

Danish Bilharziasis Laboratory



A field guide to
African freshwater snails

2. East African species
Second edition

1987

Danish Bilharziasis Laboratory



WHO Collaborating Centre
for Applied Medical Malacology
and Schistosomiasis Control

Jaegersborg Allé 1 D • DK-2920 Charlottenlund • Denmark • Tel. +45 31 62 61 68

PREFACE

The present volume is the second edition of: African Freshwater Snails 2: East African Species. It includes all the species known from Somalia, Kenya, Uganda and Rwanda and most of the species from Burundi and Tanzania. Not included are the many particular prosobranch snails endemic to Lake Tanganyika and the snail fauna of Lake Malawi.

This 2nd edition is only changed a little compared to the first edition made by Dr. G. Mandahl-Barth. Three new species described since the first edition are included. Likewise a species not previously represented in the fauna of this area is introduced.

Within the medically important genus Bulinus a number of identification problems are still unsolved in the area, especially on the coast of East Africa and the northern part of Tanzania. In these areas the anatomical and morphological characters normally used to separate the species merge into each other.

Acquaintance with terms, ability to carry out a dissection and produce radula preparations are essential for carrying out most of the identifications. These items are described in the introduction volume of this series. In more difficult cases the aid of chromosome number determination and electrophoresis is a way of carrying out a reliable identification. A guide for these methods is available on request.

Specimens which cannot be identified or for which a confirmation of the identification is required are welcome at the address below. Preferably, such specimens should be sent alive between layers of damp, but not wet, cotton wool by air mail, or preserved in 70% alcohol.

Thomas K. Kristensen
Danish Bilharziasis Laboratory
Jaegersborg Alle 1 D
DK - 2920 Charlottenlund
DENMARK

IDENTIFICATION KEY TO EAST 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 easily distinguished as described below:

- A The snail has an operculum which blocks the opening of the shell when the body is withdrawn. The shell is thick walled. The members of this group are called
Prosobranchs.....PROCEED BELOW
- B The snail does not have an operculum or lid. The shell is thin walled. All such snails belong to the group called
Pulmonates.....PROCEED TO PAGE 25

PROSOBRANCHS

The freshwater prosobranchs are most easily recognized by the presence of an operculum and the structure of the radula. In African prosobranchs the radula is taenioglossate, except in the family Neritidae, which has a rhipidoglossate radula. In comparison with the freshwater pulmonates, the prosobranchs have, in general, a stronger and heavier shell.

KEY TO PROSOBRANCH FAMILIES

- 1 A Shell hemispherical, consisting of few whorls. Spire small. Operculum calcareous, with apophyses.....NERITIDAE (p.3)
- B Shell depressed or globose or higher, operculum without apophyses.....2

- 2 A Full-grown shell more than 10 mm high.....3
 B Full-grown shell less than 10 mm high.....5
- 3 A Operculum concentric.....4
 B Operculum paucispiral or concentric with spiral nucleus.....THIARIDAE (p.19)
- 4 A Shell conical. Female viviparous. Male with enlarged right tentacle which serves as a copulatory organ.....VIVIPARIDAE (p.4)
 B Shell depressed, globose or higher. Female oviparous. Male with a copulatory organ near the mantle border.....AMPULLARIIDAE (p.8)
- 5 A Operculum calcareous, concentric with a spiral inner part. Lateral teeth without accessory plates.....BITHYNIIDAE (p.12)
 B Operculum corneous and paucispiral. Lateral teeth with accessory plates.....ASSIMINEIDAE (p.18)

FAMILY NERITIDAE

Shell strong, imperforate, hemispherical with a small spire. Aperture with semicircular outer lip and flat expanded, thickened columellar margin. Operculum calcareous, paucispiral with projecting processes (apophyses) basally on the inner surface. The only family in African freshwaters with a rhipidoglossate radula.

The species of this family live in fresh, brackish or salt water. In East Africa 2 species live in fresh or brackish water. Both belong to the genus Neritina.

GENUS Neritina Lamarck, 1816

The two East African species are found only in the coastal area.

KEY TO THE SPECIES OF NERITINA

- 1 A Shell black with an orange band inside the outer lip. Spire not projecting.....N. pulligera
 B Shell dark with yellow spots and bands. The inner side of outer lip not orange. Spire somewhat projecting.....N. natalensis

Neritina pulligera (Linnaeus, 1767)

Up to 18 x 23 mm. Known from Madagascar, Zanzibar and Pemba. On the east coast of Africa from Kenya to South African Republic.



Neritina natalensis Reeve, 1855

Up to 21 x 22 mm. Distributed in the coastal area from Natal to Somalia. Very variable in pattern.



FAMILY VIVIPARIDAE

In Africa two genera: Neothauma, only found in Lake Tanganyika and Bellamya found in most of the continent and also in southern Asia. Neothauma is not included in this guide.

GENUS Bellamya Jousseaume, 1886

Shell medium sized to rather large, conical with convex, angular or carinate whorls. Operculum thin, corneous and concentric. Females viviparous, normally with eggs and embryos in uterus. In males the right tentacle is enlarged and serves as a copulatory organ.

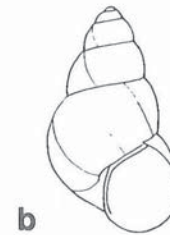
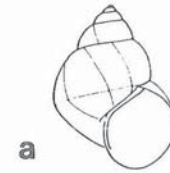
In East Africa several species are found in lakes and rivers, especially in Lake Victoria. The identification of species is difficult and may only be possible if full grown specimens are available, as the eggs and embryonic shells in some cases serve as distinguishing characters.

KEY TO THE SPECIES OF BELLAMYA

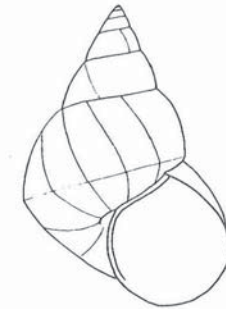
- 1 A Full-grown shell less than 35 mm high.....2
 B Full-grown shell more than 35 mm high.....B. phthinotropis
- 2 A Shell with 1 to 4 spiral ribs.....3
 B Shell without spiral ribs.....4
- 3 A With 5.5 whorls, less than 20 mm high. Umbilicus closed.....B. constricta
 B With 5.5 whorls, 25-27 mm high. Umbilicus not completely closed.....B. trochlearis
- 4 A Shell with very convex whorls and deep sutures, umbilicus open. Lake Albert.....B. rubicunda
 B Shell with less convex and frequently somewhat angular whorls, umbilicus more or less open.....5
- 5 A Small eggs, placed in 3-4 rows in uterus.....B. unicolor
 B Larger eggs, placed in 1-2 rows in uterus.....6
- 6 A Spire beehive shaped, females with higher spire than males. Lake Victoria and Victoria Nile.....B. jucunda
 B Spire more regularly conical, no sexual polymorphism.....7
- 7 A Species of Lake Victoria, shell 18-22 mm high, not glossy.....B. costulata
 B Height 25 mm or more, shell rather glossy and normally with a blunt shoulder angle.....B. capillata

Bellamya unicolor (Olivier, 1804)

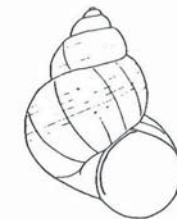
Up to 25 x 18 mm. The small eggs arranged in 3-4 rows in uterus and the embryonic shell with a low conical spire with straight sides are distinctive. The shell is greenish or brownish and usually with a blunt angle at the shoulder and another along the periphery (a). Umbilicus not completely closed and an umbilical furrow is present. Widely distributed in northern Africa from Egypt to northern Tanzania and from Ethiopia to Senegal. A subspecies, Bellamya unicolor elatior (Martens, 1892)(b) with a higher spire has been described from Lake Victoria, where it is rather common. In Lake Kyoga (Uganda) and Lake Tana (Ethiopia) similar high spired forms are found.

