

Danish Bilharziasis Laboratory



A field guide to
African freshwater snails

8. Southern African species

D. S. Brown and T. K. Kristensen
1989

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WHO Collaborating Centre
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and Schistosomiasis Control

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8. Southern African species

By

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PREFACE

This volume completes the coverage of the African continent in this series of Field Guides. The area treated here is essentially that conventionally known as 'Southern Africa', i.e. lying south of the Zambezi river.

Previous volumes in this series have dealt with the snail fauna of Mozambique, Malawi, Zambia and Zimbabwe (No. 4: South East African Species) and Zaire (No. 5: Central African Species). The present volume includes information for southern Mozambique and Zimbabwe, and deals for the first time with Angola (apart from the mouth of the river Zaire), Namibia (South West Africa), Botswana, Swaziland, Lesotho and the Republic of South Africa.

As far as possible the identification keys use readily observable characters. Acquaintance with terms, ability to carry out a dissection and to make a radula preparation are necessary to complete most identifications. These aspects are described in the introductory volume of this series (See list of recommended further reading). In the key to the genus Bulinus reference will be made to the determination of chromosome number. Description of this technique can be found in certain publications also suggested in the list of further reading.

Illustrations are printed at the same magnification or reduction for all the species belonging to the same genus. It should be borne in mind that there may be a wide difference between the scale of illustrations for different genera. The reader should note also that measurements given for the shell are usually not of the largest specimens known but the size that is not commonly exceeded. Measurements for spired shells are length x width, and for discoid shells height x maximum diameter. Maximum size achieved by a species may vary considerably among different populations, and the size of snails in a particular sample will partly depend on the time of sampling in relation to the life-cycle.

Despite the investigations of recent years there are many problems remaining with the definition and identification of species in southern Africa. Unfortunately this is still so for the medically important genus Bulinus. The authors wish the reader to appreciate that this volume is truly a guide and not a definitive system of classification. Research in progress and yet to be done will no doubt produce many changes.

Specimens which cannot be identified or for which a confirmation of identification is required will be welcome at either of the addresses below.

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Identification key to southern African freshwater snails.

KEY TO THE TWO MAIN GROUPS

African freshwater snails belong to two main groups (subclasses), viz. Prosobranchia (Prosobranchs) and Pulmonata (Pulmonates), which can be distinguished as described below:

- A The snail has an operculum, which closes the opening of the shell when the body is withdrawn. The shell is commonly thick-walled and large (20 mm or more in height/length or width). Discoid shell forms are not found
Prosobranchia, proceed below
- B The snail does not have an operculum. The shell usually is thin-walled and small (less than 20 mm in height/length or width); the shell may be discoid.
Pulmonata, proceed to page 22

PROSOBRANCHS

The freshwater prosobranchs are easily recognised by the presence of an operculum. The shell may be thick-walled and large, though some are fragile and all species in some genera are small. Shell shape is commonly globose or higher, though in the Neritidae the expanded body whorl may hide the earlier whorls (as in Neritina) and one genus is cap-like (Septaria). The prosobranch radula is distinctive in being taenioglossate (having only 7 teeth per transverse row), except in the Neritidae, in which it is rhipidoglossate (many teeth in a row of which only few are conspicuous).

KEY TO PROSOBRANCH FAMILIES

- 1 A Shell aperture D-shaped; body whorl expanded and may hide the shell apex; shell colour black or with pattern of dark markings. Operculum strong, heavily calcified, with internal apophyses
.....NERITIDAE(Neritina), p. 7
- B Shell cap-like.....NERITIDAE(Septaria), p. 9
- C Shell globose or higher, operculum without apophyses.....2
- 2 A Fully grown shell more than 10 mm high.....3
- B Fully grown shell less than 10 mm high.....7
- 3 A Operculum entirely concentric.....4
- B Operculum concentric with a spiral nucleus or wholly spiral.....5
- 4 A Shell globose or higher; more than 40 mm high when fully grown. Operculum corneous or strongly calcified. Female oviparous.....AMPULLARIIDAE(Pilidae), p. 10
- B Shell conical, dextral, less than 40 mm when fully grown. Operculum corneous. Female viviparous.....VIVIPARIDAE, p. 9

- 5 A Basal margin of aperture with a notch. Operculum multispiral. On the coast in or near tidal water..... POTAMIDIDAE, p. 21
- B Basal margin of aperture is smoothly curved.....6
- 6 A Shell conical. Operculum multispiral. Found on the coast in or near tidal water..LITTORINIDAE, p. 12
- B Shell conical or higher. Operculum paucispiral with a basal nucleus, or concentric with a paucispiral nucleus.....THIARIDAE, p. 16
- 7 A Operculum calcareous; paucispiral with an outer concentric zone when fully grown.....BITHYNIIDAE, p. 14
- B Operculum corneous an paucispiral.....8
- 8 A Shell comparatively broad, height less than width. Radula with accessory plate between the lateral and first marginal tooth.ASSIMINEIDAE, p. 15
- B Shell more slender, height generally equalling or exceeding the width. Radula lacking accessory plate..... POMATIOPSIDAE, p. 12

FAMILY NERITIDAE

Shell strong, imperforate, with a thickened columellar margin and a small spire. Usually the shell surface has a pattern of variable dark margins. Operculum calcareous, paucispiral with projecting processes(apophyses) basally on the inner surface. This is the only gastropod family in African fresh water with a

rhipidoglossate radula.

Many neritids are marine but some live in brackish or fresh water, though in tropical Africa no species penetrates far above the limit of tidal influence. Two genera are found in southern Africa.

KEY TO THE GENERA

- 1 A Shell hemispherical with a spire projecting to some extent.....Neritina
- B Shell cap-like (patelliform).....Septaria

Genus Neritina Lamarck, 1816

Shell hemispherical with a D-shaped aperture having its straight side formed by the thick columella margin. The oval egg capsules, 1 - 2 mm long, are often seen on the shell. Three species are found on the east coast and are associated with streams flowing into mangrove swamps. Four of the eight species known in western Africa extend southwards to the mouth of the Zaire River and possibly occur further south in Angola.

1. Neritina on the east coast:

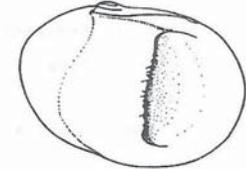
KEY TO THE SPECIES

- 1 A Shell black with an orange band inside the outer lip. Spire low, the body whorl greatly expanded, hiding the earlier whorls.....N. pulligera
- B Shell with a variable pattern of dark markings on a lighter background. There is a definite spire and the early whorls are visible (unless they have been eroded).....2

- 2 A Shell strongly patterned with black and yellow spots and bands, highly varied. Spire comparatively highN. natalensis
- B Shell generally darker, with numerous fine black zig-zag bands. Spire low.....N. gagates

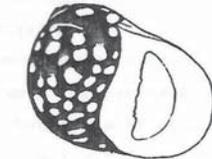
Neritina pulligera (Linnaeus, 1767)

Up to 18 x 23 mm. On the east coast of Africa from Kenya to Durban, and widespread in the Indo-Pacific region. The name N. knorri (Recluz, 1841) has been used for African specimens.



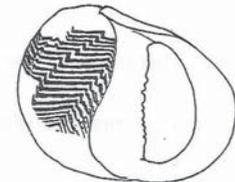
Neritina natalensis Reeve, 1855

Up to 20 x 15 mm. With spotted or broadly banded patterns contrasting with the darker appearance of the two other east coast species, which are less common. On the east coast from Somalia to southern Natal.



Neritina gagates Lamarck, 1822

Up to 21 x 22 mm (sometimes proportionally higher). Found in Africa only on the Natal coast, though widespread on islands in the western Indian Ocean.



2. Neritina on the west coast

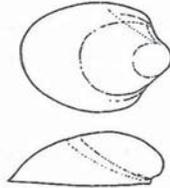
Four species are possibly found south of the Zaire river in Angola: Neritina oweniana (Wood, 1828), N. adansoniana (Recluz, 1841), N. glabrata Sowerby, 1849 and N. afra Sowerby, 1841. All these are dealt with in a previous volume in this series (no. 1: West African Species).

Genus Septaria Ferussac, 1807

Shell cap-like or patelliform, the last whorl being greatly expanded. Operculum reduced to a small plate, though at least one apophysis is still clearly visible. Widespread in the Indo-Pacific region but rarely found in Africa.

Septaria tessellaria (Lamarck, 1816)

Up to 21 mm long. Found in Africa only on the Natal coast, though widespread in the Indo-Pacific region. Possibly this should not be separated from S. borbonica (Bory de St. Vincent, 1803) of Madagascar.



