobranch, rectum and renal-duct opening

Fig. 99. *Ferrissia (Pettancylus)* sp.: Mouth with jaw, seen from the under-side

Fig. 100. *Ferrissia (Pettancylus)* sp.: Radula-teeth

7. General Part

7.1 Longitudinal Distribution of the Collected Species of Freshwater-Gastropods in the Running Waters of the Islands

7.1.1 SEYCHELLES

A) Mahé

a) Headwaters to Upper courses (600 m—400 m):

Temp.: 21.6° C — Ch.: pH: 5.3; T.H.: 0.095° dH; El₂₀: 33 µS.

Found species: Freshwater Gastropods absent!

b) Upper to Middle courses (400 m—200 m):

Temp.: 23.5° C — Ch.: pH: 6.6; T.H.: 0.55° dH; El₂₀: 47 µS.

b¹) Banks and pools (0—30 cm/sec):

Found species: *Gyraulus* cf. *mauritanus*.

c) Middle to Lower courses (200 m—10 m):

Temp.: 24.4° C—26° C — Ch.: pH: 6.5—6.9; T.H.: 0.15°—0.65° dH; El₂₀: 33—54 µS.

c¹) Banks and pools (0—30 cm/sec):

Found species: *Lymnaea* (*Radix*) cf. *natalensis*, *Gyraulus* cf. *mauritanus* (in polluted area with pH: 7.2; T. H.: 1.39° dH; El₂₀: 116 µS; *Melanoides tuberculata*).

c²) Medium to strong current (30 cm/sec—1 m/sec):

Found species: From about 40 m altitude: *Neritina pulligera stumpf* and *knorri*, *Septaria borbonica*; from about 20 m altitude: *Neritina* (V.) *gagates*, *Neritilia consimilis*.

d) Lower courses (10 m—1 m):

Temp.: 28° C — Ch.: pH: 6.8; T.H.: 0.2° dH; El₂₀: 35 µS.

d¹) Medium to strong current (30 cm—1 m/sec):

Found species: *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*.

e) Mouth-region (1 m—0 m):

Temp.: up to 32° C — Ch.: El₂₀: 20.000 µS (brackish).

e¹) Brackish pools (no current):

Found species: *Terebralia palustris*.

e²) Low to Medium current (10 cm—30 cm/sec):

Found species: *Melanoides tuberculata* (pigmy-population!), *Syncera* (= *Assimineae*) *nitida*, *Melampus* cf. *caffer*.

These lists establish the following results for the longitudinal distribution of freshwater gastropods in running waters of Mahé: In the headwaters and upper courses of the granitic, primary forests with acidic waters and extremely low content of mineral salts, no freshwater gastropods occur. In the transition to the middle courses, region of secondary forests and plantations the small *Gyraulus* cf. *mauritanus* was occasionally found near the banks and creeks if vegetable mud and debris are deposited. *Lymnaea* (*Radix*) cf. *natalensis* was

only found at one station in flooded pools of a rivulet. This species was probably introduced and was never before recorded from the Seychelles. In the transition from the middle to the lower courses the occurrence of species of the family Neritidae is typical as in all Indopacific islands. From about 40 to 50 m altitude *Neritina pulligera stumpfi* and *knorri* were recorded, both subspecies are restricted to the East-African islands. In a medium to strong current a population of *Septaria borbonica* was discovered with extremely thin shells. From about 20 m altitude we also found *Neritina* (V.) *gagates* and the small *Neritilia consimilis* in clusters. *Melanoides tuberculata* occurred exclusively in a polluted part of a rivulet with higher total hardness and conductivity. A pigmy population of high density was found in the brackish moth-zone. In this region near the coast the minute *Syncera* (= *Assimineae*) *nitida* and the pulmonate *Melampus* cf. *caffer* juv. are characteristic for brackish habitats. In flooded brackish pools with water-temperatures more than 30° C *Terebralia palustris* is found crawling on muddy bottom.

B) Silhouette

a) Upper courses:

Found species: *Cleopatra ajanensis* f. *silhouettensis* (collected by G. LIONNET, Mahé). No other data.

7.1.2 COMORES

A) Grand Comore

a) Stillwater-Cistern:

Temp.: Between 26° C and 28° C — Ch.: pH: 8.1; T.H.: 2.58° dH; El₂₀: 118 µS.

Found species: *Afrogyrus* (*Hovorbis*) cf. *crassilabrum*.

B) Anjouan

a) Headwaters to Upper courses (900 m—600 m):

Temp.: 20° C — Ch.: pH: 7.8; T.H.: 0.6° dH; El₂₀: 35 µS.

Found species: Freshwater Gastropods absent!

b) Upper courses (600 m—400 m):

Temp.: 22.2° C—23° C — Ch.: pH: 7 — 8; T.H.: 2.5°—3.15° dH; El₂₀: 120—142 µS.

b¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Lymnaea* (*Radix*) *natalensis*.

b²) Medium to strong current (30 cm—1 m/sec):

Found species: *Septaria borbonica*.

c) Upper to Middle courses (400 m—150 m):

Temp.: 24.3° C—26.3° C — Ch.: pH: 8.1—8.4; T.H.: 2.7°—3.5° dH; El₂₀: 117—180 µS.

c¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Lymnaea* (*Radix*) *natalensis*, *Cerato-phallus* sp.

d) Middle to Lower courses (150 m—10 m):

Temp.: 23.6°—27.3° C — Ch.: pH: 6.8—8.2; T.H.: 2.3°—5.5° dH; El₂₀: 120—255 µS.

d¹) Banks and pools (0—30 cm/sec):

Found species: *Ceratophallus* sp.

d²) Medium to strong current (30 cm—1 m/sec):

Found species: *Neritina pulligera stumpfi* and *knorri*, *Neritina* (V.) *gagates*, *Clithon spiniperda*, *Septaria borbonica*.

e) Lower courses to the Mouth-regions (10 m—0 m):

Temp.: 23.6°—26.5° C — Ch.: 7.4—8.1; T.H.: 1°—3.9° dH; El₂₀: 43—216 µS.

e¹) Medium to strong current (30 cm—1 m/sec):

Found species: *Clithon spiniperda*, *Clithon chlorostoma* f. *comorensis*, *Neritina pulligera stumpfi*, *Neritina* (V.) *gagates*, *Septaria borbonica*, *Neritilia consimilis*.

At the Comores-Archipelago there are no running waters on young volcanic island of Grand Comore. In the cisterns filled with collected rain-water the only recorded species was *Afrogyrus* cf. *crassilabrum*, probaly introduced from Madagascar. On the older volcanic island of Anjouan with torrents on steep slopes no freshwater-gastropods occur in the headwaters with very low hardness and conductivity. In the upper courses, near the borders and banks with low surface-current and in pools (and thanks for drinking waters nearby the rivulets) only *Melanoides tuberculata* and *Lymnaea* (*Radix*) *natalensis* were recorded. On the transition to the middle courses and downstream to the lower courses a small *Ceratophallus* sp. is also represented.