Bellamya phthinotropis (Martens, 1892)

Up to 44 x 30 mm, and the largest of the East African species. Umbilical furrow present, umbilicus more or less covered. The species has a broader basis and a more pointed spire than any of the other East African species. The embryonic shell has a high spire, but it is small in proportion to the size of the shell, only 6.0 x 5.2 mm. Only found in Lake Victoria.

Bellamya rubicunda (Martens, 1879)

Up to 27 x 20 mm. The convex, not angular whorls, the deep sutures and open umbilicus are distinctive. The embryonic shell has more rounded whorls than any other species. Only found in Lake Albert, where a smaller form, less than 20 mm high and with a whitish shell, occurs in deeper water.



Bellamya capillata (Frauenfeld, 1869)

Up to 33 x 23 mm. Frequently difficult to separate from B. unicolor, but the larger eggs and the more step-like spire in the embryonic shell are distinctive. The colour is usually darkish brown, seldom greenish and a spiral sculpture is often present. Known from the coastal area of Kenya and Tanzania and the southern part of Tanzania. The species is more common in Zambia and southeastern Zaire.

Bellamya jucunda (Smith, 1892)

Female shells up to 24 x 16 mm, male shells up to 20 x 15 mm. The only Bellamya species with a distinct sexual dimorphism. The convex-sided spire resembling a beehive and the completely closed umbilicus without an umbilical furrow are distinctive. The embryonic shell has a lower spire than the other species. A much larger form is found in the Napoleon Gulf (Lake Victoria) and in the Kavirondo Gulf (also Lake Victoria) a form is found which differs from the typical form by the not completely closed umbilicus. B. jucunda is only known from Lake Victoria and the first part of the Victoria Nile.

Bellamya costulata (Martens, 1892)

Up to 24 x 16 mm. A very variable species, which can be divided into three subspecies: costulata (Martens, 1892), ugandae Mandahl-Barth, 1973 and daqusiae Mandahl-Barth, 1973. Only found in Lake Victoria.

Bellamya constricta (Martens, 1889)

Up to 20 x 13 mm. The smallest of the species, characterized by the completely closed umbilicus and carinate whorls, with 1-3 keels, which are present also on the embryonic shell. This measures only 2.4 mm in height and width. Known from Lake Victoria and the first part of the Victoria Nile.

Bellamya trochlearis (Martens, 1892)

Up to 30 x 19 mm. Looks like a large edition of the preceding species, but the umbilicus is not completely closed. Differs from all other East African species of the genus by the females being 5 times more numerous than the males. The embryonic shell with 1-3 spiral ribs measures 5.5 x 5.2 mm. As in the preceding species the keel may disappear on the ultimate whorl. Known only from Lake Victoria.



FAMILY AMPULLARIIDAE

Shell medium to very large (more than 100 mm high), depressed, globose or higher. The mantle cavity is divided into two compartments, one with a gill and the other serving as a lung. Operculum concentric. The family has a worldwide distribution in tropical freshwaters. In East Africa two genera occur naturally. A third genus, Marisa, has been introduced to several laboratories in Africa for studies on its potential as a biological control agent of schistosome intermediate snail hosts. The species in question, Marisa cornuarietis, is being tried in field experiments and is consequently included in this field guide.

KEY TO THE GENERA OF AMPULLARIIDAE

- 1 A Shell discoid.....Marisa (p.12)
 B Shell depressed or higher.....2
- 2 A Shell sinistral, operculum corneous.....Lanistes (below)
 B Shell dextral, operculum calcareous.....Pila (p.11)

GENUS Lanistes Montfort, 1810

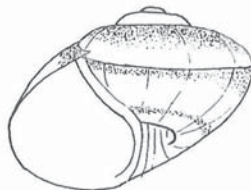
The shell, but not the animal, is sinistral (hyperstrophy).
 The genus is distinctly African. In East Africa five species,
 one of which has been divided into subspecies.

KEY TO THE SPECIES OF LANISTES

- 1 A Shell depressed, widely umbilicate and
 usually carinate along the periphery.....L. carinatus
 B Shell globose or higher. Umbilicus
 narrow or closed. No keel along the
 periphery.....2
- 2 A Shell with convex, not angular whorls.....L. ovum
 B Shell with a shoulder angle.....3
- 3 A Shell umbilicate, with a distinct
 shoulder angle.....L. ciliatus
 B Shell imperforate with a blunt
 shoulder angle.....4
- 4 A Shell with a strong spiral sculpture.....L. farleri
 B Shell without spiral sculpture.....L. stühlmanni

Lanistes carinatus (Olivier, 1804)

Up to 36 x 45 mm. The only East African
Lanistes distinctly wider than high. The
 peripheral keel is usually disappearing
 towards the aperture in adult specimens.
 Another keel or angle is present around



the umbilicus. Common in the Nile
 drainage from Lake Kyoga to Egypt and
 also in the coastal area of Kenya and
 Somalia.

Lanistes ovum Peters, 1845

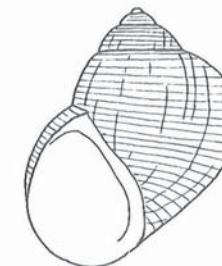
Up to 85 x 53 mm. A very variable species,
 which has been divided into three subspecies:
 1) L. o. ovum Peters, 1845, 2) L. o. procerus
 Martens, 1866 and L. o. purpureus (Jonas, 1839).
 The species is common from Somalia to
 Mozambique.

Lanistes ciliatus Martens, 1878

Up to 19 x 17.5 mm. A very poorly known
 species. The umbilicus, the dark spiral
 bands and the shoulder angle are
 distinctive. Found only in South East
 Kenya.

Lanistes farleri Craven, 1880

Up to 32 x 28 mm. The strong imperforate
 shell separates this and the following
 species from the other East African
Lanistes. Known from streams in the
 Usambara mountains, Tanzania, and the
 rivers Wami and Kingani.

Lanistes stühlmanni Martens, 1897

Up to 28 x 23.5 mm. Differs from the
 preceding species by the complete absence
 of spiral lines. Known from Dar es Salaam
 and the Ifakara area, Tanzania.



GENUS Pila Röding, 1798

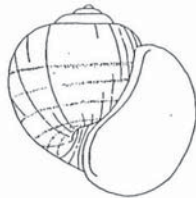
The members of this genus are characterized by the large to very large globose and dextral shell and the calcareous, concentric operculum with an inner calcareous layer. They are found throughout tropical Africa and Asia. In East Africa three species, one of which comprises several subspecies.