FAMILY VIVIPARIDAE

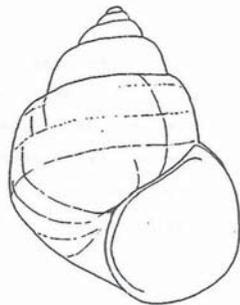
Shell dextral with a conical spire. Operculum thin, corneous and concentric. The female is viviparous and carries developing young in the lower part of the oviduct. Male with the right tentacle enlarged to serve as a copulatory organ. One genus found in southern Africa; it is associated with lakes and slowly flowing rivers and streams.

Genus Bellamya Jousseaume, 1886

Bellamya is present in Asia as well as Africa, where it occurs from Egypt southwards to the Pongola coastal plain in Natal. Two species can perhaps be distinguished in southern Africa according to shell characters, but taxonomic changes are likely to follow from the recent discovery of variation of chromosome number within this genus (Kat, 1988).

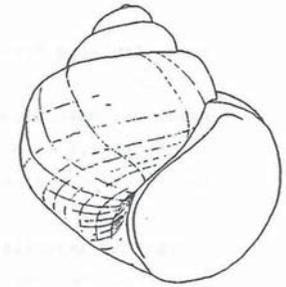
Bellamya capillata (Frauenfeld, 1865)

Up to 33 x 23 mm. Whorls varying in shape from rounded to bi-angular. Fine spiral ridges are present but the shell surface is shining when cleaned and undamaged. Widespread in central Africa, reaching southern limits in Angola, Botswana (Okavango area), northern Zimbabwe and the Pongola coastal plain of Natal.



Bellamya monardi (Haas, 1934)

Up to 36 x 29 mm. The last whorl is large in proportion to the rest of the shell, and there may be a distinct ridge around the umbilicus. Spiral ridges are numerous and close-set, giving the surface a rough texture. Angola (Cunene River), Namibia (Caprivi) and Botswana (Okavango area).



FAMILY AMPULLARIIDAE

Fully grown shell can be large (more than 100 mm high); globose or higher in southern Africa; operculum concentric; animal with a tentacle-like process (pseudopodium) on each side of the snout in addition to the tentacles; mantle cavity divided into two compartments, one with a gill and the other serving as a lung; female oviparous; male with a copulatory organ on the right side, formed by a modified part of the mantle border, which encloses the penis; worldwide distribution in tropical freshwaters. Two genera occur in southern Africa. They are associated with swamps and slowly flowing rivers and streams; some species occur in seasonal waters that dry out for many months.

KEY TO THE GENERA

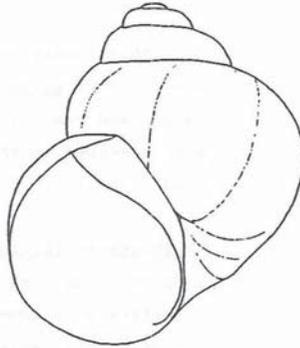
- 1 A Shell sinistral, operculum thin and corneous.....Lanistes
 B Shell dextral, operculum thick and calcareous.....Pila

Genus Lanistes Montfort, 1810

The shell, but not the animal, is sinistral (hyperstrophy). Gelatinous clusters of eggs are deposited on vegetation within water. Restricted to Madagascar and Africa, where it occurs from the lower Nile southwards to Angola, Botswana and eastern South Africa. One variable species may be recognised in southern Africa.

Lanistes ovum Peters, 1845

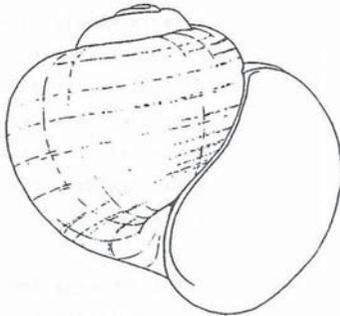
Up to 85 x 53 mm, though usually smaller. There is wide variation in proportional height of the spire and shape of the whorls. An exceptionally low-spired form (L. connollyi Pain, 1954) occurs in the Zambezi River above the Victoria Falls. Widespread in tropical Africa, occurs from Nigeria and Sudan southwards to Angola (Lagoa Delagosa), Botswana (Okavango area) and the Pongola coastal plain in Natal.

Genus Pila Röding, 1798

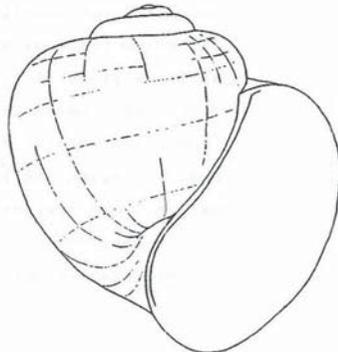
The large dextral shell and calcareous operculum are distinctive. Clusters of eggs with white calcareous shells are deposited above the water, often in crevices in earth banks. Present in Asia and Africa, where it occurs from the lower Nile southwards to Angola, Botswana and northern Mozambique. One or perhaps two species are recognisable in southern Africa.

Pila occidentalis (Mousson, 1887)

Up to 56 x 53 mm. Possibly this is no more than a locally evolved form of P. ovata (Olivier, 1804), which is widespread further north. P. occidentalis is comparatively small with a low spire, and the whorls are flattened near the suture. Southern Angola, Namibia (Caprivi) and Botswana (Okavango basin, Lake Ngami and Botletle district).

Pila wernei (Philippi, 1851)

Up to 127 x 125 mm. Shell aperture and operculum are comparatively narrow. This species, the largest African freshwater snail, is widespread in central Africa but recorded in southern Africa only from north east Namibia.



FAMILY LITTORINIDAE

This family is cosmopolitan in marine and brackish coastal waters. The 'Littorina scabra' species complex lives in mangrove swamps and coastal marshes in tropical Africa. The species are most numerous in the Indo-Pacific region and have been revised by Read (1986).

Littoraria (Littorinopsis) spp.

Up to 35 mm high. Spire sharply conical, surface with numerous spiral grooves and ridges, and variable brown markings. Several species are found on mangrove trees and amongst marsh grass in Mozambique and South Africa as far as Algoa Bay (Read, 1986).



FAMILY POMATIOPSIDAE

Distinguished from the family Hydrobiidae of earlier authors mainly by characters of the female genital organs. According to Davis (1981) a possible member of the true Hydrobiidae in southern Africa is Hydrobia alabastrina Morelet, 1889, described from Port Elizabeth. One African genus, Tomichia, found mainly near the south coast is classified in the Pomatiopsidae. This family otherwise occurs in the Americas, Asia and Australia.

GENUS Tomichia Benson, 1851

Shell small and generally slender. The spire is commonly decollate but usually is obviously higher than aperture. Operculum corneous and paucispiral. Radula central tooth with a strongly projecting basal margin; 2 or 3 basal denticles on each side. Males have a simple penis, lacking any appendages. Known from a few localities in central Africa, but commonest in the coastal regions of South Africa. Living in brackish and fresh waters; some species are amphibious. Seven South African species are recognised in a revision by Davis (1981). Many of the differences are not readily expressible in a key. For details,

distribution and ecology see Davis (1981).

Tomichia ventricosa (Reeve, 1842)

Up to 11 x 3.2 mm. Spire high with as many as 10 whorls. The most slender form has been treated as a distinct species T. producta Connolly, 1929. Western Cape province: aquatic, amphibious, in rivers and vleis.



Tomichia zwellendamensis (Küster, 1852)

Up to 6.7 x 2.0 mm. Comparatively slender with about 8 whorls. Western Cape Province, in vleis and lakes.



Tomichia tristis (Morelet, 1889)

Up to 6 x 2.7 mm. Proportionally broader than the foregoing two species; the last whorl occupying about three-fifths of the total height. Surface coarsely sculptured with transverse ridges and malleation.



Assiminea lirata Turton, 1932 is a synonym according to Davis (1981). Eastern Cape province; Port Elizabeth and near Aston. Amphibious and terrestrial.

Tomichia rogersi (Connolly, 1929)

Up to 6.5 x 3.0 mm. The lower whorls increase rapidly as in T. tristis but are less strongly convex. Western Cape province; Lamberts Bay and Little Namaqualand; aquatic and amphibious.



Tomichia natalensis Connolly, 1939

Up to 6 x 3 mm. Spire more conic than in all other species, aperture angular in young shells, peristome coloured brown. Natal province; freshwater streams between Empangeni and Gingindlovu.



Tomichia differens Connolly, 1939

Up to 5.0 x 2.7 mm. Distinguished by the small size, short spire, flattened whorls and shallow sutures. Western Cape province, amphibious.