From the transition of the middle to the lower courses, downstream to the mouth, the family Neritidae dominates with some species in the medium to strong current of cascades, such as *Neritina pulligera knorri* and *stumpfi*; in lower parts succeeded by *Neritina* (V.) *gagates*; and on the transition to the lower courses downstream to the influence of brackish-water from recurrent flow of high-tides *Clithon spiniperda* and *Clithon chlorostoma* f. *comorensis* are typically found. In parts with strong currents, such as cascades and waterfalls, *Septaria borbonica* is attached to the surface of rocks and boulders. Near the water surface was recorded the small *Neritilia consimilis* in clusters.

7.1.3 MASCARENE

A) La Réunion

a) Headwaters (2500 m—1500 m):

Temp.: 15°—16° C — Ch.: pH: 7; T.H.: 1.15° dH; El₂₀: 52 µS.

Found species: Freshwater Gastropods absent.

b) Upper courses (1500 m—700 m):

Temp.: 15.2°—18.2° C — Ch.: pH: 8; T. H.: 3° dH; El₂₀: 130 µS.

b¹) Banks and pools (0—30 cm/sec):

Found species: *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

c) Upper to Middle courses (700 m—200 m):

Temp.: 17.8°—23.4° C — Ch.: pH: 7.7—8.3; T.H.: 1.1°—5.25° dH; El₂₀: 62—250 µS.

c¹) Banks and pools (0—30 cm/sec):

Found species: *Thiara scabra*, *Omphalotropis picturata* (sporadic in water, mostly outside at wet border), *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

d) Middle to Lower courses (200 m—50 m):

Temp.: 19°—24° C — Ch.: pH: 7.4—8.6; T.H.: 8.8° dH; El₂₀: 52—258 µS.

d¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*.

d²) Medium to strong current (30 cm/sec—1 m/sec):

Found species: *Neritina (V.) gagates*, *Septaria borbonica*, *Neritilia consimilis* (lower courses only!)

e) Lower courses to the Mouth-regions (50 m—0 m):

Temp.: 22.1°—26.6° C — Ch.: pH: 7.2—8.4; T.H.: 1°—2.5° dH; El₂₀: 62—105 µS.

e¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Lymnaea (Radix) mauritiana*, *Physa borbonica*, *Planorbella (= Helisoma) duryi*.

e²) Medium to strong current (30 cm/sec—1 m/sec):

Found species: *Neritina (V.) gagates*, *Clithon coronata*, *Septaria borbonica*, *Neritilia consimilis*, *Ferrissia (Pettancylus) sp.*

f) Affluent to brackish ponds and swamps of the coast (10 m—0 m):

Temp.: 21.2° C — Ch.: pH: 8; T.H.: 10.7° dH; El₂₀: >1600 µS.

f¹) Medium current (30 cm—50 cm/sec):

Found species: *Syncera (= Assiminea) hidalgoi f. granum*.

In the headwaters of the volcanic mountains (2500 m—1500 m altitude) with low content of mineral salts, freshwater gastropods are absent. From about 1500 m altitude in the banks, creeks and pools between cascades, rich in algae, two pulmonates, *Lymnaea (Radix) mauritiana* and *Physa borbonica* occur. They are found in localities with little or no current downstream to lower courses on the coast. From an altitude from about 700 m they are associated with *Thiara scabra*, and from about 200 m also with *Melanoides tuberculata*. In one eutrophic rivulet with rich submerged vegetation *Planorbella (= Helisoma) duryi* an introduced species, was recorded. In a mountain-torrent *Omphalotropis picturata*, a terrestrial prosobranch, mostly found in wet localities, was found near the banks, partly in water.

The cascade-zones of the middle and lower courses are colonized by different species of Neritidae, such as *Neritina (V.) gagates* and *Septaria borbonica*. In the lower parts they are associated with the longspined *Clithon coronata* and the small *Neritilia consimilis*, the last always in clusters just below the water surface. On the same eutrophic rivulet, where *Planorbella*

durys was found occurs, probly also introduced, on floating waterplants and stones in the medium current the freshwater limpet *Ferrissia* (*Pettancylus*) sp.

In brackish zones near the mouth region the minute *Syncera* (= *Assimineia*) *hidalgoi* f. *granum* was attached in high density on stones and waterplants.

B) Mauritius

a) Headwaters (700 m—600 m):

Temp.: 20°—21° C — Ch.: pH: 6.1—6.5; T.H.: 0.28° dH; El₂₀: 43—54 µS.

Found species: Freshwater Gastropods absent.

b) Upper courses (600 m—400 m):

Temp.: 19.4°—20.9° C — Ch.: pH: 6.6—7.6; T.H.: 1°—1.95° dH; El₂₀: 66—97 µS.

b¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Omphalotropis gibbosa* (sporadic in water, mostly outside at wet border), *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*, *Gyraulus mauritianus*.

c) Upper to Middle courses (400 m—200 m):

Temp.: 21.2°—23.8° C — Ch.: pH: 6.6—7—9; T.H.: 1.85°—4.25° dH; El₂₀: 93—200 µS.

c¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*, *Gyraulus mauritianus*.

c²) Medium to strong current (30 cm—75 cm/sec):

Found species: *Neritina* (*V.*) *gagates*, *Clithon coronata* f. *despinosa* (both species occurring from about 300 m altitude), *Septaria borbonica*, *Ferrissia* (*Pettancylus*) sp.

d) Middle to Lower courses (200 m—10 m):

Temp.: 21.7° C—25.4° C — Ch.: pH: 7.6—8.2; T.H.: 1.55°—2.65° dH; El₂₀: 96—195 µS.

d¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Bellamya bengalensis* f. *zonata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica*.

d²) Medium to strong current (30 cm—75 cm/sec):

Found species: *Clithon coronata* (spined form from about 100 m altitude), *Neritina* (*V.*) *gagates*, *Septaria borbonica*, *Neritilia consimilis*.

e) Lower courses to the Mouth-regions (10 m—0 m):

Temp.: 22.3°—26.3° C — Ch.: pH: 7.8—8.2; T.H.: 2.3°—2.65° dH; El₂₀: 130—165 µS.

e¹) Banks and pools (0—30 cm/sec):

Found species: *Melanoides tuberculata*, *Thiara scabra*, *Bellamya bengalensis* f. *zonata*, *Lymnaea* (*Radix*) *mauritiana*, *Physa borbonica* (the last two species do not occur in the mouth-regions with brackish-water influence!).

e²): Medium to strong current (30 cm—75 cm/1 m/sec):

Found species: *Clithon coronata* (spiny form), *Neritina* (*V.*) *gagates*, *Neritina* (*Neripteron*) *auriculata* f. *mauriciae*, *Septaria borbonica*, *Neritilia consimilis*.

The headwater-streams of Mauritius are — as in the other high elevated Indian Ocean islands, such as Seychelles, Comores and La Réunion — very soft, slightly acidic and with a very low content on mineral salts. These characteristics cause the absence of freshwater gastropods.

On the banks in creeks and pools between cascades with very little or no current, and a high production of algae and submerged water-plants, the dominant gastropods from the upper courses downstream to the lower courses are the prosobranchs *Melanoides tuberculata* and *Thiara scabra*, further the pulmonate *Lymnaea (Radix) mauritiana* and *Physa borbonica*. These species occur mostly in high densities, sometimes associated with *Gyraulus mauritianus* in the upper and *Bellamya bengalensis* f. *zonata* in the middle and lower courses. All these species are to be found also in stagnant waters, such as pools, thanks, etc. At one station the land-prosobranch *Omphalotropis gibbosa* was occasionally near the border.