KEY TO THE SPECIES OF PILA

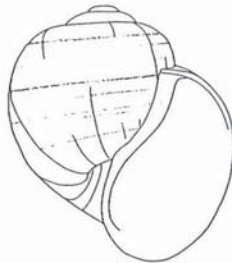
- 1 A Sutures deep, umbilicus rather wide.
Apex usually not eroded.....P. speciosa
- B Sutures not deep, umbilicus narrower
or partly covered and apex often eroded.....2
- 2 A Spire usually short and the whorls with
rather flat sides. Operculum almost twice
as high as wide with the greatest width
at the lower third.....P. wernei
- B Spire usually longer and whorls with rather
flat sides. Operculum almost twice as high
as wide with the greatest width nearer to the
middle.....P. ovata

Pila speciosa (Philippi, 1849)

Up to 105 x 100 mm. Often brightly coloured. The very deep channelled suture and the pointed apex are distinctive. Restricted to Somalia, north eastern Kenya and eastern Ethiopia.

Pila wernei (Philippi, 1851)

Up to 127 x 125 mm and the largest African freshwater snail. Distribution is wide but scattered in tropical Africa and it is uncommon in East Africa.

Pila ovata (Oliver, 1804)

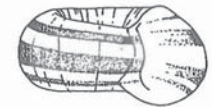
Up to 115 x 108 mm, but normally 70 x 65 mm. A very common and variable species in East Africa. A number of subspecies have been described as distinct species. The distribution of the species is from eastern Zaire through Uganda, Kenya and Tanzania.

GENUS Marisa Gray, 1824

This genus is characterized by the large, discoid shell and the corneous operculum. The genus, comprising only few species, is found in South America and the West Indies. It has been introduced to Africa for small scale field trials of biological control of Bulinus and Biomphalaria species.

Marisa cornuarietis (Linnaeus, 1758)

Up to 55 x 18 mm. The discoid shell distinguishes this species from all other African prosobranchs. The species is recorded from at least one natural habitat in East Africa at Kisangara, near Moshi Tanzania



FAMILY BITHYNIIDAE

This family is characterized by the small size of the shell (less than 10 mm) and the calcareous operculum with a paucispiral inner part surrounded by a concentric outer part. Numerous species are found in freshwaters of Europe, Africa and Asia. In Africa about 30 species are known, 16 of which have been found in East Africa. The family is divided into three genera.

KEY TO THE GENERA OF BITHYNIIDAE

- 1 A Operculum with corneous margin, only the spiral part is calcareous. The operculum does not lodge to the peristome. Central teeth with only one denticle on either side.....Incertihydrobia (below)
- B Operculum completely calcareous and lodges to the peristome. Central teeth with 2-5 basal denticles on either side.....2
- 2 A Spiral part of operculum placed centrally. Central teeth with 3-5 central denticles.....Gabbiella (below)
- B Spiral part of operculum excentrically placed near the outer lip. Central teeth with 2 basal denticles of which the outmost is very small.....Jubaia (p.18)

GENUS Incertihydrobia Verdcourt, 1958

The genus comprises only the species below. Operculum and radula are distinctive.

Incertihydrobia teesdalei Verdcourt, 1958

Up to 5.5 x 3.7 mm. The spire as high as, or slightly higher, than aperture. 4.5 rather convex whorls. Umbilicus narrow and partly covered. Known from Lake Jilore, Kenya Coast.

GENUS Gabbiella Mandahl-Barth, 1968

The shell varies in height from 2.5 to 9 mm and is of a lighter or darker horny colour. The aperture is fairly large, with a continuous, thickened and often dark peristome. The operculum, which in full-grown specimens lodges to the peristome, has a spiral part occupying from 1/6 to 4/5 of the diameter. The central teeth with 3-4, seldom 5 basal denticles on each side. About 20 species are known from Africa and 11 of

these have been recorded from East Africa.

KEY TO THE SPECIES OF GABBIELLA

- 1 A Spire as high as or shorter than aperture.....2
B Spire distinctly higher than aperture.....8
- 2 A Full-grown shell less than 3 mm high.....3
B Full-grown shell more than 3.5 mm high.....4
- 3 A Peristome not free of preceding whorl, umbilicus partly closed.....G. parva
B Peristome free of preceding whorl, umbilicus open.....G. barthi
- 4 A Spiral part of operculum of full-grown specimen occupies 2/3 or less of the diameter.....5
B Spiral part of operculum of full-grown specimen occupies 4/5 of the diameter.....7
- 5 A Central teeth of radula almost as long as wide.....G. neumanni
B Central teeth much wider than long.....6
- 6 A Shell less than 6 mm high, solid and often with a blunt shoulder angle.....G. humerosa
B Full-grown shell 6-7.5 mm high, thinner and without shoulder angle.....G. kichwambae
- 7 A Apex blunt, whorls evenly rounded.....G. parvipila
B Apex pointed, whorls with a shoulder angle.....G. verdcourti
- 8 A Smaller species, less than 5 mm high. Spiral part of operculum occupies more than half of the diameter.....9
B Larger species, more than 5 mm high. Spiral part occupies 1/3 or less of the diameter.....10

- 9 A Shell pure white. Lake Albert.....G. candida
 B Shell pink. Lake TurkanaG. rosea
- 10 A Umbilicus closed. Sutures rather shallow.....G. senaariensis
 B Umbilicus wide. Sutures very deep. Lake Albert.....G. walleri

Gabbiella humerosa (Martens, 1879)

Up to 4.5-6.2 mm high and 4.3-4.9 mm wide. Spiral part of operculum about 2/3 of the diameter. A very variable species of the Great Lakes. The typical form is common in Lake Victoria from the shores and down to at least 12 meters. Following subspecies are known:



a. G. h. kyogae Mandahl-Barth, 1968 from the Victoria Nile and Lake Kyoga. It is smaller (up to 4.5 x 3.9) than G. humerosa s. st. and has a more conical spire and less angular whorls.

b. G. h. alberti (Smith, 1888) from Lake Albert and the Albert Nile. Differs from the preceding subspecies by the more convex whorls.

c. G. h. edwardi (Mandahl-Barth, 1954) from Lake Edward and the Kazinga Channel. Larger (up to 5.6 x 4.5 mm) than G. humerosa and frequently with an obtuse shoulder angle.

d. G. h. kivuensis Mandahl-Barth, 1968 from Lake Kivu. Up to 4.8 x 4.0 mm. Differs from the other subspecies by the dull brown, rather strong periostracum with distinct spiral lines.

e. G. h. tanganyicensis Mandahl-Barth, 1968 from streams and lagoons near Lake Tanganyika. The smallest of the subspecies, on average up to 4.0 x 3.5 mm. A small replica of kivuensis but with only faint traces of spiral lines.

Gabbiella kichwambae (Mandahl-Barth, 1954) Up to 6.0-7.5 mm high and 5.0-5.7 mm wide. The spire is almost as high as the aperture. Umbilicus more open and whorls more convex than in G. humerosa. Crater lakes in western Uganda and also found in Lake Lutoto.



Gabbiella parva (Mandahl-Barth, 1954) Up to 2.9 x 2.5 mm. Resembling a young G. humerosa, but the spiral part of the operculum and the central teeth are relative longer. Lakes and streams in southwestern Uganda.