Tomichia cawstoni Connolly, 1939

Up to 4.6 x 2.5 mm. Sides of shell flat. Known only from the original specimens collected near Kokstad in Eastern Cape province; possibly extinct.



FAMILY BITHYNIIDAE

Small to moderately large dextral snails with a calcareous operculum. Male with a penis having a lateral lobe. Only one genus is represented in southern Africa.

Genus Gabbiella Mandahl-Barth, 1968

Fully grown shell from 2.5 to 9 mm high, varying in shape from depressed to ovate with a conical spire. Operculum with paucispiral nucleus and, when fully grown, an outer concentric zone. Central tooth on the radula with from 2 to 5 basal denticles on either side. Known only from Africa; some 20 species are recognised, mostly occurring in central tropical Africa. Just one species penetrates into southern Africa.

Gabbiella kisalensis (Pilsbry & Bequaert, 1927)

Up to 4.2 x 3.7 mm. Whorls rapidly increasing and strongly convex. Spiral part of operculum occupying about half of the total width. South east Zaire, Zambia, Mozambique (Zambesi and Niassa provinces), Angola (Cuije river), northern Namibia, Botswana (Okavango basin).



FAMILY ASSIMINEIDAE

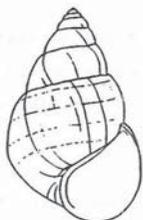
The aquatic members of this family (subfamily Assimineinae) are small and live generally near coasts in fresh and brackish water. The radula is distinctive in having an accessory plate between the lateral tooth and the first marginal tooth. Central tooth with or without basal denticles. Operculum corneous and paucispiral. The male has a simple penis lacking a lateral lobe. Only one of the two genera considered here is known to live in entirely fresh water.

Genus Assiminea Fleming, 1828

Some 12 southern African species have been placed in this genus, but their true position is uncertain, since internal organs have been little studied. Detailed comparisons are needed with species found in Europe, Asia and Indo-Pacific islands. The one species mentioned here lives on the coast near, and possibly in, freshwater.

Assiminea bifasciata Nevill, 1880

Up to 7 x 4 mm. Spire with nearly flat sides, umbilicus closed. Brown bands may be visible, particularly on young shells. Central tooth lacking basal denticles; outer marginal tooth with about 15 cusps. Reported from Mozambique (Komati estuary) and the east coast of South Africa, where it lives on moist mud shaded by mangrove trees.

Genus Eussoia Preston, 1912

Small shells with a conical spire not much higher than the aperture. The central tooth lacks basal denticles; this feature and other characters of the radula led Mandahl-Barth (1973) to maintain this genus. One species lives in freshwater far inland in Kenya. A single species found in southern Mozambique was included in the genus by Mandahl-Barth.

Eussoia leptodonta (Connolly, 1925)

Up to 5.2 x 3.5 mm. Whorls nearly convex, sides of spire slightly curved, umbilicus closed. Uniformly brown in colour. Known only from the type locality in the Komati river estuary at Rikatla (north of Maputo).



FAMILY THIARIDAE

Shell ovate to turreted and frequently strongly sculptured. Operculum corneous. The male lacks a copulatory organ. A large family of mainly freshwater snails, and a few that are estuarine. Four genera are found in southern Africa.

KEY TO THE GENERA

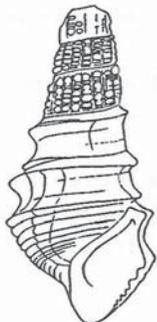
- 1 A Found on the west coast in brackish water. Basal margin of aperture spout-like.....Pachymelania
- B Found on east coast in or near brackish water, or in fresh water. Basal margin of aperture evenly curved.....2
- 2 A Upper part of whorls with strong ribs projecting as spines. Restricted to the coast, in or near brackish water.....Thiara
- B Whorls lacking spines. Widespread in fresh water.....3
- 3 A Shell usually with several brown spiral bands. Operculum concentric with a small spiral nucleus.....Cleopatra
- B Shell usually with brown spots or patches in transverse and spiral rows. Operculum paucispiral with a basal nucleus.....Melanooides

Genus Pachymelania Smith, 1893

Large snails reaching 60 mm high, with a tall spire (usually decollate) and strong sculpture. Base of aperture is spout-like. Operculum and radula similar to Melanooides. Living on west coast of Africa in brackish water. At least one of the three known species occurs south of the Zaire estuary.

Pachymelania fusca (Gmelin, 1791)

Up to 45 x 16 mm. Sculpture varies from mainly small tubercles to strong spiral ridges. The tuberculate form can be confused with Melanooides tuberculata, but should be distinguishable by the spout-like base of the aperture. Found from Senegal to Angola (Benguela).

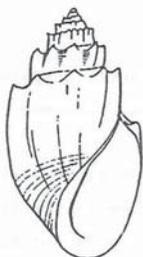


Genus Thiara Rüdging, 1798

One of the two species found in Africa occurs in southern Africa.

Thiara amarula (Linnaeus, 1758)

Up to 33 x 12.5 mm. The spire is often eroded, though it is not much higher than the aperture when complete. Dark brown in colour. Widespread in the Indo-Pacific region. Found in Africa from Somalia southwards to Natal province, living in streams and lagoons just above the brackish zone.



Genus Melanooides Olivier, 1804

Slender shells with a high spire, though often decollate. Both transverse and spiral sculpture are generally present on some part of the shell, commonly forming tubercles. Rectangular patches of reddish-brown colour follow the pattern of sculpture. Operculum paucispiral with a basal nucleus. The female is viviparous; males are rarely found. With a large range, including the Indo-Pacific region, southern Asia, Caribbean islands and much of Africa. About 30 species known in Africa, of which 4 are found in the southern region.

KEY TO THE SPECIES

- 1 A Shell with lower whorls nearly smooth.....2
- B Transverse and/or spiral shell sculpture is well developed.....3
- 2 A Whorls convex, suture comparatively deep. Central tooth with 9 cusps.....M. angolensis
- B Whorls flattened, suture shallow. Central tooth with 5-7 cusps. (Snail fully grown).....M. victoriae
- 3 A Shell with strong, widely spaced ribs.....M. reticosta
- B Shell sculpture is transverse and spiral, highly varied, reticulate or nodular.....4
- 4 A Shell comparatively slender and weakly sculptured. Central tooth with 9-11 cusps....M. tuberculata
- B Shell more strongly sculptured. Central tooth with 5-7 cusps. (Snail not fully grown).....M. victoriae

Melanooides angolensis Mandahl-Barth, 1974

Up to 24 x 10 mm. The smooth convex whorls are distinctive. Central tooth with 9 cusps. There are some grooves and ridges at the base. Known only from Angola (Luanda and Huila provinces).



Melanooides victoriae (Dohrn, 1865)

Up to 29 x 30 mm. A flat-sided shell with smooth lower whorls in large specimens, which usually are decollate. (Early whorls



are ribbed or tuberculate). Central tooth with 5-7 cusps. Cunene, Okavango and Zambezi rivers, streams and rivers in north and east Transvaal.

Melanoides recticosta (Martens, 1882)

Up to 20 x 8.3 mm. With strong and widely spaced ribs. Central tooth with 5-7 cusps. Known only from Angola (Cuanza river) and lower Zaire.



Melanoides tuberculata (Müller, 1774)

Up to 47 x 14 mm (though usually smaller). Shell highly varied though recognisable by the high slender spire, convex whorls and reticulate or finely tuberculate sculpture. Central tooth with 9-11 cusps. Further study is needed of M. inhambanica (Martens, 1860), a form from Mozambique with weak transverse sculpture, which possibly is distinct. M. tuberculata is widespread in freshwater and also lives in brackish coastal lagoons. Widely distributed in the Indo-Pacific region, and in northern and eastern Africa. In southern Africa it extends westwards from Mozambique and Zimbabwe to the Okavango basin and isolated localities in northern Namibia. Also present in the Vaal river basin and down the eastern coast to Port Elizabeth.



Genus Cleopatra Troschel, 1856

Shell ovate or higher, though the apex is commonly decollate. Spiral sculpture can be strong, but transverse sculpture is fine and the shell may appear smooth. Dark brown spiral bands are commonly present. Operculum concentric with a small spiral nucleus. Mode of reproduction unknown, though probably ovoviviparous. An African genus, present from lower Egypt

southwards to northern Namibia, the Okavango basin and the coastal plain of Natal. About 20 species of which 3 occur in southern Africa.