In the cascade-zones of the middle courses different species of Neritidae appear: *Clithon coronata* is represented from an altitude of about 300 m in the spineless form of *despinosa*. In the lower courses downstream to the mouth the typically longspined form is characteristic. *Neritina (Vittina) gagates* occurs from the middle courses at about 300 m altitude downstreams to the brackish regions of the mouth, where salt waters enters during hightide. *Neritina (Neripteron) auriculata* f. *mauriciae*, attached on the underside of stones is to be found exclusively in the lower parts of the lower courses near the influence of brackish water from high tides.

Septaria borbonica, with a streamlined shell, is always attached to the surface of rocks and stones, overflowed by the strong current (cascades, water-falls). These Neritidae occur from an altitude from about 300 m downstream to the lower courses as long as there is no brackish water present. *Ferrissia (Pettancylus)* sp., a very small pulmonate species with a caplike shell was recorded sporadically in cascade-zones between upper and middle courses. The snails were mostly attached to floating water-plants.

Neritilia consimilis, a small species of Neritidae, was recognized from the lower parts of the middle courses at 100 m altitude downstream to the mouth-region, but also outside of the influence of brackish water. The specimens are attached in clusters on stones, just below the water surface.

C) Rodriguez

From the small isolated island of Rodriguez, E of Mauritius, only a small collection of freshwater gastropods was recorded by the Lund-University-Mission of 1973.

In the small creeks only species, typically of stagnant waters or very slow current, were found: *Melanoides tuberculata* and *Thiara scabra*, besides the

pulmonate *Lymnaea (Radix) mauritiana* and *Afrogyrus (Afrogyrus) rodriguezensis*, an endemic species of an African genus of small Planorbidae.

At two localities *Omphalotropis rangi*, a terrestrial prosobranch, known from wet localities, such as borders of creeks etc., was recorded.

7.2 Zoogeographical Range of the recorded Freshwater-Gastropods of Indian Ocean Islands (Seychelles, Comores, Mascarene)

Abbreviations: Af: Africa; Co: Comores; Ma: Madagascar; Sey: Seychelles; Ré: Réunion; Mau: Mauritius; Ro: Rodriguez; I.,B: India, incl. Burma; Cey: Ceylon (Sri Lanka); Mal: Malay Archipelago; Ph: Philippines; N.G.: New Guinea; P.I.: Pacific Islands. Nossi-Bé: island of Nossi-Bé, NW of Madagascar; And: Andaman-Islands; Nic: Nicobar-Islands; N-Aus: N-Australia; Gr.Co: Grand Comore; Anj: Anjouan; int: introduced

[illegible]

Species	Palaeotropis											Australis	
	Ethiopis		Madegassis				Orientalis				Ph	Austr. s. str.	Oceanis
	Af	Co	Ma	Sey	Ré	Mau	Ro	I.,B	Cey	Mal		N.G.	P.I.
<i>Terebralia palustris</i>	+	(+)	(+)	+	(+)	(+)	(+)	+	+	+	+	(+) (N-Aus.)	—
<i>Melampus lividus</i>	+	+	+	+	+	+	+	+	(+)	—	—	—	—
<i>Melampus cf. caffer</i>	+	+	+	+	+	+	+	+	+	(+)	(+)	+	+
								(Nic.)					
								(And. Nic.)					
<i>Physa borbonica</i>	—	—	—	?	+	+	?	—	—	—	—	—	—
<i>Lymnaea (Radix) natalensis</i> s. str.	+	+	+	+	—	—	—	—	—	—	—	—	—
			(hovarum)										
<i>Lymnaea (Radix) mauritiana</i>	—	—	—	—	+	+	+	—	—	—	—	—	—
<i>Planorbella (= Helisoma) duryi</i>	A species, originating from Florida, introduced in many tropical countries!												
<i>Gyraulus mauritanus</i>	—	—	—	—	—	+	—	—	—	—	—	—	—
<i>Afrogyrus (A.) rodri-guezensis</i>	—	—	—	—	—	—	+	—	—	—	—	—	—
<i>Afrogyrus (Hovorbis) crassilabrum</i>	—	+	+	—	—	—	—	—	—	—	—	—	—
		(Gr.Co.)											
<i>Ceratophallus</i> sp.	+	+	—	—	—	—	—	—	—	—	—	—	—
		(Anj.)											
<i>Ferrissia (Pett-ancylus)</i> sp.	diff. species	—	F. (P.) modesta	—	+	+	—					different species	

7.2.1 Species with a Palaeotropis-Australis Range (including Oceanis-Region) = Indopacific Range:

Melanoides tuberculata, *Thiara scabra*, *Terebralia palustris*, *Melampus lividus*, *Melampus cf. caffer*, *Neritina (Neripteron) auriculata*-group, *Neritina (N.) pulligera*-group, *Clithon chlorostoma*-group, *Paludinella hidalgoi* f. *granum*, *Syncera (= Assiminea) nitida*.

7.2.2 Species with an Ethiopis-Madegassis-(Orientalis?) Range: *Neritina (Vittina) gagates*.

7.2.3 Species with an Ethiopis-Madegassis Range:

Lymnaea (Radix) natalensis-group (including *hovarum* from Madagascar), *Ceratophallus* sp., *Cleopatra ajanensis* (including f. *silhouettensis*).

7.2.4 Species with a Madegassis-Orientalis Range:

Septaria borbonica (the distribution eastwards the Australis Region is doubtful and perhaps a confusion with *Septaria porcellana* (including *porcellana depressa*);

7.2.5 Species with a Madegassis Range:

a) Endemic for Madagascar [passively introduced to Grand Comore-island(?)]:

Afrogyrus (Hovorbis) crassilabrum

b) Endemic for Comores-islands and Nossi-Bé:

Clithon spiniperda.

c) Endemic for the Mascarene-Archipelago: *Omphalotropis picturata*, *Omphalotropis rangi*, *Omphalotropis globosa* (also recorded from the Seychelles!), *Physa borbonica*, *Lymnaea (Radix) mauritiana*, *Gyraulus mauritianus* (probably also introduced to the Seychelles!).

d) Endemic for Rodriguez:

Agrogyrus (Afrogyrus) rodriguezensis

7.3 Comparison of the geographical range of the recorded species of fresh- and brackish-water gastropods from running waters of Indian Ocean islands (Seychelles, Comores, Mascarene):

7.3.1 Seychelles: From 12 recorded species in running waters are with

Palaeotropis-Australis (incl. Oceanis) Range: 54%

(Ethiopis ?)-Madegassis-(Orientalis) Range: 7.5%

Ethiopis-Madegassis Range: 15.5%

Madegassis-Orientalis Range: 7.5%

Madegassis Range: 15.5%

This list indicates that the majority of gastropods in the running waters of the Seychelles have a wide geographic range in the Indopacific. No endemic species occur in the Seychelles Archipelago, with exception of a forma of the Eastafrican *Cleopatra ajanensis* (anatomy unknown, onyl shells recorded). This species is the only old faunistic element in the freshwater gastropod fauna of these islands. The genus *Cleopatra* is typical of the Ethiopian Region, including the Madegassian Subregion (with endemic species). The near related genus *Paludomus* occurs with many endemic species (and an endemic subgenus: *Tanalia*) in Ceylon and other parts of the Oriental Region (STARMÜHLNER 1969; 1974).

