

Prolegomena for a checklist of the terrestrial molluscs of the Upemba National Park, Katanga, D.R. Congo

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Abstract

Dr William ADAM's explorations of the Upemba National Park (Katanga, D.R. Congo) in 1948-1949 have yielded an enormous number of terrestrial molluscs. So far 70 species have been identified of which 22 have not (yet) been reported from outside this national park, the so-called 'endemics'. The strongly biased preliminary checklist enumerates a large number of species with small to at most medium-sized shells (*e.g.* at least 35 streptaxids) reflecting the interest of Dr ADAM (and the present authors). Some families are poorly (*e.g.* Achatinidae, Urocyclidae) or not at all (*e.g.* Pomatiasidae, Subulinidae) represented, indicating that much identification work is still outstanding. The list contains new distribution records and illustrations of poorly known taxa. The total number of terrestrial gastropod species in the Upemba National Park is estimated at 120. Comparison with what is known about the distribution of the land molluscs of Zambia, Tanzania and Malawi shows that many species are shared by these countries and the Upemba National Park.

Key-words: Gastropoda, Prosobranchia, Caenogastropoda, Pulmonata, Ferussaciidae, *Cecilioides*, Punctidae, *Paralaoma*,

Charopidae, *Trachycystis*, Streptaxidae, *Tayloria*, Urocyclidae, *Trochozonites*, systematics, faunistics, biogeography, Africa, D.R. Congo (ex Zaïre), Katanga (ex Shaba), Upemba National Park.

Résumé

Les explorations du Dr William ADAM dans le Parc National de l'Upemba (Katanga, R.D. du Congo) en 1948-1949 ont rapporté une quantité impressionnante de mollusques terrestres. A l'heure actuelle, 70 espèces ont été identifiées, dont 22 sont actuellement 'endémiques'. La liste préliminaire des espèces, comprend un grand nombre de petits représentants (par ex. au moins 35 espèces de Streptaxidae), ce qui reflète l'intérêt particulier du Dr W. ADAM pour cette famille. En revanche, dans les récoltes du Dr W. ADAM, certaines familles sont peu représentées (par ex. les Achatinidae et les Urocyclidae), d'autres sont même absents (par ex. les Pomatiasidae et les Subulinidae). Il en résulte que la liste préliminaire, présentée ici, est hautement biaisée et qu'un vaste travail taxonomique reste à faire.

La liste présente de nouvelles données de distribution, ainsi que des illustrations de taxons peu connus. Le nombre total des espèces de gastéropodes terrestres dans le Parc National de l'Upemba est estimé à 120. Bon nombre d'entre elles se rencontrent aussi dans les pays avoisinants: la Zambie, la Tanzanie et le Malawi.

Mots clefs: Gastropoda, Prosobranchia, Caenogastropoda, Pulmonata, Ferussaciidae, *Cecilioides*, Punctidae, *Paralaoma*, Charopidae, *Trachycystis*, Streptaxidae, *Tayloria*, Urocyclidae, *Trochozonites*, systématique, faunistique, biogéographie, Afrique, R.D. Congo (ex Zaïre), Katanga (ex Shaba), Parc National de l'Upemba.

Introduction

The originally Dutch malacologist Dr William ADAM (1909-1988) served the Royal Belgian Institute of Natural Sciences (Institut royal des Sciences naturelles de Belgique / Koninklijk Belgisch Instituut voor Natuurwetenschappen, formerly Musée Royal d'Histoire naturelle de Belgique / Koninklijk Natuurhistorisch Museum van België), Brussels, from 1932 until his death, mainly as curator of molluscs (1932-1974, in the period 1974-1988 in an honorary capacity). For an obituary see VAN GOETHEM (1989).