KEY TO THE SPECIES

- 1 A Whorls somewhat flattened and smooth,
suture shallow.....C. nsendweensis
- B Whorls definitely convex.....2
- 2 A Whorls without raised spiral ridges
(except extreme apex). Found in
eastern area.....C. ferruginea
- B Spiral ridges present on most whorls
and may extend to the lip. Found in
central and western area..... C. smithi

Cleopatra nsendweensis Dupuis & Putzeys, 1901

Up to 19 x 10.5 mm. The smooth, flattened whorls and closed umbilicus are distinctive. A small form living in the Zambezi river above the Victoria Falls has been regarded as a distinct species, C. morelli Preston (1905). A senior name could be C. welwitschi Martens (1897) from Angola. Found in Zaire, Zambia, Angola, northern Namibia and Okavango basin.



Cleopatra ferruginea (I. & H.C. Lea, 1850)

Up to 30 x 15 mm (though often decollate). Large, with smooth convex whorls and generally brown in colour with darker bands. Lower margin of aperture spout-like in young snails, becoming rounded as they grow. Distributed from eastern Kenya southwards through Mozambique into eastern



Transvaal and the coastal plain of Natal (Mkuzi Flats).

Cleopatra smithi Ancey, 1906

Up to 18 x 11 mm. This name is used here provisionally for a slender form of Cleopatra with convex, carinate whorls, found at Chirundu near the Zambesi River and in the eastern Caprivi area and Okavango River. It was classified as C. lesnei Germain, 1935 in a previous volume of this series (No. 4: South East African species), but this taxon is not a Cleopatra (Brown & Mandahl-Barth, in preparation). C. smithi is reported most commonly in north-east Zambia.



FAMILY POTAMIDIDAE

Medium-sized to large snails reaching 160 mm high, with a turreted spire and commonly strongly sculptured. Aperture with a deep notch at the base. Operculum corneous and multispiral. Widely distributed in tropical brackish waters. The three species known from brackish water in southern Africa are readily identified by the following key.

KEY TO THE SPECIES

- 1 A Found on the west coast. Shell with tubercles of varied strength, sometimes projecting as spines.....Tympanotonus fuscatus
- B Found on the east coast. Shell sculpture consists mainly of low ribs.....2

- 2 A Ribs strong, apex decollate, lip of aperture curved outwards.....Cerithidea decollata

- B Ribs weaker, spire high and pointed, lip of aperture not curved outwards.....Terebralia palustris

Tympanotonus fuscatus (Linnaeus, 1758)

Up to 80 x 25 mm. Commonly found with Pachymelania fusca, from which it may be distinguished by the notch in the base of the aperture. Found in Senegal and southwards to Angola (Mossamedes).



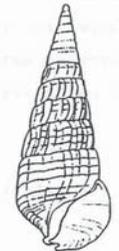
Cerithidea decollata (Bruguière, 1838)

Up to 32 x 15 mm (decollate). Greyish-brown in colour. Occurring in large numbers on the trunks of mangrove trees and surrounding mud. Found in Kenya and southwards to eastern Cape (Port Elizabeth).



Terebralia palustris (Linnaeus, 1767)

Up to 120 x 44 mm. Almost flat-sided with low ribs becoming weak on the lower whorls. Lives on the mud in brackish water. Found in Kenya and southwards into Natal.



PULMONATES

The African freshwater pulmonates can be distinguished from the prosobranchs by the absence of an operculum and by the radula, which has numerous small and rather uniform teeth. The shell generally is thin-walled and fragile, lacking strong sculpture. Shell shape includes cap-like, discoid, globose, and slender high-spined forms.

KEY TO THE PULMONATE FAMILIES

- 1 A Living in brackish waters; common
in mangrove swamps. Dextral shell;
aperture narrow, with internal folds
or teeth.....ELLOBIIDAE, p. 24
- B Living in fresh water. Dextral or
sinistral shells of various shapes.....2
- 2 A Shell cap-like or shield-shaped.....ANCYLIDAE, p. 27
- B Shell spirally coiled.....3
- 3 A Shell discoid, flat or lentiform..... PLANORBIDAE,
.....subfamily PLANORBINAE, p. 29
- B Shell with exserted spire.....4
- 4 A Shell dextral.....LYMNAEIDAE, p. 25
- B Shell sinistral.....5
- 5 A Spire not sharply pointed, surface dull.
Pseudobranch present. Mantle border smooth.
Radula teeth in nearly straight rows. Blood
red.....PLANORBIDAE, subfamily BULININAE, p. 38
- B Spire sharply pointed, surface glossy.
Pseudobranch lacking. Mantle border with
finger-like processes. Radula teeth in
v-shaped rows. Blood colourless.....PHYSIDAE, p. 48

FAMILY ELLOBIIDAE

Small to large snails with the aperture partly obstructed by folds or teeth on the margin. Amphibious, living in marine and brackish habitats, especially mangrove swamps in the Indo-Pacific region. Three species of three different genera found on the east coast can be considered here.

KEY TO ELLOBIIDAE

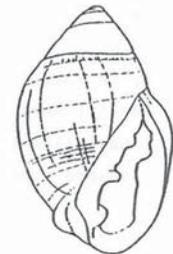
- 1 A Shell slender, at least twice as
high as wide. Lives in crevices
in mud.....Auriculastra radiolata
- B Shell proportionally broader.....2
- 2 A Outer lip with a strong internal
rib.....Cassidula labrella
- B Outer lip lacking a rib.....Melampus semiaratus

Auriculastra radiolata (Morelet, 1860)

Up to 11.7 x 5.3 mm. Shell tapered above and below (fusiform), nearly smooth, pale in colour. Columella with folds but there are none on the outer lip. Found in Somalia and southwards to Natal (Umgeni estuary).

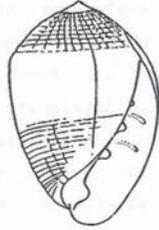
Cassidula labrella (Deshayes, 1830)

Up to 12 x 7.5 mm. Shell with spiral grooves and sometimes rows of bristles; dark reddish-brown. The rib on the lip has a tooth and there are 2 or 3 folds on the inner aperture margin. Found on islands in the Red Sea and southwards to eastern Cape (Port Elizabeth).



Melampus semiaratus Connolly, 1912

Up to 9.6 x 5.5 mm. Ribs intersected by spiral grooves produce a granular sculpture on the spire. Shell colour is dark brown. Outer lip with one or two internal ridges; inner aperture margin with 4 or more folds. It is possible that taxonomic revision will reveal more than one species of Melampus living in the mangrove habitat. Found in Somalia and southwards to Natal (Umkomaas river).



FAMILY LYMNAEIDAE

Dextral shells with a pointed spire. The flat and triangular tentacles are distinctive. Pseudobranch lacking. Worldwide in distribution, though with relatively few species in tropical Africa, all of which can be placed in the genus Lymnaea

Genus Lymnaea Lamarck, 1799

Three species occur in southern Africa, one of which is an introduction of American origin. All are of interest in relation to transmission of the trematode liver-fluke Fasciola.

KEY TO THE SPECIES

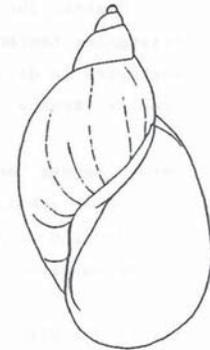
- 1 A Shell small, less than 12 mm high,
with the spire about as high as the
aperture, consisting of 5-6 convex whorls.....L. truncatula
- B Shell large, up to 25 mm high,
with the spire much shorter than
the aperture, consisting of 4-4.5 whorls.....2
- 2 A Shell lacking spiral ridges.....L. natalensis
- B Shell with spiral ridges, spaced closely
and regularly.....L. columella

Lymnaea truncatula (Müller, 1774)

Up to 11 x 6 mm. Recognisable by its small size, high spire and strongly convex whorls. Columellar margin of the peristome is more broadly reflected than in L. natalensis. Widespread in Europe, discontinuously distributed in north, east and southern Africa. Living in small waterbodies, often seasonal, over a large area of South Africa and particularly common in Lesotho; subfossil shells found in Namibia. L. truncatula is important in Lesotho as a host for Fasciola hepatica.

Lymnaea natalensis Krauss, 1848

Up to 25 x 16.5 mm. The spire is variable though always less high than the aperture. Shell surface often with spiral rows of small grooves but never with spiral ridges. L. natalensis is closely related to species in Europe, Arabia and Asia. It occurs almost throughout tropical and subtropical Africa, in mostly permanent waters. Present mainly in the eastern part of southern Africa, being rare in Namibia, Botswana and western Cape, and absent from Lesotho and much of the South African highveld. Intermediate host to Fasciola gigantica.