An other Ethiopic element is *Lymnaea (Radix)* cf. *natalensis*, but probably passively introduced by man to Mahé. Only from the Madegassian Subregion are recorded two species of *Omphalotropis*, a genus of landprosobranchs and found only occasionally in water on the borders of running waters. The genus with many species is distributed on different Indian Ocean islands.

Gyraulus cf. *mauritianus*, recorded on Mahé, was probably passively introduced by Indian immigrants from Mauritius. *Neritina pulligera*, widely distributed on the coasts of the Indopacific with many local forms occurs on Mahé with the subspecies *knorri* (range: SE-Africa, Comores, Madagascar, Mascarene-Archipelago) and the subspecies *stumpfi* (range: Comores, island of Nossi-Bé).

7.3.2 Comores

7.3.2.1 Grand Comore

The geologically youngest island of the Comores-Archipelago, Grand Comore, is lacking any running and natural stagnant waters. Rainwater is collected by the inhabitants in cisterns. In such localities was recorded *Afrogyrus* (*Hovorbis*) cf. *crassilabrum*., a highly variable species, known from Madagascar. The snail was probably introduced passively by man to Grand Comore.

7.3.2.2 Anjouan

11 recorded species of gastropods in the running waters are distributed:

Palaeotropis-Australis (incl. Oceanis) Range: 36%

(Ethiopsis?)-Madegassis-(Orientalis?) Range: 9%

Ethiopsis-Madegassis Range: 18%

Madegassis-Orientalis Range: 18%

Madegassis Range: 18%

The only endemic species for the Comores-Archipelago (including the island of Nossi-Bé) is *Clithon spiniperda*. A related species, *Clithon bicolor*, is known from the Malay Archipelago (STARMÜHLNER, 1969). *Neritilia consimilis* was recorded from all islands of the Madegassian Subregion and is very near related to the Pacific species *Neritilia rubida* (see STARMÜHLNER, 1976). *Clithon chlorostoma*, recorded from different Pacific islands (STARMÜHLNER, 1976) is after our opinion identical with *Clithon comorensis*, described from Anjouan. The specimens recorded at Anjouan are in our opinion only a local form of the Pacific *Clithon chlorostoma*.

More than one-third of the recorded species have a wide range on the Indopacific coasts, but are represented in local forms such as the *Neritina pulligera*-group with the subspecies *knorri* and *stumpfi* in the Madegassian Subregion. Immigrated (or passively introduced by man or water-birds) from the Ethiopian Region are the pulmonate snails *Lymnaea* (*Radix*) *natalensis* and a *Ceratophallus* sp. (some species are known from Africa). *Septaria borbonica* was recorded on all islands of the Madegassian Subregion. The species is probably distributed eastwards to islands of the Oriental Region (BENTHEM-JUTTING, 1956). The record in the Australian Region (Pacific Islands, RIECH, 1937) is probably confused with *Septaria porcellana* and *S. p. depressa*. *Neritina* (*Vittina*) *gagates* is recorded from all islands of the Madegassian Subregion, but the records on the coast of SE-Africa and in the east of the Indian Ocean, from the Andaman- and Nicobar-Islands are doubtful.

7.3.3 Mascarene

7.3.3.1 La Réunion

17 recorded species of freshwater- and brackish-water gastropods (one species, *Ferrissia* (*Pettancylus*) sp. not included!) in running waters are distributed:

Palaeotropis-Australis (incl. Oceanis) Range:	48%
Tropical ubiquitous Range:	5.5%
Madegassis-Orientalis Range:	11.5%
Madegassis Range:	35%

Nearly half of the recorded gastropods in running waters are widely distributed on the coasts of the Indopacific. In contrast to the Seychelles and Comores, no species from the Ethiopian region was found. Only *Neritina* (*Vittina*) *gagates*, a characteristic species of the Madegassian Subregion, probably extended its range westward to the coast of SE-Africa.

A third of the collected species are recorded only from the Madegassian Subregion, such as *Clithon coronata*, *Neritilia consimilis* and two species of *Omphalotropis*, collected on banks of rivulets. All four species have related species in the Oriental Region, resp. on Pacific islands.

Lymnaea (*Radix*) *mauritiana* and *Physa borbonica* are endemic to the Mascarene-Archipelago. *Septaria borbonica* probably occurs eastward to the Malay Archipelago (BENTHEM-JUTTING, 1956). *Planorbella* (= *Helisoma*) *duryi* is passively introduced by man like in many subtropical and tropical countries of the world.

7.3.3.2 Mauritius

19 recorded species of fresh- and brackish-water gastropods (one species, *Ferrissia* (*Pettancylus*) sp. not included!) in running waters are distributed:

Palaeotropis-Australis (incl. Oceanis) Range:	42%
(Ethiopia ?)-Madegassis-(Orientalis ?) Range:	5%
Madegassis-Orientalis Range:	11%
Madegassis Range:	42%

From 42% of widely distributed gastropods half (as on other Indian Ocean islands) are recorded in brackish localities of the mouth-regions of running waters. *Neritina* (*Neripteron*) *auriculata* is a extremely variable species in shape and form of the shell. From Mauritius was described a forma *mauriciae* (GERMAIN, 1921). *Bellamyia bengalensis* f. *zonata*-mostly in stagnant waters with muddy bottom was also found sometimes on the banks of slow-flowing rivers. The species was introduced from India, probably also from Indian immigrants. All other recorded species are distributed only in the Madegassian Subregion or have the center of the range on the islands of the Subregion. Two species are endemic for the Mascarene-Archipelago: *Lymnaea* (*Radix*) *mauritiana* and *Physa borbonica*; one species is endemic only for Mauritius: *Gyraulus mauritianus* (probably introduced on Mahé, Seychelles).

7.3.3.3 Rodriguez

12 recorded species of freshwater- and brackish-water gastropods in running waters are distributed:

Palaeotropis-Australis (incl. Oceanis) Range:	46%
(Ethiopia ?)-Madagassis-(Orientalis ?) Range:	8%
Madagassis-Orientalis Range:	8%
Madagassis Range:	38%

On the small islands of Rodriguez, the farthest island of the Mascarene-Archipelago, in the Eastern Madagassian Subregion, are nearly half of the recorded (and reported) species from running waters widely distributed on the coasts of the Indopacific. The majority of these species occur in brackish habitats of the mouth-zones.

Two species, *Melanoides tuberculata* and *Thiara scabra* are the most common freshwater snails on Indopacific islands and probably introduced by man passively with rice- and waterplants in many habitats.