Gabbiella barthi Brown, 1980

Up to 2.5 x 3.1 mm. Low spire, circular and free aperture and open umbilicus are distinctive. A newly recognized (1976) species found on the Kano Plain, Kenya.



Gabbiella neumanni (Martens, 1897)

Up to 5.7 x 4.3 mm. The shell rather similar to that of G. humerosa, but the radula has distinctly longer, almost squarish central teeth. Operculum unknown. Described from the pond Monlo-Sakissagan on the Masai Steppe, Tanzania, and never re-found.



Gabbiella parvipila (Verdcourt, 1958)

Up to 3.5–5.0 mm high and 3.2–4.0 mm wide. The very blunt apex and the very large spiral part of operculum are distinctive.

Southern Somalia and Kenya Coast.

Gabbiella verdcourti Mandahl-Barth, 1968

Up to 4.0 x 3.2 mm. The pointed, reddish apex and shouldered whorls separate this species from G. parvipila.

Gabbiella candida Mandahl-Barth, 1968

Up to 4.0 x 2.8 mm. The small, pure white shell and convex whorls are distinctive. Endemic to Lake Albert.

Gabbiella rosea Mandahl-Barth, 1968

Up to 4.5 x 3.2 mm. Similar in shape to the preceding species, but slightly larger, with a relatively large spiral part of operculum and a pink or orange colour. Endemic to Lake Turkana.

Gabbiella senaariensis (Küster, 1852)

Up to 5.3 x 3.5 mm. The form occurs in northern Uganda (G. s. ugandae Mandahl-Barth, 1968) and is smaller than the typical form from the Sudan. The high spire and brown horny colour separate it from the other East African Gabbiella species. Victoria and Albert Nile.

Gabbiella walleri (Smith, 1888)

Up to 7.6 x 4.8 mm. The umbilicate white shell with very convex whorls cannot be confused with any other Gabbiella. Lake



Albert, at depths of 8–40 meters.

GENUS Jubaia Mandahl-Barth, 1968

Related to Gabbiella, but differs from this by the operculum having the nucleus situated to the right, and by the radula on which the central tooth has two basal denticles on either side. The genus comprises two species, both from the northeastern part of East Africa.

KEY TO THE SPECIES OF JUBAIA

- 1 A Shell whitish, with obtuse apex and almost closed umbilicus. The spiral part of operculum about 3/4 of the diameter.....J. excentrica
 B Shell brownish, with more pointed spire and narrow umbilicus. Spiral part of operculum only 2/5 of the diameter.....J. aethiopica

Jubaia excentrica Mandahl-Barth, 1968

Up to 6.8 x 4.7 mm. Known only from southern Somalia, but the species might occur in northeastern Kenya.

Jubaia aethiopica (Verdcourt, 1958)

Up to 4.9 x 3.6 mm. Known only from the type locality: Belleh Mersin, Ogadan, Ethiopia, but its occurrence in Somalia is probable.



FAMILY ASSIMINEIDAE

This family is characterized by the small size of the shell (less than 10 mm) and the corneous, paucispiral operculum. The lateral teeth of the radula have an accessory plate. Members of this family are mostly estuarine or terrestrial, rather few species are found in freshwater. In East Africa three species belonging to the genus Eussoia are found in freshwater.

GENUS *Eussoia* Preston, 1912

Among the *Assimineidae* the genus *Eussoia* is characterized by the long central tooth without basal denticles.

KEY TO THE SPECIES OF *EUSSOIA*

- 1 A Shell ovate and imperforate.....*E. oblonga*
 B Shell conical, perforate or umbilicate.....2
- 2 A Umbilicus distinct, small species.....*E. inopina*
 B Umbilicus almost closed, larger species.....*E. aethiopica*

Eussoia oblonga (Mandahl-Barth, 1973)

Up to 5.5 x 3.6 mm. The ovate, imperforate shell is distinctive. Known only from the type locality, Nianjema pool near Bagamoyo, Tanzania.

*Eussoia inopina* (Preston, 1912)

Up to 5.0 x 3.7 mm. The whorls of the spire are flatter than the preceding species. Known only from Kenya.

*Eussoia aethiopica* (Thiele, 1927)

Up to 6.5 x 5.0 mm. The ultimate whorl and the aperture are relatively higher than in *E. inopina*. Known from southern Somalia (the Juba and Webe-Shebili river system).



FAMILY THIARIDAE

A large family of freshwater snails, very few are estuarine. In most species the shell is high ovate to turreted and frequently sculptured. The operculum is corneous, paucispiral or concentric, and the spiral nucleus is often

America, but few in Europe, Africa or Asia. In Africa two species are found. The one occurring in East Africa has been introduced and is extending its range of distribution.

Physa acuta Draparnaud, 1805

Up to 15 x 9 mm. The species is easily confused with species of *Bulinus*, but the V-shaped tooth rows of the radula and the absence of a pseudobranch are distinctive characters. The shell is stronger, more conical and pointed in the spire and with a twisted columella. The species is originally mediterranean, but is now common in many parts of eastern Africa from Egypt to South Africa.



FAMILY LYMNAEIDAE

The thin dextral shell, usually with a large body whorl and the broad triangular tentacles are distinctive. The family is distributed throughout the world. In Africa only one genus, *Lymnaea*.

GENUS *Lymnaea* Lamarck, 1799

Two species are known from East Africa, but an additional species also found in South Africa has now been found in Zambia and Kenya.

KEY TO THE SPECIES OF *LYMNAEA*

- 1 A Shell small, less than 12 mm high, with a spire equal in length to aperture, and consisting of 5-6 convex whorls.....*L. truncatula*
 B Shell large. Spire much shorter than aperture. 4-4.5 whorls.....2

- 2 A Shell without spiral lines.....L. natalensis
 B Shell with distinct, regular spiral lines,
 giving the shell a reticulate
 sculpture.....L. columella

Lymnaea truncatula (Müller, 1774)

Up to 11 x 6 mm, but often smaller.

The species has a scattered distribution in eastern Africa from Egypt to South Africa. The species has been introduced from Europe and is now found in the highlands, e.g. Ethiopia, the Kenyan highlands and the Usambara mountains.



Lymnaea natalensis Krauss, 1848

Up to 23 x 15 mm, but usually smaller.

A very widespread species acting as intermediate host for Fasciola gigantica, the liver fluke of cattle and sheep.



Lymnaea columella Say, 1817

Up to 23 x 12 mm. Resembling a slender

L. natalensis in size and shape, but always distinguishable by the distinct reticulate sculpture. Originally an American species, but now found in many parts of the world and spreading. It is known from South Africa, Zimbabwe, Zambia, Kenya and Egypt. Its invasion of a new territory usually starts from a botanical garden or an ornamental pool. Presumed to be intermediate host for both Fasciola gigantica and F. hepatica.



FAMILY PLANORBIDAE

The PLANORBIDAE is divided into two subfamilies: PLANORBINAE and BULININAE. The PLANORBINAE are characterized by the flat discoid or lentiform shell. The African BULININAE are characterized by the sinistral, globose, ovate or turriculated shell.