Lymnaea columella Say, 1817

Up to 23 x 12 mm. Resembling a slender L. natalensis but always distinguishable by the numerous spiral ridges in the periostracum. Often immediately recognisable by its habit of crawling out of the water. An American species introduced into many parts of the world. Known in Africa from scattered localities in Egypt, Kenya, Zambia, Zimbabwe and



southern Mozambique. It is more strongly established in South Africa, where the first known finding was in 1942. Reported to be an intermediate host for Fasciola hepatica as well as F. gigantica.

FAMILY ANCYLIDAE

Small, usually less than 10 mm long, cap-like or shield-shaped shells. Although often abundant, ancyliids are not readily obtained by standard collecting methods, as they adhere closely to vegetation and stones. World-wide in distribution, with three genera in Africa, two of which occur in the southern region.

KEY TO THE GENERA

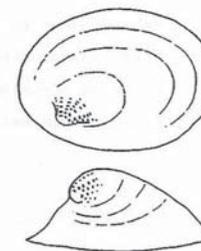
- 1 A Shell cap-like, its apex with radial rows of small pits.....Burnupia
- B Shell lower, shield-shaped, its apex with radial ridges (very fine).....Ferrissia

Genus Burnupia Walker, 1912

Usually 5-10 mm long when fully grown, with a prominent apex on which are radial rows of pits. Copulatory organ lacking a flagellum; its internal structure is complex (Oberholzer & Van Eeden, 1969). Often abundant on stones in well-oxygenated streams and lakes. Known only from Africa, highlands of Ethiopia and East Africa, and southwards into the Cape, and westwards in the Zaire basin.

Many species have been named and defined by characters of shell shape, which is highly variable and likely to be affected by substratum and current speed. Probably few of the named species are really different. It does not seem useful to attempt to differentiate among the numerous taxa named from specimens collected in southern Africa. Accordingly, all will be aggregated with the B. caffra, the oldest named form.

Burnupia caffra (Krauss, 1848) aggregate
Measurements of large shells: 6.8 x 5.5 x 2.5 mm (length, width and height of a broad form), 8.0 x 4.5 x 3.0 mm (narrow form). Other forms may reach 10 mm length and vary in proportional breadth and height. In southern Africa Burnupia is found in Angola, Zimbabwe, and throughout South Africa; there are isolated locations in Namibia. Not yet reported from southern Mozambique.

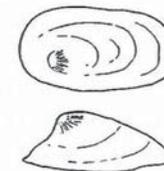


Genus Ferrissia Walker, 1903

Usually less than 5 mm long, with an obtuse apex on which are numerous very fine radial ridges. Copulatory organ with a flagellum (Brown, 1967), though aphyllid animals are frequent. Common though not easily seen, attached to vegetation in more varied habitats than Burnupia, including stagnant seasonal pools. A shell septum is sometimes formed, apparently in preparation for the dry season, after which a new shell grows beneath the old one; such shells have been classified in the genus Gundlachia. Distributed in North America, Europe, Asia, the Indo-Pacific region, and probably throughout Africa.

For reasons given under Burnupia, no attempt is made here to differentiate among numerous species named from shells collected in southern Africa. All will be aggregated with F. burnupi (Walker, 1912), the oldest named form from this region.

Ferrissia burnupi (Walker, 1912) aggregate
Up to 4 x 2.2 x 1 mm. Other named forms generally are smaller and vary in the proportion of width to height. Septate shells from the type locality of F. burnupia were named Gundlachia equeefensis Walter, 1924. Ferrissia probably lives throughout southern Africa, though it is rarely collected because of its small size.



FAMILY PLANORBIDAE

Animal with long, slender tentacles and reddish blood. Shell and anatomy highly diverse. Two subfamilies are present in Africa.

Subfamily PLANORBINAE

Shell discoid; commonly described and illustrated as dextral though the animal is anatomically sinistral (genital openings and pneumostome on the left side). Pseudobranch consisting of a simple lobe. Copulatory organ not of the 'ultrapenis' type characteristic of Bulininae. Worldwide in distribution; the 7 genera represented in southern Africa include one introduction from America (Helisoma).

KEY TO THE GENERA

- 1 A Large shell more than 2 mm high.....2
 B Small shell less than 2 mm high.....3
- 2 A Shell less than 6 mm high; whorls more or less convex above and below. Prostatic lobes in a row. Copulatory organ lacking a preputial gland.....Biomphalaria, below
- B Shell up to 14 mm high; whorls strongly convex above, angular on the underside and flat within the umbilicus. Prostatic lobes in a bunch. Copulatory organ with an external preputial gland.....Helisoma, p. 33

- 3 A Umbilicus large (at least one-third of the shell diameter). Curvature of whorls similar above and below.....4
 B Umbilicus small (less than one-third of the shell diameter). Upper surface of shell curved, underside flattened. Internal septa may be present. Shell often reddish-brown and glossy.....6
- 4 A Fully grown shell usually less than 1 mm high with 4-5 slowly increasing whorls. Penis with a cap-like stylet.....Afrogyrus, p. 33
 B Fully grown shell higher, with whorls increasing more rapidly.....5
- 5 A Whorls rapidly increasing; 3-4 completed. Shell with regular ribs and may be carinate at the periphery. Penis with dagger-like stylet.....Gyraulus, p. 34
 B Whorls strongly increasing; up to 5 completed. Shell lacking ribs; not carinate. Penis with a sclerotised tip but no stylet.....Ceratophallus, p. 34
- 6 A Shell depressed, sharply carinate at the periphery, with septa and distinct spiral sculptureSegmentorbis (Carinorbis), p. 35
 B Shell higher with the upper surface convex and underside flattened, bluntly angular at the periphery 7

- 7 A Shell with 5 or more sets of septa;
copulatory organ with flagellum
.....Segmentorbis (Segmentorbis), p. 35
- B Shell entirely lacking septa or rarely
with up to 4 sets; copulatory organ
lacking a flagellumLentorbis, p. 37

Genus Biomphalaria Preston, 1910

The genus comprises most of the larger planorbid snails of Africa, Arabia, Central and South America. Reaching up to 22 mm in diameter in Africa. Certain shell forms of Helisoma are similar but Biomphalaria is clearly distinguishable by its prostatic lobes arranged in a row and the lack of an accessory preputial gland on the copulatory organ. Of great medical importance as perhaps all species can act as intermediate hosts for Schistosoma mansoni.

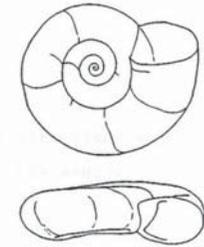
Distributed practically throughout tropical Africa, with southwards limits in Angola, north east Namibia, the Vaal river basin and the coastal plain of eastern South Africa. Two species can be recognised in southern Africa.

KEY TO THE SPECIES

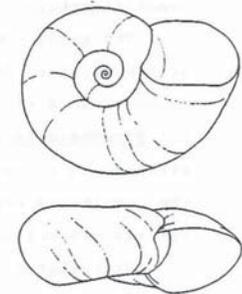
- 1 A Shell large and depressed with
rather flat whorls and a large
umbilicus (its width distinctively
greater than the height of the
aperture).....B. salinarum
- B Shell usually smaller, relatively
higher with a narrow umbilicus
(about equal to or less than the
height of the aperture).....B. pfeifferi

Biomphalaria salinarum (Morelet, 1868)
Up to 4.8 x 16.3 mm. Similar in shell

shape to B. camerunensis (Boettger, 1941) of west central Africa and to B. sudanica (Martens, 1870) of eastern Africa. A distinctive pattern of esterase enzymes has been observed (Wium-Andersen, 1974). Angola and northern Namibia.



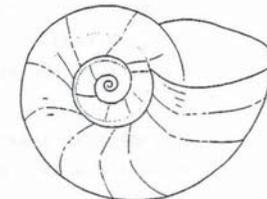
Biomphalaria pfeifferi (Krauss, 1848)
Up to 5.2 x 13 mm. Highly variable in the proportion of height and relative size of the umbilicus. Lamellae are sometimes present within the aperture. Living in a wide variety of flowing and still waterbodies, but not small seasonal pools. The persistent populations in South African rivers are associated with perennial pools in hard rock formations (Appleton & Stiles, 1976). Very widespread in Africa, occurring from the Sahara southwards to southern Angola, the Okavango basin, Vaal river basin, eastern Transvaal and Mozambique southwards in a narrow coastal strip to Port St. Johns in Transkei. Not found in the cooler areas of the South African highveld or in the Cape province and Lesotho.