As regards field-work, the highlight of ADAM's career must have been his prolonged sojourn in the Upemba National Park (Parc National de l'Upemba / Nationaal Upemba Park: PNU) in the then Belgian Congo from February 1948 to September 1949. Over a period of about 18 months terrestrial and freshwater molluscs were collected with the assistance

of native collectors and his Belgian colleagues A. JANSSENS, L. VAN MEEL and R. VERHEYEN throughout this national park and also in the immediate surroundings. Thousands of snails and shells were obtained, many of the smaller ones through sieving samples of leaf litter, etc. In the years 1950 until his death in 1988 ADAM worked assiduously on this collection, interrupted by his multifarious duties as a museum curator which *e.g.* involved a survey of the Belgian non-marine molluscs. He also pursued his interest in cephalopods, where he subsequently deservedly became a world-leader in the field, and certain groups of marine prosobranchs.

Nevertheless, a large amount of land molluscs of the PNU was identified and many publications saw the light of day. In publication ADAM was ably supported by the talents of his artist, Mrs Jacqueline VAN MELDEREN-SERGYSELS, who made numerous drawings of shells, many of which were only published after his death in a series of papers by ADAM, VAN BRUGGEN & VAN GOETHEM (1993-1994) and thereafter by VAN BRUGGEN & VAN GOETHEM (1997, 1999). Apart from some semi-scientific reports and lecture texts [ADAM, 1951 (little data on the PNU), 1952, 1955 (these two with many general data on the PNU)], the first scientific paper by ADAM containing PNU data was published in 1954 (ADAM, 1954) and the final one appeared almost forty years later and after his demise (ADAM, VAN BRUGGEN & VAN GOETHEM, 1993). Other scientists working on the Upemba National Park material were the junior author (VAN GOETHEM, 1969, 1975, 1977: urocyclid slugs), ADAM's successor at the RBINS, and the senior author (Leiden University, but located at the RMNH). As far as is known, and somewhat surprisingly, no other people have worked on Upemba National Park mollusc material.

The word 'Prolegomena' emphasizes the preliminary nature of this list; ADAM's main interest was obviously with small and minute snails, an interest generally shared by the present authors. Many species are still to be identified and properly evaluated. This paper is to be regarded as a base and a point of departure for further studies on the malacofauna of this fascinating area. Also, it is convenient for comparison with what is known of the land snails of adjoining areas such as Zambia, Malawi and Tanzania. At the same time this checklist serves to close the ADAM period of studies on the PNU. The Upemba National Park (PNU) occupies a very large area of *c.* 1,773,000 ha (approximately three-fifths of the area of Belgium) in the south-eastern part of the Democratic Republic of Congo (Fig. 1). The relevant province was originally called Katanga, subsequently changed to Shaba and is recently again known under its original name. The national park encompasses various types of soil, vegetation and climate, ably described in a general volume edited by DE WITTE (1966; see also Colloque, 1963 - notwithstanding its somewhat presumptuous title, this collection of papers hardly touches upon the biogeography of the area). The PNU is one of the national parks of the D.R. Congo that does not include tropical rainforest. It covers large tracts of habitat suitable for terrestrial molluscs.

Studies on the land molluscs of the PNU are of great interest for more than one reason. First of all, the land snails of Katanga Province are little known. Much of the mollusc research in the D.R. Congo has centred on the tropical rainfor-

est area further north. For example, most of the data in PILSBRY's major treatise (1919) refer to this particular habitat. Katanga is atypical for the D.R. Congo because it has little equatorial forest. In fact, the vegetation of this area is a continuation of that of the adjoining areas to the South and East (Zambia, Malawi and SW. Tanzania) and is characterized by a savanna-type vegetation with fringing forest along the rivers and types of forest other than tropical rainforest *sensu stricto*. VERDCOURT (1983a) has composed a valuable list of the non-marine molluscs of East Africa which includes Tanzania. The senior author has supplied checklists for the terrestrial gastropods of Zambia (VAN BRUGGEN, 1988) and of Malawi (VAN BRUGGEN & MEREDITH, 1984; VAN BRUGGEN, 1993) which, by virtue of their proximity to the PNU, may be a basis for comparison.