Subfamily PLANORBINAE

The shell of the PLANORBINAE appears dextral, because it is carried inverted so that the side corresponding to the apical side in other snails is the lower side of the planorbin shell. In the present descriptions the planorbin shell is regarded as dextral. The animal is always sinistral as anus, pneumostome and genital openings are placed on the left side. The subfamily is distributed worldwide and is divided into several genera, eight of which are known from East Africa.

KEY TO THE GENERA OF PLANORBINAE

- 1 A Full-grown shell more than 2 mm high.....2
 B Full-grown shell less than 2 mm high.....3
- 2 A Shell less than 6 mm high. Prostatic duct and preputial gland are absent.....Biomphalaria (p.29)
 B Shell up to 14 mm high. A prostatic duct and a preputial gland are present.....Helisoma (p.32)
- 3 A Shell discoid flat on both sides.....4
 B Shell lentiform, with a convex upper side and flat underside, or convex on both sides.....6

- 4 A Full-grown shell 0.7 mm high with 5 slowly increasing whorls.....Afrogyrus (p.36)
 B Shell higher and in most cases with less than 5 whorls.....5
- 5 A The shell costulate and often with an angle along the periphery.....Gyraulus (p.36)
 B Shell smooth and no angle at the periphery.....Cerotophallus (p.32)
- 6 A Shell with internal septa on the underside.....Segmentorbis (p.37)
 B Shell usually without internal septa, but sometimes with incomplete septa.....Lentorbis (p.37)

GENUS Biomphalaria Preston, 1910.

The genus comprises most of the larger planorbid snails in Africa and in Central and South America. With a few exceptions the species are acting as intermediate hosts of Schistosoma mansoni, thus they are of great medical importance. Eleven species are known from Africa, six of which occur in East Africa.

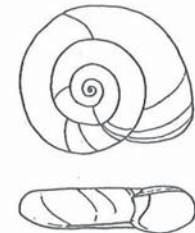
KEY TO THE SPECIES OF BIOMPHALARIA

- 1 A Shell large and flat, consisting of 6-6.5 whorls, which are flat on the upper side. Diameter of the umbilicus distinctly larger than height of the last whorl. Central teeth of radula less than 10 microns long.....B. sudanica
 B Shell relatively high, consisting of 4-5.5 whorls which are rounded or angular on the upper side. Diameter of umbilicus equal to or smaller in size than the height of last whorl. Central teeth more than 10 microns long.....2

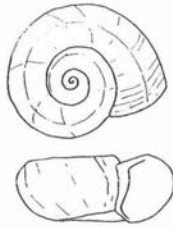
- 2 A Diameter of shell at least 2.5 times as large as height. Diameter of umbilicus at least two thirds the height of the last whorl.....3
 B Diameter of shell less than 2.5 times as large as height. Diameter of umbilicus only about half or less the height of the last whorl.....4
- 3 A Whorls rounded on upper side and bluntly angular on underside. Shell greyish.....B. pfeifferi
 B Whorls with a distinct angle on both sides, the upper one almost in the middle of whorls, the lower one nearer to the suture. Shell reddish.....B. angulosa
- 4 A Shell up to 13 mm in diameter. Lake Edward.....B. smithi
 B Shell up to 11 mm in diameter. Lake Albert.....5
- 5 A Whorls higher than wide. Umbilicus very narrow with a diameter of about 1/5 of the shell diameter.....B. stanleyi
 B Whorls wider than high. Umbilicus about 1/4 of the diameter of the shell. Lake Victoria, Lake Albert, and possibly others.....B. choanomphala

Biomphalaria sudanica (Martens, 1870)

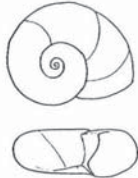
Up to 4.2 mm x 15 mm, but sometimes up to 22 mm. Distributed from Sudan and Ethiopia to Tanzania and eastern Zaire. The typical form with a very flat shell and very wide umbilicus is mainly found north of the equator. South of the equator it is usually larger and higher and the umbilicus is slightly narrower.



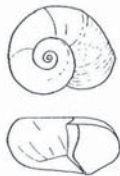
Biomphalaria angulosa Mandahl-Barth, 1957.
Up to 5.5 x 15 mm. The angular whorls and the reddish colour are distinctive. Known from some localities in southern Tanzania and northern Zambia, but not common.



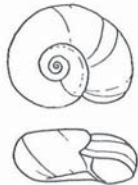
Biomphalaria pfeifferi (Krauss, 1848)
Up to 5.2 x 13 mm. A very variable species regarding size and shape. Many local forms have been described as distinct species, but it is not even possible to regard them as subspecies. The species is common throughout tropical Africa and is the most important intermediate host of S. mansoni. It is widely distributed in East Africa, but is rare or absent from coastal areas and the Great Lakes.



Biomphalaria choanomphala (Martens, 1879)
Up to 4.2 x 9.7 mm. A common species in Lake Victoria, the Victoria Nile and Lake Kyoga from the shore and down to depths of 10 meters. In deeper water it is usually smaller and has more angular whorls. In Lake Albert and the Albert Nile another form with a finer sculpture is found. This is characterized by the basal angle being placed nearer to the suture and by the smaller size. (Up to 3.4 x 7.8 mm).



Biomphalaria smithi Preston, 1910
Up to 5.0 x 12 mm. The strongly downward sloping body whorl is distinctive. Endemic to Lake Edward, where it occurs mainly in the Vallisneria beds at about one meter.



Biomphalaria stanleyi (Smith, 1888)
Up to 5.8 x 10.5 mm. The high whorls and narrow umbilicus separate this species from the other species.

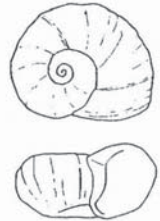


GENUS Helisoma Swainson, 1840

The genus is originally American, but one single species, Helisoma duryi, has been introduced into botanical gardens in many parts of the world. In warmer climates it usually spreads from there and establishes colonies under natural conditions.

Helisoma duryi (Wetherby, 1879)

Up to 14 x 25 mm. Very often confused with Biomphalaria, but the presence of prostatic duct and a preputial gland is distinctive for the species. In the shell the higher whorls and the flat umbilicus characterize the species. In East Africa the species is found near Mombasa, Tanga and Moshi.



GENUS Ceratophallus Brown and Mandahl-Barth, 1973

Small planorbids in which the distal part of the penis is sclerotized. Nine species are known from East Africa, most of them from the Great Lakes. The species are rather variable and often difficult to identify.