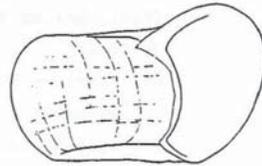
Genus Helisoma Swainson, 1840

Often growing larger than Biomphalaria, the relatively high whorls, strongly convex or angular, and the flat umbilical surface are distinctive. An American group introduced into many parts of the world. One species has been found in widely separated localities in Africa.

Helisoma duryi (Wetherby, 1879)
Up to 14 x 25 mm. Reported from Africa as Biomphalaria in at least two publications. The flat umbilical area should be distinctive, and a conclusive



identification can be reached by examination of the bunched prostatic lobes and the accessory preputial gland. Found in Egypt, Kenya, Tanzania, Namibia (Spitz Koppe) and South Africa (Natal, western Cape province and Johannesburg).

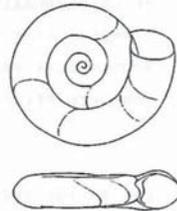


Genus Afrogyrus Brown and Mandahl-Barth, 1973

Small, rarely exceeding 4 mm in diameter in Africa. Penis with sub-terminal opening and a small cap-like cuticular stylet (less than 10 µm long). Found in much of tropical Africa and in Madagascar and other islands. One or two species are recognisable in southern Africa.

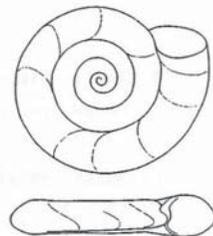
Afrogyrus coretus (de Blainville, 1826)

0.7 x 4.0 mm. Completing about 4-5 whorls, which is about half a whorl more than a young Ceratophallus of the same diameter. Identification should be confirmed by examination of the penis. Distribution poorly known because of lack of reliable determinations. A tropical species present in southern Africa at least as far south as the coastal plain of Natal (Ngoboseleni lake) and probably Namibia (Planorbis anderssoni Ancey 1890, known only from the shell).



A. misellus (Morelet, 1868)

1.2 x 5 mm. This possibly is merely a large form of A. coretus found in Angola.

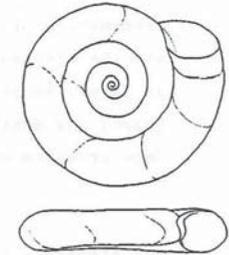


Genus Ceratophallus Brown & Mandahl-Barth, 1973

Shell with whorls increasing more rapidly than in Afrogyrus. Penis with a terminal opening through the sclerotised tip. Found only in Africa, mainly in the eastern part. One species is known to occur in southern Africa.

Ceratophallus natalensis (Krauss, 1848)

Up to 1.8 x 6.7 mm. Up to 5 convex whorls, which may be somewhat flattened beneath. Occasionally specimens are found having a low spire (scalariform). Even young snails can be distinguished from Afrogyrus by the different appearance of the penis. Living in marshes, slowly flowing streams and seasonal pools. Ethiopia and southwards into the western Cape; though not found in Angola or Namibia.



Genus Gyraulus Charpentier, 1837

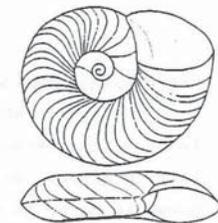
Whorls fewer and more rapidly increasing than in Afrogyrus or Ceratophallus natalensis. Penis with a sub-terminal opening and a dagger-like stylet. Worldwide in distribution except for the Neotropical region. Found throughout Africa; two species in southern Africa.

KEY TO THE SPECIES

- 1 A Whorls depressed, convex above and below, angular or carinate at the peripheryG. costulatus
- B Whorls higher, strongly convex or angular below, periphery smoothly curved.....G. connollyi

Gyraulus costulatus (Krauss, 1848)

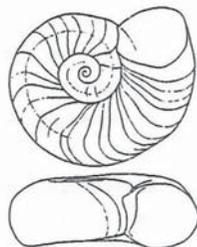
Up to 1.5 x 6.6 mm (depressed form). The typical depressed form is described in the key; it has strong and evenly spaced ribs. Other populations are less depressed and hardly at all carinate; such shells can be easily confused with G. connollyi. In rivers, streams and lakes but not waters that regularly dry out. Widespread in tropical Africa, extending southwards into



Angola, Botswana, Transvaal and Transkei.

Gyraulus connollyi Brown & Van Eeden, 1969

Up to 1.6 x 4.7 mm. The high, strongly convex and non-carinate whorls differ clearly from typical G. costulatus, but some populations can appear intermediate. The ribs of G. connollyi are less regular. In rivers and streams in the southern temperate climatic region of South Africa: highveld and escarpments, and living near sea-level in the Cape province.



Genus Segmentorbis Mandahl-Barth, 1954

Shell with convex upper surface and flat underside; whorls deeply embracing, umbilicus narrow and deep; sets of internal septa are present. Penis sheath with or without a single flagellum according to species. An African genus, present in Lower Egypt and southwards to eastern South Africa and Angola. Six species of which 3 occur in the southern region.

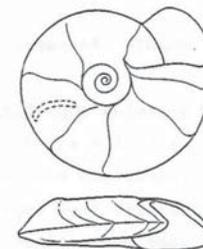
KEY TO THE SPECIES

- 1 A Last whorl sharply carinate at the periphery, spiral lines present
.....S. (Carinorbis) kanisaensis
- B Last whorl bluntly angular at the periphery, without spiral lines.....2
- 2 A Usually less than 5 sets of septa in the last whorl.....S. (Segmentorbis) angustus
- B 6 - 10 sets of septa in each whorl.....S. (Segmentorbis) planodiscus

Segmentorbis kanisaensis (Preston, 1914)

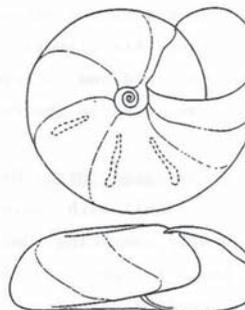
Up to 1.2 x 4.6 mm. Carination and spiral

sculpture are distinctive. Penis sheath lacking a flagellum. In marshes and seasonal pools in the tropical region southwards to the coastal plain of Angola; present in a narrow strip of south eastern Africa as far as Durban. Otherwise not reported in southern Africa.



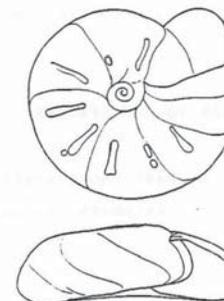
Segmentorbis angustus (Jickeli, 1874)

Up to 2 x 5.5 mm. Shell about three times broader than high. Usually less than 5 sets of septa present. Penis sheath with a flagellum. In permanent waters; widespread in the tropical region but with a restricted range in southern Africa like that of S. kanisaensis.



Segmentorbis planodiscus (Melvill & Ponsonby, 1897)

Up to 1.6 x 5.8 mm. Typical form is a little more depressed than S. angustus and has more septa (up to 10 sets). If the two species are really different, detailed study is needed to establish their respective distributions. S. planodiscus has been recorded from South Africa (east coast between Port St. Johns and Mtubatuba) and Namibia (Ovamboland).



Genus Lentorbis Mandahl-Barth, 1954

Shell similar in shape to Segmentorbis but septa are few or lacking entirely in most specimens. Penis sheath lacking a flagellum; preputium containing a large eversible lobe. An African genus, present in Ethiopia and Sudan and southwards to eastern South Africa and Angola. All three species occur in southern Africa; their shells are not easily distinguishable.

KEY TO THE SPECIES

1 A Found in western Africa. Penis sheath about equal in length to the preputium L. benguelensis

B Found in central and eastern Africa. Penis sheath 2 to 3 times length of preputium.....2

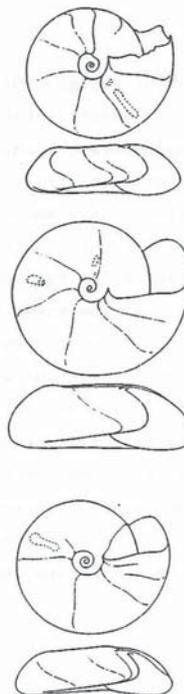
2 A Penis sheath twice the length of preputium.....L. junodi

B Penis sheath 3 times the length of preputium.....L. carringtoni

Lentorbis benguelensis (Dunker, 1845)
Up to 1.5 x 5.0 mm (rarely 7 mm). Traces of one or two sets of septa may be present. Penis sheath about equal in length to the preputium, though aphyallic animals are found. Niger, lower Zaire and the coastal plain of Angola.