Secondly, the PNU is situated in a biogeographically highly interesting area still harbouring elements of the (West African) forest belt, many of which reach their southern limits here. The most celebrated example of this is an antelope, the yellow-backed duiker (*Cephalophus silvicultor*), which according to Kingdon (1997: 380) is distributed from "Senegal to SW Sudan and discontinuously to W Kenya. Angolan littoral to western shores of L. Tanganyika." It does not quite reach the Zambezi R. in the South (ANSELL, 1979: 56). Undoubtedly kindred patterns occur among land snails - unfortunately in many cases snail distribution data are very incomplete suggesting rather than establishing such patterns.

Abbreviations

BM	The Natural History Museum [British Museum (Natural History)], London
D.R. Congo	Democratic Republic of Congo (formerly Zaïre)
MRAC	Musée royal de l'Afrique centrale / Koninklijk Museum voor Midden-Afrika, Tervuren
PNG	Garamba National Park (Parc National de la Garamba / Nationaal Garamba Park), D.R. Congo
PNU	Upemba National Park (Parc National de l'Upemba / Nationaal Upemba Park), D.R. Congo
RBINS	Royal Belgian Institute of Natural Sciences (Institut royal des Sciences naturelles de Belgique / Koninklijk Belgisch Instituut voor Natuurwetenschappen), Brussels
RMNH	National Museum of Natural History (Nationaal Natuurhistorisch Museum, formerly Rijksmuseum van Natuurlijke Historie), Leiden
l/d	the ratio length/major diameter as an indication of the shape of the shell. In a number of cases the l/d has been calculated from micrometer readings, so that the l/d values do not always agree with those calculated from the dimensions in mm
lw	length of the last whorl measured in front view of the shell