KEY TO THE SPECIES OF CERATOPHALLUS

- 1 A Whorls slowly increasing, up to 5 whorls.....C.natalensis
- B Whorls rapidly increasing, up to 4 whorls.....2
- 2 A Whorls distinctly angular.....3
- B Whorls rounded or bluntly angular along the periphery.....7

- 3 A Height of shell about half the diameter.....4
 B Height of shell less than 1/3 of the diameter.....5
- 4 A Sculpture very coarse, whorls with one angle.....C. crassus
 B Sculpture fine, whorls with two carinate angles..... C. pelecystoma
- A Shell distinctly bicarinate. Umbilicus flat and very large, diameter almost twice the height of the shell.....C. bicarinatus
 B Shell with angular whorls. Diameter of umbilicus does not exceed 1.6 times height of shell.....6
- 6 A Diameter of umbilicus 1.2 times the height. Transverse sculpture rather coarse.....C. faini
 B Diameter of umbilicus 1.5 the height. Transverse sculpture much finer.....C. kigeziensis
- 7 A Underside deeply concave.....8
 B Underside slightly concave.....9
- 8 A Penultimate whorl not raising above the ultimate one which slopes downwards. Umbilicus very narrow, its diameter 2/3 of height of shell.....C. apertus
 B Penultimate whorl not raising above the ultimate whorl, which slopes slightly towards the aperture. Diameter of umbilicus equal to height of shell.....C. concavus
- 9 A Diameter of umbilicus smaller than height of shell. Transverse sculpture fine and regular.....C. subtilis
 B Diameter of umbilicus equal to height of shell. Transverse sculpture coarse.....C. kisumiensis

Ceratophallus natalensis (Krauss, 1848)

Up to 1.8 x 6.7 mm, but usually smaller. The largest of the Ceratophallus species and always identifiable by the large number of whorls slowly increasing in width. In the coiling it is very similar to Afrogyrus coretus, but this is a much smaller species seldom exceeding 0.7 x 4.0 mm. C. natalensis is a very common and often abundant species throughout eastern and southern Africa.

Ceratophallus subtilis (Mandahl-Barth, 1954)

Up to 1.6 x 5.0 mm. In size and shape it resembles Gyraulus costulatus but the sculpture is much finer; like G. costulatus it might have a membrane edge along the periphery. Endemic to Lake Victoria, where it is found mainly at depths of 10 to 30 meters.

Ceratophallus kisumiensis (Preston, 1912)

Up to 1.5 x 4.5 mm. The sculpture is coarse and umbilicus wider than in the preceding species, and the last whorl is usually more descending towards the aperture. Lake Victoria.

Ceratophallus concavus (Mandahl-Barth, 1954)

Up to 1.2 x 3.2 mm. Reddish-brown and rather glossy. In shallow water in Lake Victoria and the Victoria Nile.

Ceratophallus apertus (Martens, 1897)

Up to 1.5 x 3.1 mm. It has the same deeply concave underside as the preceding species, but differs from these by the projecting penultimate whorl, narrower



umbilicus and less glossy shell. Known from Lakes Edward and Albert, but seems to be seldom and very local.

Ceratophallus crassus (Mandahl-Barth, 1954)

Up to 2.0 x 4.5 mm. The high ultimate whorl and coarse sculpture are distinctive. Known only from Lake Victoria, where it is found from the shore and down to 10 meters.



Ceratophallus bicarinatus (Mandahl-Barth, 1974)

Up to 0.7 x 3.0 mm. The live shell is very pale, almost hyaline and with membranaceous edges on the keels. The empty shells, abundant on the shores of Lake Albert, usually have the keels worn down to more or less blunt angles. In Lake Albert live specimens have been collected at depths of 20 meters. The species is also found in Lake Chad and Lake Awasa, Ethiopia. In Lake Awasa it grows to a larger size (1.1 x 3.7) and the upper keel is less pronounced.



Ceratophallus faini (Adam, 1957)

Up to 1.2 x 3.4 mm. A distinct angle along the periphery and another near the underside. Related to the next two species. Known only from Lake Albert.



Ceratophallus pelecystoma Brown, 1975

Up to 2.0 x 3.6 mm. The keels are very well developed, and the aperture resembles an axe-head. A recently described species known only from Lake Chala, Taveta, Kenya.



Ceratophallus kigeziensis (Preston, 1912)

Up to 1.2 x 4.4 mm. The wide, shallow umbilicus is distinctive. In the typical form from the south west of Uganda spiral lines are absent, while specimens from Lake Victoria frequently have a distinct spiral sculpture. Distributed from Lake Kyoga and southwards to Kigezi and Rwanda.



GENUS Afrogyrus Brown and Mandahl-Barth, 1973

The genus comprises a few species from Africa and Madagascar. In East Africa only one species characterized by the slowly increasing whorls, low shell height (less than 0.7 mm) and by a small cap like stylet on the penis.

Afrogyrus coretus (Blainville, 1826)

Up to 0.7 x 4.0 mm with 4-4.5 slowly increasing whorls. Can be confused with Ceratophallus natalensis, but in most cases the much smaller size and flatter whorls are sufficient for identification. In cases of doubt the copulatory organs must be examined. The species is common in West Africa and scarce in East Africa, but it is found in all countries in both areas.



GENUS Gyraulus Charpentier, 1837

The genus Gyraulus is characterized by the rapidly increasing whorls, the presence of a prostatic duct and a long stylet on the tip of the penis. Only three species are known from Africa, and one of these is common in East Africa.

Gyraulus costulatus (Krauss, 1848)

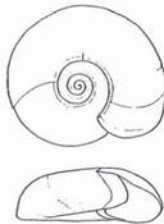
Up to 1.5 x 6.5 mm but usually smaller. The regular transverse costulation separates it from all other small African planorbids. Sometimes the costulation is less developed and such specimens can be confused with Ceratophallus subtilis, but in such cases the verge is distinctive. Widely distributed and usually common throughout tropical Africa.

GENUS Lentorbis Mandahl-Barth, 1954

Shell convex on the upper side and flat on the underside with deeply embracing whorls and a narrow umbilicus. Without internal septa or with rudimental septa. The vergic sheath is large and there is no flagellum. The genus comprises three species all found in Africa, but only one species is known from East Africa.

Lentorbis junodi (Connoly, 1922)

Up to 2.0 x 5.5 mm. Shell very similar in size and shape to Segmentorbis angustus, but usually without internal septa and slightly lower in height. Widely distributed in eastern Africa from Ethiopia to Natal, but not common.

GENUS Segmentorbis Mandahl-Barth, 1954

Shell with convex side and flatter underside, with deeply embracing whorls, umbilicate and always with internal septa. Vergic sheath shorter than preputium, with a single flagellum or without flagellum. The genus comprises six species, all African, and three of these are known from eastern Africa.

KEY TO THE SPECIES OF SEGMENTORBIS

- 1 A The underside almost flat and umbilicus narrow.
Shell up to 2 mm high, and three times as wide as high.....S. angustus
- B Underside slightly convex and umbilicus wider. Shell up to 1.5 mm high, and 3.5-4 times wider than high.....2
- 2 A Last whorl bluntly carinate at the periphery.
No spiral lines.....S. eussoensis
- B Last whorl sharply carinate at the periphery.
Spiral lines present.....S. kanisaensis

Segmentorbis angustus (Jickeli, 1874)

Up to 2.0 x 5.5 mm. With 4-9 sets of internal lamellae. The shell is usually reddish brown and glossy, but sometimes colourless and hyaline. Widely distributed from Sudan to Natal and from Ethiopia to Lower Zaire.

Segmentorbis eussoensis (Preston, 1912)

Up to 1.5 x 5.3 mm. Lower than S. angustus and lighter in colour, with umbilicus more open and five septa. Described from Chandler Falls, Kenya, and never refound in East Africa, but has been found in Sudan.

Segmentorbis kanisaensis (Preston, 1914)

Up to 1.2 x 4.6 mm. Flatter and more strongly carinate than other species of the genus, with a distinct spiral sculpture. Known from most countries in tropical Africa and not rare in eastern Africa from Ethiopia to Tanzania.