Lentorbis junodi (Connolly, 1922)
Up to 2 x 5.5 mm. Penis sheath about twice as long as the preputium. Ethiopia, Sudan and southwards in eastern Africa to Natal province(Durban).

Lentorbis carringtoni (de Azevedo et. al., 1961)
Up to 1 x 3 mm. Septa entirely lacking or one to four sets may be present. The characteristic long penis sheath reaches 3 times the length of the preputium. Mozambique and south east Transvaal (Kruger National Park). Further study is



needed of the morphology and distribution of this species in comparison with L. junodi.

Subfamily BULININAE

Shell small to medium sized, sinistral, reaching 25 mm in height or diameter. Globose, ovate or higher (Bulinus) or discoid (Indoplanorbis). The major anatomical difference from the Planorbinae is the structure of the 'ultrapenis', which is attached at both the upper and lower ends of the penis sheath. The prostatic lobes are concentrated into a compact organ. Two genera are known: Bulinus of Africa and south west Asia, and Indoplanorbis of southern Asia and Arabia. Indoplanorbis has recently been found in Nigeria and it is not unlikely that it might be introduced into southern Africa; the shell somewhat resembles Helisoma.

GENUS Bulinus Müller, 1781

Identifiable by the sinistral shell and the presence of a pseudobranch, which is lacking in the Physidae, the only other family in Africa with which confusion is possible. About 30 species are known from Africa and islands in the Indian Ocean; this genus also occurs in Iberia, Mediterranean islands and South East Asia. Bulinus is of great medical importance and it provides all of the known snail host species for Schistosoma haematobium. Unfortunately few of the species are well enough defined and it may be doubtful whether morphological characters by themselves will ever be sufficient for a classification of value to the parasitologist. Characters more directly linked to genetic differences, such as chromosome number and enzyme variation are becoming of increasing importance in the taxonomy of this group. It is still convenient, however, to divide Bulinus into 4 species-groups, based mainly on shell forms.

KEY TO THE SPECIES GROUPS OF BULINUS

- 1 A Shell turreted, total height more than twice the height of the aperture.....forskalii-group
- B Shell globose or ovate, total height less than twice the height of the aperture.....2
- 2 A Shell small, usually less than 8 mm high; with spiral and transverse sculpture (reticulate), deep sutures (spire 'step-sided'), and large umbilicus. In temporary seasonal waters.....reticulatus-group
- B Shell more than 8 mm high; sculpture weaker (not reticulate), spire not 'step-sided', if umbilicate the opening is usually small.....3
- 3 A Columella truncate, microsculpture of nodules, short ridges or corrugations. A renal ridge is present.....africanus-group
- B Columella not truncate, usually straight or evenly concave, though sometimes twisted. Microsculpture of transverse ribs usually present; often with raised lamellae of periostracum. No renal ridge.....tropicus/truncatus-group

FORSKALII-GROUP

Of the 6 African species recognised, 3 occur in southern

Africa. In this region the forskalii-group is not known to play any significant part in transmitting the schistosome parasites of man or other definite hosts.

KEY TO SPECIES OF THE FORSKALII-GROUP

- 1 A Whorls distinctly shouldered or angular, even sharply carinate; strong ribs usually present.....2
- B Whorls evenly curved; ribs if present are weak and irregular.....3
- 2 A Shell slender. Height about 3 times the width.....B. forskalii
- B Shell broader, height about twice the width.....B. crystallinus
- 3 A Copulatory organ with penis sheath longer than the preputium, and swollen to accomodate the long epiphallus..... B. scalaris
- B Penis sheath about as long as the preputium and not much swollen.....B. canescens

Bulinus forskalii (Ehrenberg, 1831)

Up to 17 x 5.4 mm. An easily recognised form is slender, high-spined, with angular whorls bearing a sharp carination and strong ribs. Various other shell forms are at present placed in B. forskalii, which possibly will be subdivided as a result of future study. Investigation is particularly needed of a number of species named by Morelet (1868) for shells collected in Angola. B. forskalii lives in



various waterbodies, including lakes, irrigation channels and seasonal pools. It occurs in the lower Nile basin and almost throughout tropical Africa, extending into Namibia and the lower Orange river basin. South eastern arm of distribution reaches down the Natal coast into eastern Cape province (Mossel Bay). Not found in most of the western Cape or in Orange Free State and Lesotho.

Bulinus crystallinus (Morelet, 1868)

Up to 9.5 x 4.6 mm. Comparatively broad with shouldered whorls giving the spire a 'step-sided' appearance. There is some evidence that this snail might transmit S. haematobium; compatibility with S. intercalatum and S. bovis has been demonstrated in the laboratory.



Bulinus scalaris (Dunker, 1845)

Up to 12 x 4.5 mm. The evenly curved, smooth lower whorl distinguishes this species from the two preceding ones. In comparison with B. forskalii the shell is relatively broader and the last-formed whorl is proportionally bigger. Also distinctive is the long and swollen penis sheath. Found in briefly filled seasonal pools and also more permanent waters including irrigation channels (Jennings et al., 1974). A compatible host for S. intercalatum in the laboratory. Found in scattered localities in Ethiopia and southwards to Zimbabwe (near Harare), Angola (northern plateau and coastal plain) and Namibia (Ovamboland and Kaokoveld).



Bulinus canescens (Morelet, 1868)

Up to 15 x 6.2 mm. The shell is shaped like that of B. scalaris but the copulatory organ is like that of B. forskalii, i.e. with a small penis sheath (Mandahl-Barth, 1968). There may be ribs on the early whorls. The type locality is in Angola near the Bengo river (between Luanda and Ambriz) but B. canescens has not been reported from south of the Zambezi.



RETICULATUS-GROUP

This group was established for two species, one living in Arabia and the other in Africa.

Bulinus reticulatus Mandahl-Barth, 1954

Up to 8.5 x 6 mm (usually less than 7 mm high). Small for the genus, comparatively broad and sometimes globose. Other characteristics include the 'step-sided' appearance of the spire, the reticulate sculpture, widely reflected columella margin and large umbilicus. Living in temporary seasonal rainpools. A scattered distribution from Ethiopia to South Africa, where it is relatively abundant in the central highveld and Orange river basin.



AFRICANUS-GROUP

This group, also known as the subgenus or genus Physopsis, has two species in southern Africa. They have a microsculpture made of nodules, short transverse ridges or corrugations. The columella appears truncated, due to the presence of a ridge and the outward twisting of its base. The kidney has a longitudinal renal ridge. Two species to be considered are intermediate hosts for S. haematobium and other schistosomes. Further information is needed to establish the geographical distribution of each snail

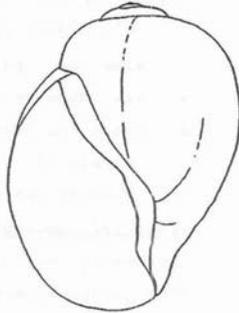
species, and to learn the part each one plays in transmitting schistosomes.

KEY TO THE SPECIES OF THE AFRICANUS-GROUP

- 1 A Penis sheath distinctly longer
and wider than the preputium.....B. africanus
- B Penis sheath shorter and narrower
than the preputium.....B. globosus

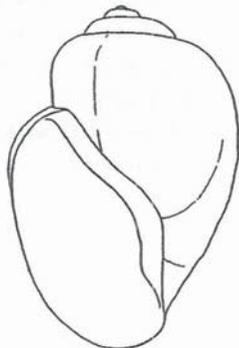
Bulinus africanus (Krauss, 1848)

Up to 24 x 13 mm. The comparatively long and broad penis sheath provides the most reliable difference from B. globosus. Further investigations are needed, as individuals with a copulatory organ of intermediate form have been reported from Angola and Zambia. Distribution is best known for the Natal province of South Africa (Brown, 1966), where B. africanus occurs in a cooler climatic area than B. globosus. Distributed in eastern Africa from Ethiopia southwards to the Vaal river basin and the coastal regions of Natal and eastern Cape province (Humansdorp).



Bulinus globosus (Morelet, 1866)

Up to 22 x 14 mm. The comparatively small and narrow penis sheath provides the main difference from B. africanus. In making an identification it is important to make allowance for the possible effect of parasitisation the size and shape of the copulatory organ. Detailed studies of distribution indicate that this species is adapted to more tropical conditions than B. africanus. B. globosus occurs in a large part of Africa south of the Sahara;



its southern limits appear to lie in Angola, the Okavango basin, eastern Transvaal and the coastal plain of Natal.