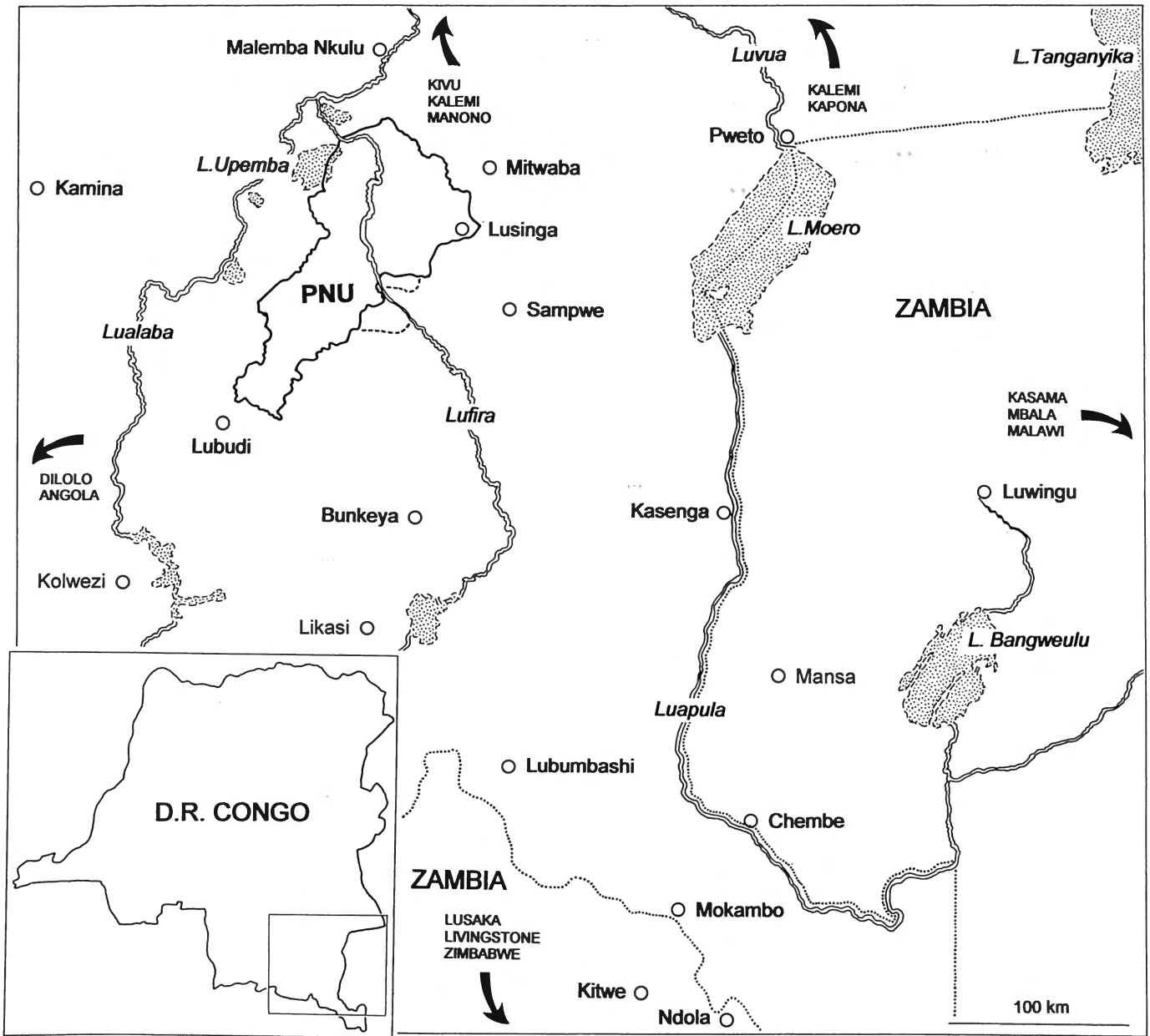


Fig. 1. The Upemba National Park is situated in the south-eastern corner of Katanga, D.R. Congo. Map based on figure on p. 47 in Colloque sur les problèmes biogéographiques du Parc National de l'Upemba/Symposium on the biogeographical problems of the Upemba National Park (1963). H. VAN PAESSCHEN del.

Checklist

The following preliminary checklist contains the most up-to-date names with references to recent literature and figures, accompanied by concise notes on the known distribution of the various taxa. Some species are treated in more detail. Data have been extracted from (a) publications (references given), and (b) as yet unpublished sources. The latter consist of (b-1) the ADAM files in the RBINS, and (b-2) material in the RBINS identified by either the late Dr ADAM or the present authors. Most of the already named material and data extracted from the ADAM files have been checked as regards identification.

Taxa so far only known from the PNU (and the few localities directly adjoining the PNU included in ADAM's 1948/1949 survey), so-called 'endemic' taxa, have been indicated by an asterisk (*) in front of the name. In view of the general geographical situation of the PNU it is highly unlikely that such taxa are endemic to the area. These asterisks simply reflect the poor state of knowledge of the distribution of the terrestrial molluscs of Central Africa in general and of the D.R. Congo and Katanga in particular. Species are shown in alphabetical sequence under their respective genera/subgenera.

Orthogastropoda / Caenogastropoda [formerly 'Prosobranchia']

Cyclophoridae (1 'endemic' species)

- **Cyathopoma straeleni* ADAM, 1987 (p. 91, Figs 1-2).

Maizaniidae (2 species)

- *Maizania elatior* (VON MARTENS, 1892) (VERDCOURT, 1964: 3, 10, 20, Figs 6-12, 14, 19; ADAM, 1987: 94). This species is widely distributed in Central Africa: S. Sudan, D.R. Congo, Uganda, Kenya, Tanzania, Angola, roughly in an area bordered by 4°30'N-10°S and 15°-36°E.
- *Maizania (Micromaizania) kazibae* ADAM, 1987 (p. 93, Fig. 3; VERDCOURT, 1995: 273). So far only recorded from the PNU and Uganda.