More than the half of the collected running water-gastropods have their occurrence in the Madagassian Subregion, such as *Clithon coronata*, *Neritilia consimilis*, *Septaria borbonica* and *Neritina (Vittina) gagates*, but all with near-related species of the same genus in the Oriental, resp. Australian and Oceanic Regions. *Lymnaea (Radix) mauritiana* and *Omphalotropis rangi* are endemic for the Mascarene-Archipelago, and one species, *Afrogyrus (Afrogyrus) rodriquezensis*, is endemic to the small island. *Afrogyrus (Afrogyrus)*, created by BROWN & MANDAHL-BARTH (1973) is distributed with different species in the Ethiopian Region.

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Abbreviations of the text-figures

- A: Abd.g.: Abdominal ganglion
 A.g.: Albumen gland
 ant. Ad.: anterior Adductor-muscle
- B: b.c.: basal cusps (on central-tooth of the radula)
- C: C.B.c.: Cerebro-Buccal-connective
 Cet.: Central-tooth (or Rachis-tooth)
 Coe.: Coecum
 Cr.: Crystal-sac
- D: D.e.: Ductus enigmaticus
 Di.gl.: Digestive gland
 d.sp.: darkblue spot
- F: f.: foot
 Fl.l.: First lateral-tooth
 f.p.: fingerlike process (on the mantle edge)
 fl. f.: flaplike fold
 Fo. l.: Fourth lateral-tooth
- G: g.: gill
 ge.gr.: genital groove
 Go.: Gonade
- I: I.m.: Inner marginal-tooth
 Int.: Intestine
- J: J.: Jaw
- K: Kid.: Kidney
- L: l. Bu.g.: left Buccal-ganglion
 l.C.g.: left Cerebral-ganglion
 l.Par. g.: left Parietal-ganglion
 l.Pe.g.: left Pedal-ganglion
 l.Pl.g.: left Pleural-ganglion

- M: m.lac.: mantle-edge lacune
 M.t.: Marginal-tooth
 m.st.: muscle stomach
- N: N.l.: Nervus labialis (1—3)
 N.o.: Nervus opticus
 N.t.: Nervus tentacularis
- O: Oes.: Oesophagus
 O.m.: Outer marginal-tooth
 Oot.: Ootype (with capsule gland)
 Os.: Osphradium
 Ov.: Oviduct
- P: Pe.: Penis
 Per.: Pericard
 Pn.: Pneumostom
 po. p. st.: posterior part of stomach
 post.Ad.: posterior Adductor
 Prae.: Praeputium
 Prae.gl.: Praeputial gland
 Pro.: Prostate
 Ps.: Pseudobranch
- R: r.Bu.g.: right Buccal-ganglion
 r.C.g.: right Cerebral-ganglion
 Re.: Rectum
 Ret.: Retractor-muscle
 Rh.: Rhachis-tooth (or Central-tooth)
 r.Par. g.: right Parietal-ganglion
 r.Pl. g.: right Pleural-ganglion
 R.s.: Receptaculum seminis
 re.du.: renal duct
- S: Sal.gl.: Salivary gland
 Sb.g.: Subintestinal-ganglion
 Sp.g.: Supraintestinal-ganglion
 Sp. s.: Spermatophor-sac (or Spermatheca)
 Stat.: Statocyst
 Sti.: Stilet
- U: Ut.p.: Uteral part (of oviduct)
- V: Vag.: Vagina
 V.e.d.: Vaginal connecting duct

Explanation of the plates

Plate I

Fig. 1. *Clithon (Cl.) chlorostoma* f. *comorensis*; Co: A: No. 13; a: aperture; b: dorsal side; Height: 13.9 mm

Fig. 2. *Clithon (Cl.) coronata*; spined form; Mas: Mau: No. 21; a: aperture; b: dorsal side; Height: 17.7 mm

Fig. 3. *Clithon (Cl.) coronata* f. *despinosa*; Mas: Mau: No. 5; a: aperture; b: young specimen from dorsal side with rests of spines; c: f. *despinosa* from dorsal side; Height: 19 mm (adult)

Fig. 4. *Clithon (Cl.) spiniperda*; Co: A: No. 13; a: aperture; b: young specimen from dorsal side with rests of spines; c: adult specimen from dorsal side without spines; Height: 13.2 mm (adult)

Fig. 5. *Neritina (Neripteron) auriculata f. mauriciae*; Mas: Mau: No. 23; a: aperture; b: dorsal side; Height: 11 mm

Fig. 6. *Neritina (Vittina) gagates*; Sey: M: No. 3; a: aperture; b: dorsal side; Height: 24.4 mm

Fig. 7. *Neritina (Vittina) gagates*; Mas: Mau: No. 8; a: aperture; b: dorsal side; Height: 16.5 mm

Fig. 8. *Neritina (Vittina) gagates*; Mas: Ré: No. 19; a: aperture; b, c: dorsal sides of immature specimens, to show the zig-zag lines on the shells; Height: 12.5 mm

Plate 2

Fig. 9. *Neritina (Neritina) pulligera knorri*; Sey: M: No. 3; a: aperture; b: dorsal side; Height: 23.4 mm

Fig. 10. *Neritina (Neritina) pulligera stumpfi*; Sey: M: No. 3; a: aperture; b: dorsal side; Height: 17.2 mm

Fig. 11. *Septaria borbonica*; Sey: M: No. 7; a: aperture; b: dorsal side; Length: 22 mm

Fig. 12. *Septaria borbonica*; Co: A: No. 15; a: aperture; b: dorsal side; Length: 30 mm

Fig. 13. *Septaria borbonica*; Mas: Mau: No. 15; a: aperture; b: dorsal side; Length: 31 mm

Plate 3

Fig. 14. *Clithon (Cl.) chlorostoma f. comorensis*; Co: A: No. 13; Operculum: a: ventral side; b: dorsal side; Size: 6.8×4 mm

Fig. 15. *Clithon (Cl.) coronata*; Mas: Ré: No. 19; Operculum: a: ventral side; b: dorsal side; Size: 8.5×4.7 mm

Fig. 16. *Clithon (Cl.) spiniperda*; Co: A: No. 13; Operculum: a: ventral side; b: dorsal side; Size: 8.9×5 mm

Fig. 17. *Neritina (Neripteron) auriculata f. mauriciae*; Mas: Mau: No. 23; Operculum: a: ventral side; b: dorsal side; Size: 7×4.3 mm

Fig. 18. *Neritina (Vittina) gagates*; Sey: M: No. 3; Operculum: a: ventral side; b: dorsal side; Size: 11×7 mm

Plate 4

Fig. 19. *Neritina (Neritina) pulligera knorri*; Sey: M: No. 3; Operculum: a: ventral side; b: dorsal side; Size: 10×7 mm

Fig. 20. *Neritina (Neritina) pulligera stumpfi*; Sey: M: No. 3; Operculum: a: ventral side; b: dorsal side; Size: 12.5×7.5 mm

Fig. 21. *Septaria borbonica*; Sey: M: No. 7; Operculum: ventral side; Size: 8×5 mm

Fig. 22. *Septaria borbonica*; Co: A: No. 15; Operculum: a: ventral side; b: dorsal side; Size: 7.8×4.9 mm

Fig. 23. *Neritilia consimilis*; Sey: M: No. 7; a: aperture; b: dorsal side; Size: 7.8×4.9 mm