TROPICUS/TRUNCATUS-GROUP

The shell microsculpture differs clearly from that in the africanus-group. It is neither nodular nor corrugated, but regular transverse ribs usually are present and they may bear raised lamellae of periostracum. The ribs may however become weak on the last whorl.

Twisting of the columella sometimes produces a shape like that seen in the africanus-group, but close inspection will show the lack of a columellar ridge.

The kidney lacks a renal ridge. Apathalic animals (lacking the copulatory organ) are found in some species. None of the 4 species recognised here is known at present to transmit S. haematobium in southern Africa but certain of them have the potential to do so.

Populations belonging to the tropicus/truncatus-group are perhaps the commonest freshwater snails in Africa. Variation in the shell is wide though apparently continuous. It is still uncertain how many species occur in southern Africa, and substantial progress will not be made until much more information becomes available about chromosome number and biochemical variation, in addition to detailed morphometric analysis.

It is unfortunately impossible to construct a simple dichotomous key, as the species do not show sharp morphological differences. The student will face difficulties with many shells of intermediate appearance.

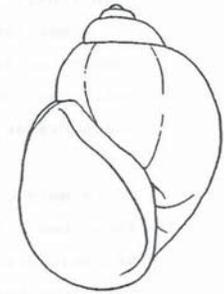
KEY TO THE TROPICUS/TRUNCATUS-GROUP

- 1 A Spire sharply pointed and comparatively high (shell height commonly more than 1.3 times the aperture height). Columella concave or straight, margin broadly reflected. Umbilicus open. Copulatory organ present (animal euphallic).....B. tropicus
- B Spire more obtuse and lower (shell height less than 1.3 times as high as the aperture height). Columella commonly twisted. Umbilicus narrow or closed. Copulatory organ lacking in some individuals (aphallic).....2
- 2 A Chromosome number tetraploid. Found in southern Africa so far only in Angola, though could be more widespread.....B. truncatus
- B Chromosome number diploid.....3
- 3 A Small shell rarely reaching 10 mm high. Spire depressed and obtuse. Ahallic animals very frequent (sometimes over 90% of population). Northern Transvaal and further northwards.....B. depressus
- B Shell commonly larger, up to 13 mm high. Spire usually low though variable. Ahallic animals less common (few in some populations). Natal province and perhaps more widespread.....B. natalensis

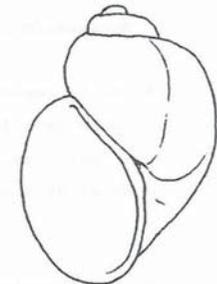
Bulinus tropicus (Krauss, 1848)

Commonly reaching 15 x 10 mm and sometimes 20 mm high. Diploid (2n=36 chromosomes). Typical shell with the spire comparatively high (shell height usually at least 1.3

times the aperture height), columella concave or straight, and the umbilicus moderate to large. The mesocone on the 1st lateral tooth is commonly non-angular (triangular) but in some populations it is more or less angular. Ahallic animals hardly ever seen (though the copulatory organ may be very small as a result of parasitic infection). Abundant in farm dams, particularly on the highveld of South Africa. In Natal province, distribution is associated with cool climatic conditions (Brown et al., 1971). Host for Schistosoma margrebowiei in Botswana and of the amphistome Calicophoron microbothrium. Highlands of Ethiopia and Kenya, and found southwards into Zimbabwe, Botswana and South Africa (including the western Cape and the Orange river basin).

Bulinus truncatus (Audouin, 1827)

Up to 10 x 8 mm (in Malawi). Chromosome number tetraploid (2n=72); this needs to be confirmed for Angolan populations reported by Wright (1963 as B. truncatus rohlfsi). The small size, depressed spire and narrowly reflected columella margin are similarities to B. depressus (see below). In both species ahallic individuals are common and the mesocone is angular (arrowhead-shaped). B. truncatus transmits S. haematobium in lower Zaire, and laboratory-bred snails originating from Angola were compatible hosts for this parasite from North Africa (Wright, 1963). Therefore this snail must be regarded as a potential intermediate host throughout its range. Widespread in North and tropical Africa; the known southern limits have



been greatly extended through investigations of chromosome number (Brown & Rollinson, 1982). Since the snail is present in southern Malawi, it should be looked for south of the Zambezi.

Bulinus depressus Haas, 1936

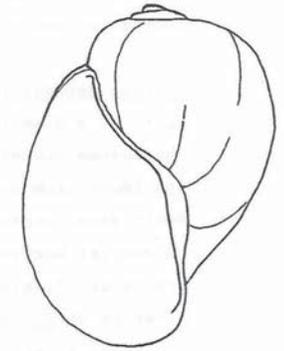
Up to 11 x 8 mm (usually smaller). Chromosome number diploid ($2n=36$) in specimens from northern Transvaal. The small size, depressed spire, narrow columellar margin and slit-like umbilicus are clear differences from typical examples of B. tropicus. The nature of B. depressus is still debatable; it was regarded as a subspecies of B. tropicus by Mandahl-Barth (1968) who examined specimens from near the type locality in Zambia, but to Hamilton-Atwell & Van Eeden (1969) B. depressus has a strongly angular mesocone and is frequently aphyallic. B. depressus in the sense of Hamilton-Atwell & Van Eeden occurs in northern Transvaal and westwards down the basins of the Vaal and Orange rivers. Present also in the Okavango basin and Caprivi area.



Bulinus natalensis (Kuster, 1841)

Up to 10 x 7.5 mm (rarely 13 mm high). Chromosome number diploid ($2n=36$). Commonly with a low to moderate spire (shell height usually less than 1.3 times aperture height). Columella often twisted and umbilicus small. Mesocone commonly angular, though its shape varies widely and intergrades continuously with the range seen in B. tropicus. Some aphyallic snails are present in many but perhaps not all populations. Named forms that may be the same species include B. angolensis

(Morelet, 1866; from Angola) and B. parietalis (Mousson, 1887); from Namibia). The questions cannot be settled until observations become available on chromosome number and biochemical characters for relevant snail populations in these countries. Infection with S. haematobium has been achieved in laboratory experiments with B. natalensis from South Africa (Lo et al., 1970) and Zimbabwe (Mandahl-Barth et al. 1976). There is however still no evidence of natural transmission. The distribution of B. natalensis will remain unclear until there is a better understanding of the taxonomy of all diploid snail populations in this group. Reported from Ethiopia to South Africa, where it is most common in the warm climatic area in Natal Province.



FAMILY PHYSIDAE

The shell is sinistral with a sharply pointed spire and smooth surface which may appear polished. Physid snails can be confused with Bulinus on first sight, but their distinguishing characters include colourless blood, lack of pseudobranch, radular teeth in V-shaped rows and freely ending penis (in contrast to the 'ultrapenis' of Bulinus). Moreover, African physids may be recognised externally by the enlarged margin of the mantle, which may project over the shell. This is mainly an American family with a few species in Eurasia and Africa. At least two different groups are represented in southern Africa, but because classification in this family is far from stable no attempt is made here to define genera.

KEY TO SPECIES OF PHYSIDAE

- 1 A Shell slender, preputium not swollen about midway along its length. Mantle with a broad skirt around the front margin.....Aplexa (Stenophysa) mosambiquensis
- B Shell broader, preputium with an ovoid swelling caused by a bulging gland. Front margin of mantle lacking a skirt, though finger-like processes project from the sides.....Physa acuta

Aplexa (Stenophysa) mosambiquensis (Clessin, 1886)

Up to 12 x 6 mm. The slender shell is distinctly brown in colour, shiny and so smooth that it slips easily through the fingers. The junction between the penis sheath and the preputium may be swollen and this should not be mistaken for the bulging preputial gland of P. acuta. The mantle skirt extends posteriorly as broad flaps with wavy edges. Recent anatomical observations by Appleton (1989) proved this species to be different from P. acuta and it may be closely related to A. (Stenophysa) waterloti of West Africa. A. mosambiquensis is so far known from the Natal province of South Africa and Mozambique (Tete, the type locality).

Physa acuta Draparnaud, 1805

Up to 15 x 9 mm. In comparison with A. mosambiquensis the shell is broad, paler and less shiny. P. acuta is more similar to a Bulinus such as B. tropicus, from which it differs in its more acutely

pointed apex and smoother surface; the most readily observed physid characters are absence of a pseudobranch and the presence of finger-like projections from the mantle. P. acuta is reported from many African countries. It appears to be spread through human activities and thrives in mildly polluted waters in urban areas. Found in southern Africa in Zimbabwe, Namibia and above all South Africa, where it has become common over a period of about 30 years (Hamilton-Atwell et al., 1970).



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