Orthogastropoda / Heterobranchia / Eupulmonata ['Pulmonata']

Vertiginidae (9 species, of which 4 'endemic')

- *Nesopupa (Afripupa) bisulcata* (JICKELI, 1873) (ADAM, 1954: 764, Figs 12D-J; ADAM, 1957: 6; VAN BRUGGEN & MEREDITH, 1984: 160; VAN BRUGGEN & VERDCOURT, 1993: 103, Fig. 2). A widely distributed species as witnessed by scattered records from South Africa (Eastern Cape Province), Zimbabwe, to D.R. Congo, Angola (RMNH, unpublished data), Cameroon (DE WINTER & GITTENBERGER, 1998: 239), Tanzania ("cf. *bisulcata*", TATTERSFIELD *et al.*, 2000: 138), Kenya, and Ethiopia.
- **N. (Afripupa) griqualandica musepagii* ADAM, 1954 (p. 759, Fig. 12B). This appears to be a fairly well-defined subspecies of a widely distributed taxon: Eastern Cape Province to Zambia, Malawi, and D.R. Congo (fide CONNOLLY, 1939; VAN BRUGGEN & MEREDITH, 1984; VAN BRUGGEN, 1988).
- **N. (Afripupa) pelengeae* ADAM, 1954 (p. 770, Fig. 12K).
- **N. (?Cocopupa) kanongae* ADAM, 1954 (p. 756, Fig. 14A).
- *N. (Insulipupa) corrugata* (PRESTON, 1912) (ADAM, 1954: 781, Fig. 14G). So far only known from a few scattered localities in Zimbabwe, Mozambique and D.R. Congo.
- *N. (Insulipupa) ganzae* ADAM, 1954 (p. 782, Figs 14H-L; VAN BRUGGEN & MEREDITH, 1984: 160). Thus far only recorded from the PNU and Malawi.
- **Truncatellina obesa* ADAM, 1954 (p. 743, Fig. 2H).
- *T. pygmaeorum* (PILSBRY & COCKERELL, 1933) (ADAM, 1954: 746, Fig. 5D, *s.n.* *T. p. katangae* n. ssp.; VAN BRUGGEN

& MEREDITH, 1984: 160; VAN BRUGGEN, 1994: 13, 20, Figs 5-8, 20-21, 32). Widely distributed in Central Africa: Malawi, SE. and E. D.R. Congo, SW. Angola, Kenya.

- *T. upembae* ADAM, 1954 (p. 739, Figs 2D-G; ADAM, 1957: 5; VAN BRUGGEN, 1994: 19, Figs 9-12, 22-23, 29). Widely distributed in Central Africa: NE. Angola, S., E., and NE. D.R. Congo.

Chondrinidae (1 species)

- *Gastrocopta klunzingeri* (JICKELI, 1873) (ADAM, 1954: 791, Figs 19A-B, 19E-F, 20A, 20C-D; VAN BRUGGEN & MEREDITH, 1984: 160). Widely distributed in Central, East and West Africa: Malawi, Tanzania, D.R. Congo, Kenya, Ethiopia, Senegal.

Valloniidae (1, or if the Pupisomidae are not considered a separate family: 3 species)

- *Acanthinula straeleni* ADAM, 1954 (p. 804, Fig. 23; ADAM, 1957: 22; VAN BRUGGEN, 1988: 6; VAN BRUGGEN, 1993: 103). So far known from a limited area in Central-East Africa: Zambia, Malawi, SE. and E. D.R. Congo.

(Pupisomidae: 2 species)

- *Pupisoma (Salpingoma) harpula* (REINHARDT, 1886) (ADAM, 1954: 806, Fig. 24A; 1957: 22; VAN BRUGGEN & MEREDITH, 1984: 160 - all *s.n.* *Pupisoma japonicum* PILSBRY, 1902, *vide* VAN BRUGGEN, 1993: 109). *Pupisoma* and allied genera are sometimes classified with the Vertiginidae. Widely distributed in Africa, but also in Asia (originally described from Japan) - this taxon (or perhaps complex of species) is recorded from scattered localities throughout its enormous range under a variety of (local) names.
- *Parazoogenetes orcula* (BENSON, 1850) (ADAM, 1954: 807, Fig. 24B; 1957: 24; VAN BRUGGEN & MEREDITH, 1984: 160; VERMEULEN & WHITTEN, 1998: 83, Fig. 69 - all *s.n.* *Pupisoma orcula*, *vide* VAN BRUGGEN, 1993: 109). This, again, is a very widely distributed (complex of?) species. We quote VERMEULEN & WHITTEN (1998: 83): "common and widespread in Africa, Asia, Australia, Pacific." It appears in the literature under a variety of (local) names.