Fig. 24. *Neritilia consimilis*; Sey: M: No. 7; Operculum: a) ventral side; b, c: dorsal side; Size: 2×1.3 mm

Plate 5

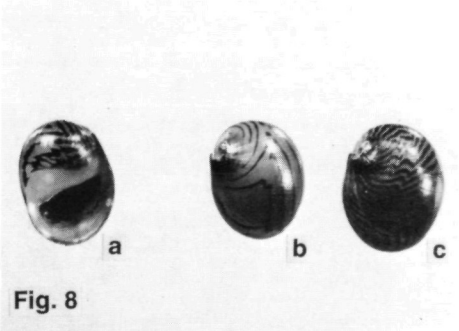
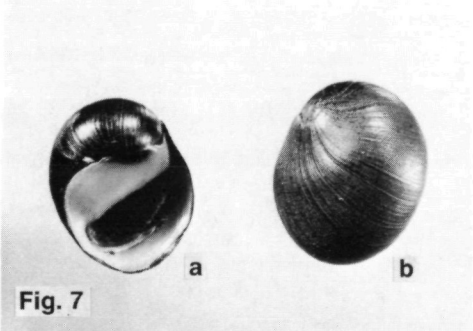
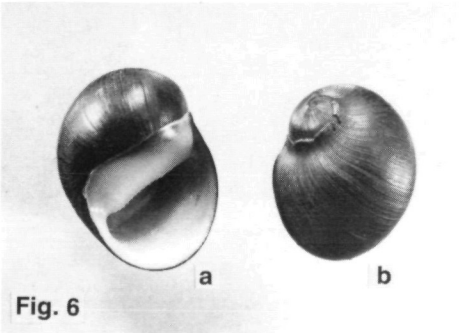
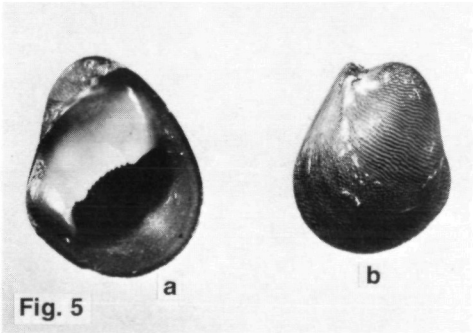
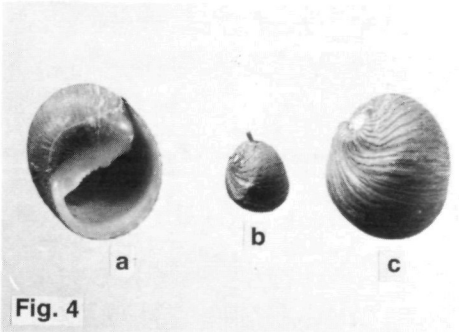
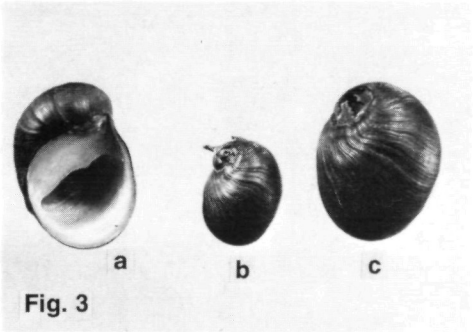
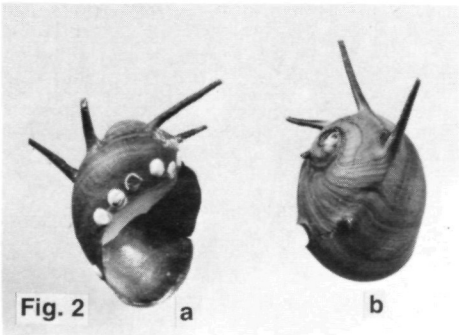
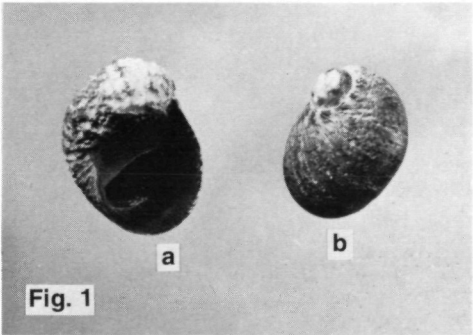
Fig. 25. *Bellamyia bengalensis f. zonata*; Mas: Mau: No. 25; Aperture; Height: 23 mm

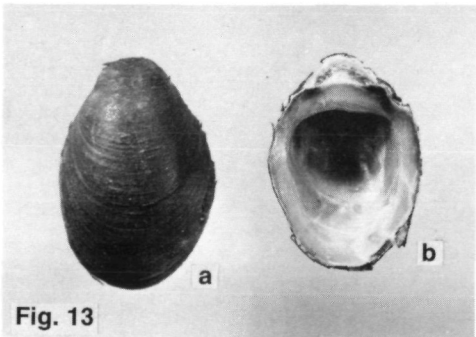
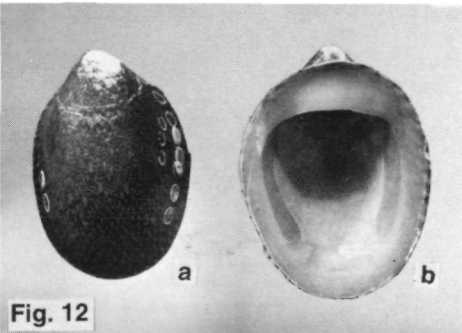
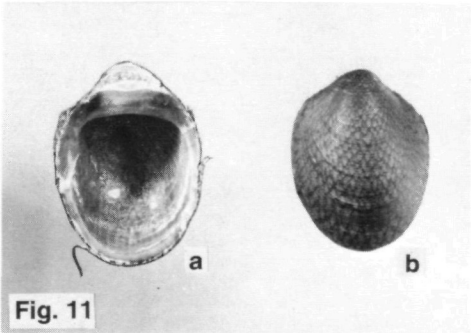
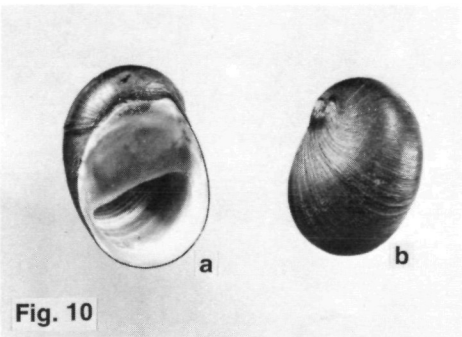
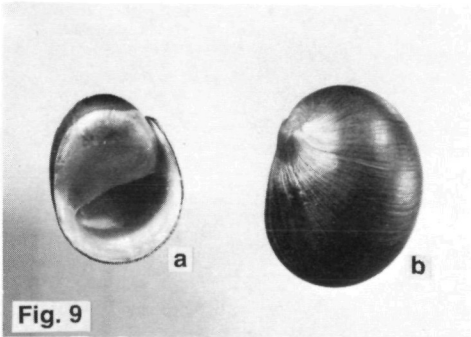
Fig. 26. *Bellamyia bengalensis f. zonata*; Mas: Mau: No. 25; Operculum; Size: 12×9 mm