Subfamily BULININAE

The shell is sinistral, in African species globose, ovate or higher. In the Asian genus Indoplanorbis, the shell is discoid. The subfamily is closely related to the Planorbinae, but differs from them in the development of the copulatory organ which in the Bulininae is completely introverted when not in use. The subfamily is distributed throughout Africa and eastern and southern Europe. In Africa two genera, Bulinus and Indoplanorbis, the latter recently found in Nigeria.

GENUS Bulinus Müller, 1781

The genus is easily identified by the sinistral shell and the presence of a pseudobranch. The latter is not found in the Physidae, the only other African family with which confusion is possible. The genus Bulinus is mainly found on the African continent and adjoining islands. Records of Bulinus species found in Australia are very doubtful: in all thoroughly investigated cases the anatomy proved the species to belong to the subfamily Planorbinae.

The genus comprises about 30 species, 15 of which occur in eastern Africa. Most of the species are of medical and veterinary importance as they act as intermediate hosts for schistosomes and paramphistomes, parasites of man and cattle. The major importance of the genus is, however, that it acts as intermediate hosts for human urinary schistosomiasis. Seven of the East African species of Bulinus have so far been shown to be susceptible to Schistosoma haematobium. While it is easy to identify the genus, it often proves difficult to perform a reliable identification of species using the morphological and anatomical characters, because of the great variability encountered in these. When only young specimens are available, it is often impossible to identify the material to species on the basis of morphological and anatomical characters. The genus is conveniently divided into 4 different species groups, partly reflecting the evolution of the genus.

KEY TO THE SPECIES-GROUPS OF BULINUS

- 1 A Shell globose or ovate with a spire shorter than aperture. Height of shell less than twice the width.....2
 B Shell turriculate, spire in full-grown specimens higher than aperture. Height of shell larger than twice the aperture.....forskalii-group
- 2 A Umbilicate species, shell height less than 9 mm. Inhabitants of temporary water.....reticulatus-group
 B Species rarely with umbilicus and full-grown shell height more than 9 mm. Inhabitants of more permanent water.....3
- 3 A Columella more or less truncate. The microsculpture, if present, consists of spirally arranged short transverse lines or dots, or of corrugation. A renal ridge is usually present.....africanus-group
 B Columella not truncate. If present, the microsculpture consists of transverse ribs. A renal ridge is always absent.....tropicus/truncatus-group

Reticulatus-group.

This group comprises the most primitive members of the Bulinus. In East Africa two species, both of which can act as intermediate host for S. haematobium, are found. The two species are typically inhabitants of water bodies which are only filled with water for four months or less.

KEY TO SPECIES OF THE RETICULATUS-GROUP

- 1 A Reticulate microsculpture on the shell.....B. reticulatus
 B Microsculpture composed of transverse ribs.....B. hightoni

Bulinus reticulatus Mandahl-Barth, 1954

Up to 7.0 x 5.0, often smaller. The broadly reflexed not adnated columellar margin and the reticulate sculpture are distinctive. It has a scattered distribution from Ethiopia to South Africa, and it is often overlooked when searching for snails.

Bulinus hightoni Brown and Wright, 1978

Up to 9.0 x 8.0 mm. The transverse sculpture of the shell is distinctive for this newly described species. So far only known from around the type locality Orma Kote, near Hola, Kenya.

Forskalii group.

This group comprises 6 African species, 3 of which are known to transmit S. haematobium. The two East African species have so far not been shown to transmit S. haematobium, but transmission of S. bovis has been shown by East African members of the species group.

KEY TO SPECIES OF THE FORSKALII-GROUP

- 1 A Whorls of spire usually with a shoulder angle. Penis sheath same length as preputium.....B. forskalii
 B No shoulder angle on the upper whorls. Penis sheath twice as long as preputium.....B. scalaris

Bulinus scalaris (Dunker, 1845)

Up to 11.5 x 4.4 mm. The relatively broader shell without shoulder angle separates it from the following species. Known from Ethiopia to Namibia, but has a very scattered distribution. In East Africa it is recorded from a few localities in Uganda, and near Kisumu, Kenya, always in temporary waters.

Bulinus forskalii (Ehrenberg, 1831)

Up to 14 x 4 mm. The high spired shell, usually with a shoulder angle on the upper whorls, makes it easy to recognize this species. The species is found widespread all over Africa in both temporary and permanent waters.

Africanus-group.

This group comprises 7 African species, at least 5 of which are known to act as intermediate hosts for S. haematobium. In addition S. bovis and S. matthei are transmitted through members of the species group. From East Africa 5 species are known. On the coast of Kenya and Tanzania the identification of the species on the basis of morphological characters is very difficult, as the characters merge into each other.

KEY TO SPECIES OF THE AFRICANUS-GROUP

- 1 A Microsculpture on spire consists of a corrugation. Shell with shouldered whorls.
 Somalia and eastern Ethiopia.....B. abyssinicus
 B Microsculpture on spire in distinctly transverse and spiral lines or dots.....2
 2 A Microsculpture, if found, is only on the upper whorls.....4
 B Microsculpture on the whole shell.....3
 3 A Spire as long as or longer than the height of the aperture.....B. productus
 B Spire shorter than aperture.....B. nasutus

- 4 A Penis sheath distinctly longer and much wider than preputium. Immature specimens cannot be identified with certainty.....B. africanus
 B Penis sheath not longer and not much wider than preputium.....5
- 5 A Microsculpture often found all over the shell. Spire with pointed apex.....B. nasutus
 B Microsculpture restricted to the uppermost part of the shell and may even be missing. Spire normally short with a blunt apex.....6
- 6 A Full-grown shell 10-15 mm high, almost without microsculpture and almost obsolete truncation.....B. ugandae
 B Full-grown shell 15-20 mm high, with more or less pronounced microsculpture, and usually with distinct truncation.....B. globosus

Bulinus africanus (Krauss, 1848)

Up to 22 x 14 mm. The long and wide penis sheath is distinctive and the only reliable character. Widely distributed in eastern Africa from Ethiopia to Natal and westwards to eastern Zaire. Important intermediate host of S. haematobium and S. bovis.



Bulinus abyssinicus (Martens, 1866)

Up to 18 x 11 mm. The light coloured shell, the shouldered whorls and peculiar corrugated sculpture are distinctive, but all these characters are not always present in the same shell. Its distribution is restricted to Somalia, eastern Ethiopia and perhaps north eastern Kenya. Intermediate host of S. haematobium.



Bulinus nasutus (Martens, 1879)

Up to 18 x 11 mm. This species has a rather low conical spire and an average size of 15 x 10 mm. The shorter and more slender penis sheath separates B. nasutus from B. africanus, and the microsculpture separates it from B. globosus and B. ugandae. Although it occurs in temporary waters the species is an important intermediate host of S. haematobium and S. bovis. It is found in Kenya and Tanzania.



Bulinus productus (Mandahl-Barth, 1960)

Up to 21 x 11 mm. Found in Uganda, western Kenya and north west Tanzania. Spire as long as, or longer, than the aperture. The average size is 17.5 x 9.5 mm.