Fig. 27. *Paludinella hidalgoi f. granum*; Mas: Ré: No. 24; Aperture; Height: 2.2 mm

Fig. 28. *Paludinella hidalgoi f. granum*; Mas: Ré: No. 24; Dorsal side (apex eroded); Height: 2.2 mm

Fig. 29. *Syncera (= Assiminea) nitida*; Sey: M: No. 8; Aperture; Height: 2.3 mm







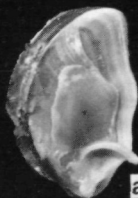


a



b

Fig. 19



a



b

Fig. 20

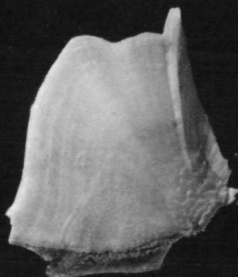
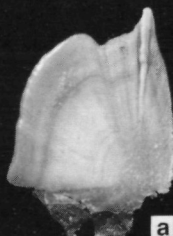


Fig. 21



a



b

Fig. 22

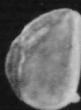


a



b

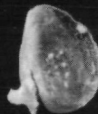
Fig. 23



a



b



c

Fig. 24

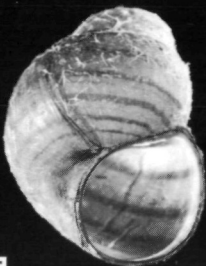


Fig. 25

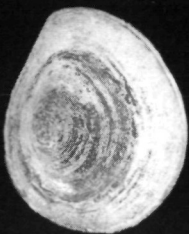


Fig. 26



Fig. 27

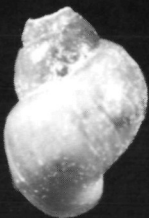


Fig. 28



Fig. 29



Fig. 30

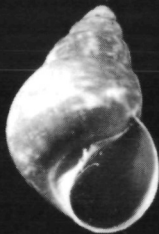
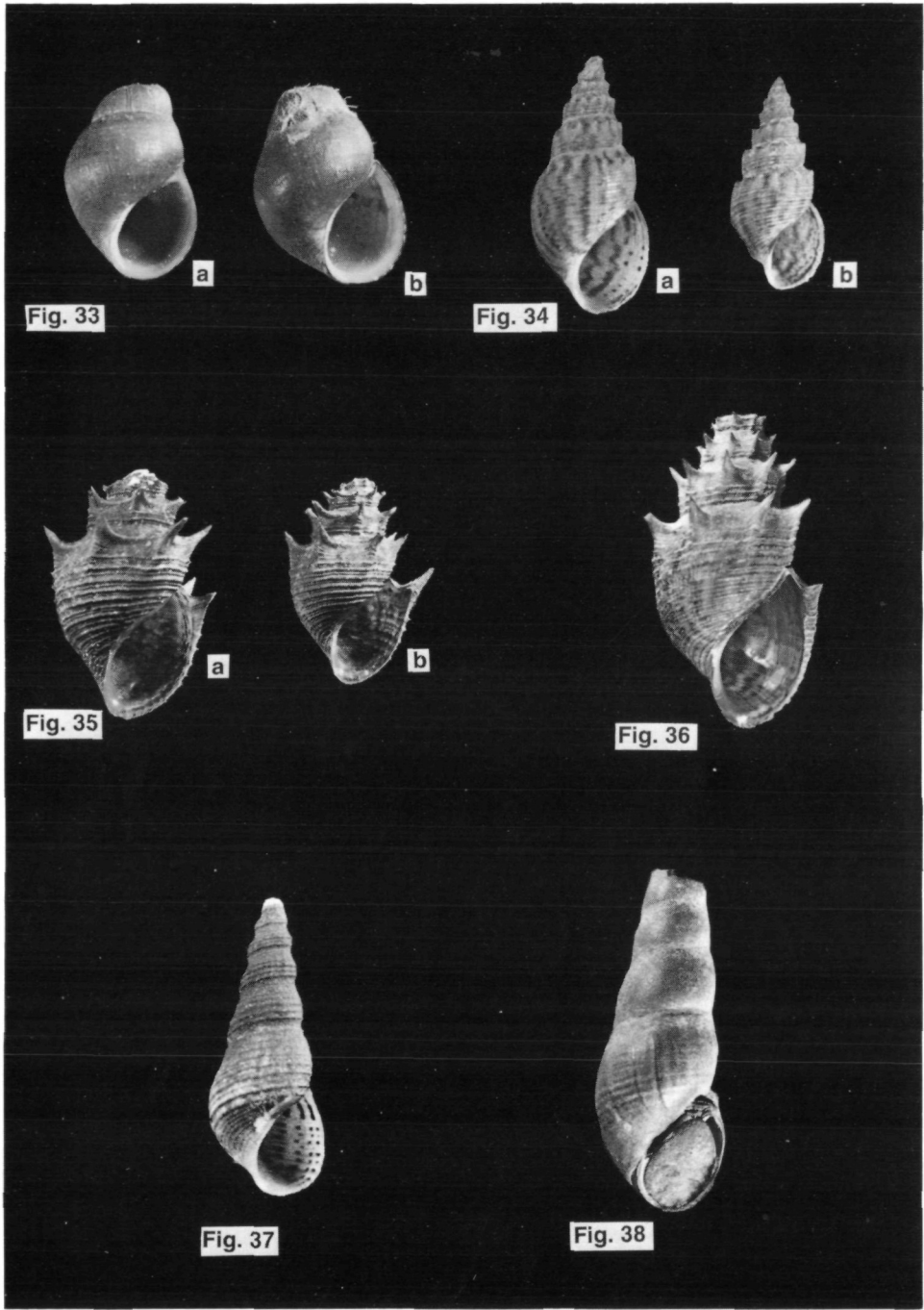
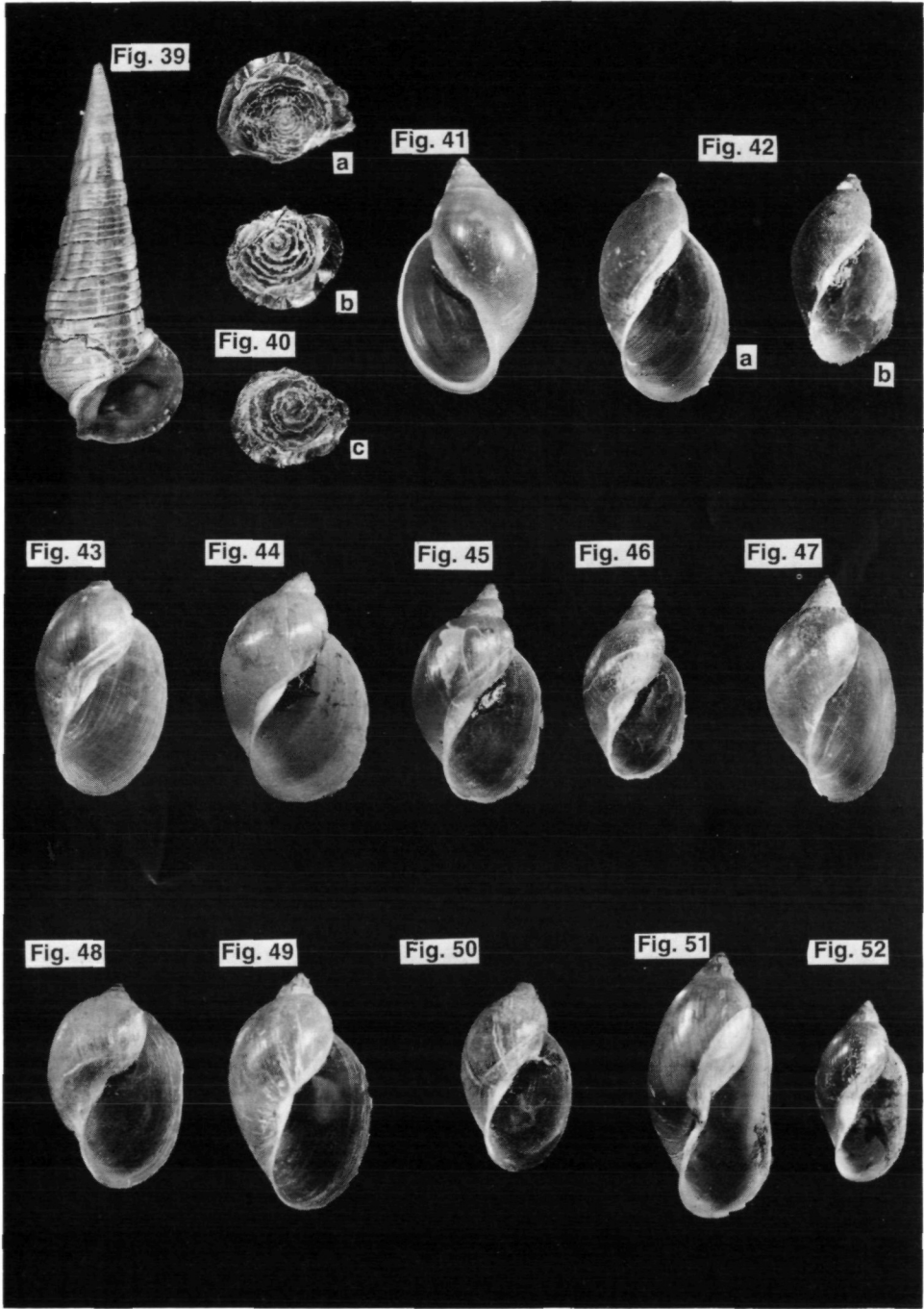