Bulinus globosus (Morelet, 1866)

Up to 20 x 13 mm. The short, slender penis sheath and the obtuse apex are distinctive. Widely distributed in Africa south of the Sahara and common in certain parts of East Africa. Important intermediate host of S. haematobium, especially in areas where B. nasutus and B. africanus are absent.



Bulinus ugandae (Mandahl-Barth, 1954)

Up to 16 x 11 mm. This is the smallest of the species in this group. The obsolete truncation and very slight or completely lacking microsculpture are distinctive. In East Africa known only from Uganda and the swamps around Lake Victoria. A larger form occurs in the Sudan and Ethiopia. It is the only member of this group which is not intermediate host for S. haematobium.



Tropicus/truncatus-group

This group comprises 11 species in Africa, 6 of which are found in eastern Africa. From a taxonomical point of view the group is very much in need of revision. The complex taxonomy of the group is clearly reflected in the difficulties encountered when identifications are to be carried out. The group is characterized by the globose or ovate shell and the lack of a truncate columella. If a microsculpture is present it consists of transverse ribs.

KEY TO SPECIES OF THE TROPICUS/TRUNCATUS-GROUP

- 1 A Shell 5-8 mm high, shell and animal dark.
Found in Lake Victoria and the first part
of the Victoria Nile.....B. transversalis
- B Shell more than 8 mm high.....2
- 2 A Mesocone of the first lateral teeth simply
triangular and deeply separated from the
endocone.....3
- B Mesocone of the first lateral teeth arrow-head
shaped and more coalescent with the endocone.....5
- 3 A Shell thin and fragile, not exceeding 10 mm in
height. Columella thin and narrow. Most specimens
are aphyllid.....B. coulboisi
- B Shell rather strong, more than 10 mm high.
Columella often strongly reflexed. Aphyllid
specimens rarely seen.....4
- 4 A Found in the highlands of Kenya from about 2400
meters above sea level and upwards. Chromosome
number tetraploid (2n = 72).....B. permembranaceus
- B Found at altitudes of less than 3500 metres.
Chromosome number diploid (2n = 36).....B. tropicus

- 5 A First lateral teeth 13-18 microns long. Mesocone
and endocone not very coalescent. Chromosome
number diploid (2n = 36).....B. natalensis
- B First lateral teeth of radula 20-25 microns
long. Mesocone and endocone largely
coalescent. Chromosome number tetraploid
(2n = 72).....B. truncatus

Bulinus tropicus (Krauss, 1842)

Up to 15 x 10 mm. A very variable species, but usually with a rather pointed apex and broadly reflexed columellar margin. The mesocone on the lateral teeth is simply triangular, and aphyllid specimens are extremely rare. The chromosome number is diploid (2n = 36). The species is widely distributed in eastern Africa from Ethiopia to South Africa. B. tropicus is non-susceptible to S. haematobium but is susceptible to S. bovis. It is possibly an important intermediate host of paramphistomes.

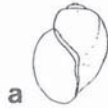
Bulinus permembranaceus (Preston, 1912)

Up to 15 x 10 mm. Very closely related to B. tropicus. The species differs mainly from B. tropicus by differences found in enzyme electrophoresis and chromosome numbers (2n = 72). Generally it is found at higher altitudes than B. tropicus. The parasitological characteristics of this species are apparently the same as for B. tropicus. The species has a limited distribution in the highlands of Kenya.



Bulinus coulboisi (Bourguignat, 1885)

Up to 9 x 7 mm. In the typical form (a) the shell is thin and fragile with a narrow columellar margin. The mesocone of the first lateral teeth is triangular, and aplanal specimens are common. This form is known from Lakes Tanganyika, Kivu, Edward, Albert and Kyoga and adjacent areas. In the northern part of Tanzania a related form occurs. It has a stronger, often costulate shell and somewhat arrow-shaped mesocones (b). B. coulboisi might act as host for schistosomes. The taxonomic position of this species is far from clear as indicated by records of both diploid and tetraploid chromosome numbers, and by the morphological variability encountered in this species.

Bulinus natalensis (Küster, 1841)

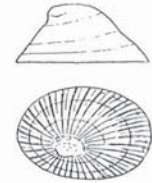
Up to 12 x 9 mm. The typical form has a rather inflated shell with low spire and twisted columella, but the shape of the shell is variable, sometimes almost cylindrical, sometimes more conical, as in B. tropicus. The shape and size of the lateral teeth and the chromosome number ($2n = 36$) are distinctive. Aplanal specimens are frequent. Widely distributed in eastern Africa from Kenya and southwards. Non-susceptible to S. haematobium.

Bulinus transversalis (Martens, 1897)

Up to 7 x 6 mm. The small size, the black animal and dark brown shell are distinctive. Known only from shores of Lake Victoria and the first part of the Victoria Nile. From a parasitological

Burnupia crassistriata (Preston, 1911)

The shell is 2.9 mm high, 6.0 mm long and 4.2 mm wide. The relatively higher shell and the strong striation make this species recognizable. It is known only from streams and rivers in the Kenya highlands.

GENUS Ferrissia Walker, 1903

This genus is characterized by the small, shield shaped shell with radially striate apex. Several species have been described from Africa, but most of them are ill-defined and their classification is unsatisfactory. Five species are known from East Africa.

KEY TO THE SPECIES OF FERRISSIA

- 1 A Shell almost twice as long as wide, with slightly curved sides.....2
 B Shell not more than 1.5 times as long as wide with evenly curved sides.....3
- 2 A Up to 5 mm long. Anterior end much broader than posterior end.....F. clessiniana
 B Up to 3.2 mm long, anterior and posterior ends equal.....F. kavirondica
- 3 A Shell with distinct radial striation.....F. tanganyicensis
 B Shell without radial striation.....4
- 4 A Shell 3-4 mm long. Height equal to or greater than 1/3 of length.....F. isseli
 B Shell less than 3 mm long. Height equal to 1/4 of length or less.....F. toroensis

Ferrissia clessiniana (Jickeli, 1882)

The largest of the species: 1.8 mm high, 5.0 mm long and 2.8 mm wide, but often smaller. The long shell with broad anterior and almost straight sides is distinctive. Distributed from the Middle East through Egypt to Uganda and Kenya.

Ferrissia kavirondica (Mandahl-Barth, 1954)

0.8 mm high, 3.1 mm long and 1.8 mm wide. Smaller and relatively flatter than the preceding species. The anterior end is not broader than the posterior. Known from a few localities in Uganda, western Kenya and northern Tanzania.

Ferrissia isseli (Bourguignat, 1966)

1.5 mm high, 3.6 mm long and 2.4 mm wide, but often smaller. The relatively large and high shell separates it from other broad species. A scattered distribution from Egypt to southern Tanzania.

Ferrissia toroensis Mandahl-Barth, 1954

The smallest of the species: 0.6 mm high, 2.7 mm long and 2.0 mm wide. The flat and broad shell is distinctive. Known only from Crater lakes in western Uganda.

Ferrissia tanganyicensis (Smith, 1906)

1.4 mm high, 3.4 mm long and 2.6 mm wide, but sometimes almost circular in outline. The broad and high shell with a distinct radial striation makes it easily recognizable. Found only in Lake Tanganyika.