Fig. 31



Fig. 32





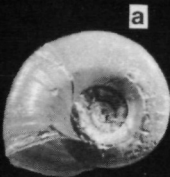


Fig. 53

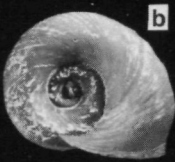


Fig. 55



Fig. 56

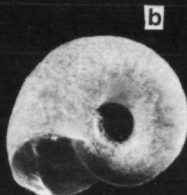


Fig. 57

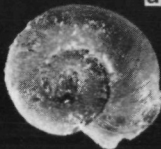


Fig. 58



Fig. 30. *Omphalotropis* (O.) *globosa*; Mas: Mau: No. 2; Aperture; Height: 5.5 mm

Fig. 31. *Omphalotropis* (O.) *picturata*; Mas: Ré: No. 3; Aperture; Height: 4.2 mm

Fig. 32. *Omphalotropis* (O.) *rangi*; Mas: Ro: No. 1; Aperture; Height: 5.6 mm

Plate 6

Fig. 33. *Cleopatra* (*Zanguebarica*) *ajanensis* f. *silhouettensis*; Sey: S: No. 1; a, b: Aperture (apex eroded); Height: 9.5 mm

Fig. 34. *Thiara* (*Plotia*) *scabra*; Mas: Ré: No. 4; a, b: Aperture; Height: 17.6 mm, 15 mm

Fig. 35. *Thiara* (*Plotia*) *scabra*; Mas: Mau: No. 21; a, b: Aperture; Height: 21.8 mm, 19 mm

Fig. 36. *Thiara* (*Plotia*) *scabra*; Mas: Ré: No. 24; Aperture; (f. *pagoda*); Height: 22.5 mm

Fig. 37. *Melanoides* (M.) *tuberculata*; Sey: M: No. 8; Aperture; specimen of a pigmy population; Height: 8.3 mm

Fig. 38. *Melanoides* (M.) *tuberculata*; Mas: Mau: No. 4; Aperture; (apex eroded); Height: 23 mm

Plate 7

Fig. 39. *Terebralia palustris*; Sey: M: No. 8; Aperture; Height: 117 mm

Fig. 40. *Terebralia palustris*; Sey: M: No. 8; Operculum; Diameter: 50—60 mm

Fig. 41. *Physa borbonica*; Mas: Ré: No. 1; Aperture; Height: 11.4 mm

Fig. 42. *Lymnaea* (*Radix*) *natalensis*; Co: A: No. 5; Aperture; Height: a) 13.7 mm; b) 11 mm

Fig. 43. *Lymnaea* (*Radix*) cf. *natalensis*; Sey: M: No. 2; Aperture; Height: 11 mm

Fig. 44. *Lymnaea* (*Radix*) *natalensis hovarum*; Mad: No. 1; Aperture; Height: 13.1 mm

Fig. 45. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ré: No. 5; Aperture; Height: 10 mm

Fig. 46. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ré: No. 5; Aperture; Height: 8 mm

Fig. 47. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ré: No. 23; Aperture; Height: 19 mm

Fig. 48. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ré: No. 23; Aperture; Height: 15 mm

Fig. 49. *Lymnaea* (*Radix*) *mauritiana*; Mas: Mau: No. 6; Aperture; Height: 11 mm

Fig. 50. *Lymnaea* (*Radix*) *mauritiana*; Mas: Mau: No. 6; Aperture; Height: 10.5 mm

Fig. 51. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ro: No. 4; Aperture; abnorme form; Height: 18.8 mm

Fig. 52. *Lymnaea* (*Radix*) *mauritiana*; Mas: Ro: No. 4; Aperture; normale form; Height: 15 mm

Plate 8

Fig. 53. *Planorbella* (= *Helisoma*) *duryi*; Mas: Ré: No. 17; two shells; Diameter: 14.7 mm

Fig. 54. *Gyraulus* cf. *mauritanus*; Sey: M: No. 1; two shells; Diameter: 3.6 mm

Fig. 55. *Gyraulus mauritanus*; Mas: Mau: No. 6; two shells; Diameter: 3.5 mm

Fig. 56. *Afrogyrus* (*Afrogyrus*) *rodriguezensis*; Mas: Ro: No. 1; two shells; Diameter: 4.2 mm

Fig. 57. *Afrogyrus* (*Hovorbis*) cf. *crassilabrum*; Co: Gr. Co: No. 2; two shells; Diameter: 4.5 mm

Fig. 58. *Ceratophallus* sp.; Co: A: No. 5; two shells; Diameter: 4 mm