Cerastidae (formerly Enidae) (1 'endemic' species)

- **Cerastus upembae* (VAN GOETHEM & ADAM, 1978) (p. 6, Figs 2, 4, 7, 10, Pl. 1 Figs 4-6).¹

1. Following MORDAN (1986: p. 208) *Cerastus* DEJEAN, 1821, the name which was supposed to invalidate *Cerastus* ALBERS, 1860, must be considered a *nomen nudum* under Article 12 of the International Code of Zoological Nomenclature

No.	locality/Fig.	height x maj. diam.	l/d	aperture	lw	whorls
1	PNU 2330/Fig. 3	2.2 x 0.75	2.96	0.80 x 0.3	1.4	5 1/2
2	Holotype	2.43 x 0.77	3.15	0.97 x 0.4	—	5
3	PNU 2382/Fig. 2	2.8 x 0.87	3.25	0.87 x 0.3	1.5	6

Table 1. Measurements in mm of the two figured PNU shells of *Cecilioides kalawangaensis* DARTEVELLE & VENMANS (RBINS) as compared to those of the holotype *ex descr.* The PNU localities are the following: PNU 2330 - Kaziba, gallery forest of the Kaziba River, 1140 m, 18.IV.1949, leg. W. ADAM; PNU 2382 - Ganza, gallery forest of the Kamandula and Lukaka Rivers, 860 m, 30.V-4.VII.1949, leg. W. ADAM.

Ferussaciidae (3 species)

This family is mainly represented in tropical and southern Africa by the genus *Cecilioides* DE FÉRUSAC, 1814, in which it is notoriously difficult to distinguish between the species. The shells of these subterranean snails are somewhat featureless and consequently exhibit few reliable characters. In addition there is a fair amount of intraspecific variation. Also, in most cases anatomical details are conspicuously absent. Repeatedly *Cecilioides* species have been recorded as subulinids. Important data on African *Cecilioides* are contained in CONNOLLY (1939), DARTEVELLE & VENMANS (1951), VAN BRUGGEN (1970), and VERDCOURT (1986).

- *Cecilioides kalawangaensis* DARTEVELLE & VENMANS, 1951 (p. 64, Fig. 1, *Caecilioides*). Since its description in 1951 this species has only been mentioned (for comparative purposes) in the literature by DE WINTER (1990: 306). The distance from the type locality, a small island in the Congo R. opposite Matadi (“dans l’humus du petit îlot boisé Kalawanga, situé dans le fleuve, en face de Matadi”), to the PNU is about 1450 km in a straight line. A distribution comprising two widely distant localities reflects the state of knowledge of small terrestrial molluscs in Central Africa; the taxon undoubtedly occurs in suitable habitat throughout much of the Congo.

The dimensions of adult shell material in the original description (DARTEVELLE & VENMANS, 1951: 65) may be summarized as:

2.17-2.83 x 0.71-0.86 mm, l/d 2.97-3.15, aperture 0.91-1.00 mm, 5 whorls.

The two figured specimens from the PNU (Figs 2-3, Table 1) measure:

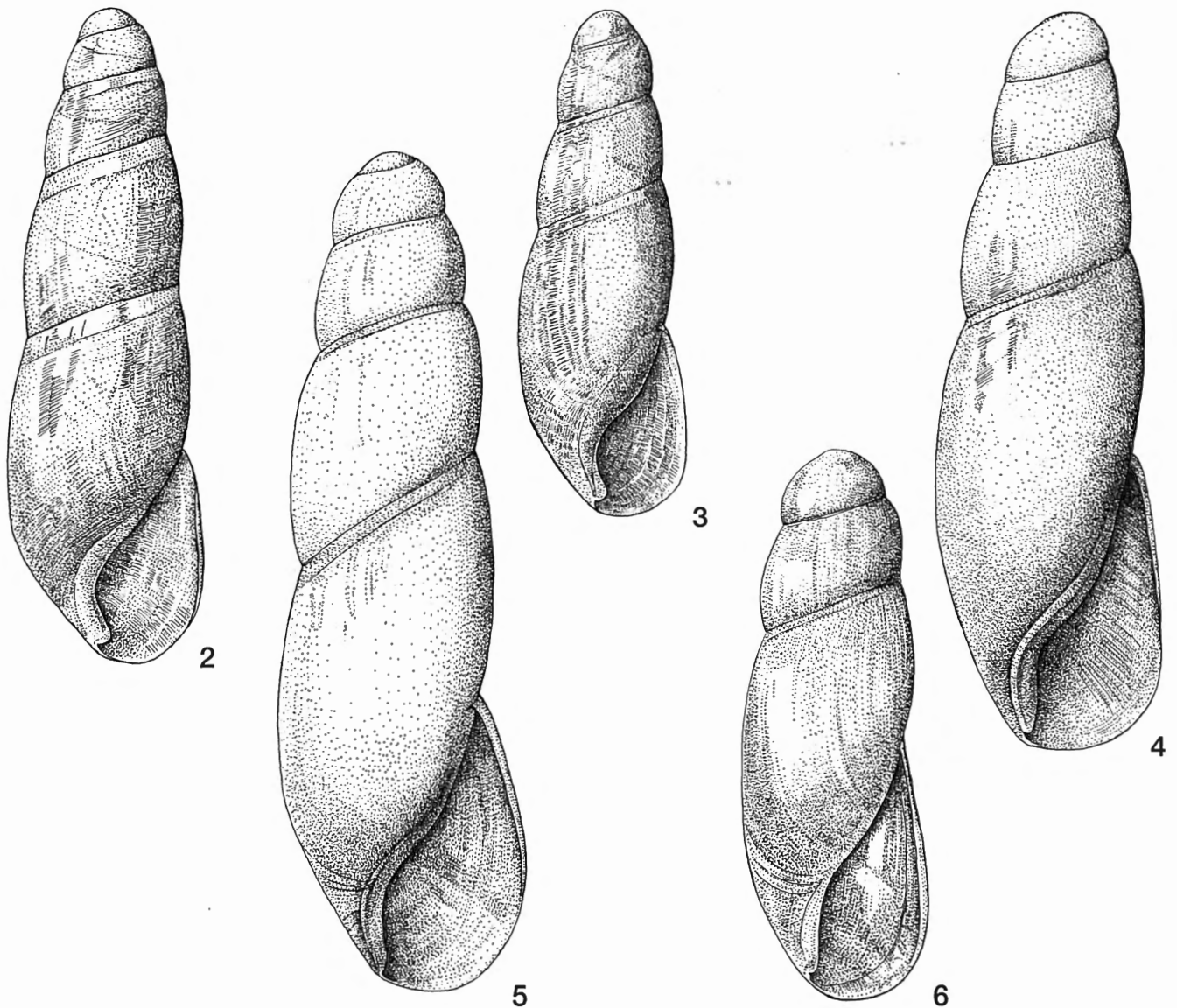
2.2-2.8 x 0.7-0.9 mm, l/d 2.96-3.25, aperture 0.8-0.9 x 0.3 mm, 5 1/2-6 whorls.

In the original description this species is compared to *C. virgo* (PRESTON, 1911). Various specimens are shown here for comparison (Figs 4-5), *i.e.* the lectotype (Fig. 4), a ‘cotype’ of *C. pertranslucens* PRESTON (Fig. 5), and another somewhat immature shell (Fig. 6). Material was distributed by PRESTON under the manuscript name *C. pertranslucens*; VERDCOURT’s (1983: 211) record in his East African checklist has elevated this name to the status of a *nomen nudum*. The specimens depicted in Figs 5 and 6 derive from the P. DAUTZENBERG collection (RBINS). ADAM’s labelling hints at a possible synonymy of *C. pertranslucens* with *C. virgo*, with which the present authors agree. All specimens are shown at the same enlargement, *i.e.* x33. The differences between *C. kalawangaensis* and *C. virgo* (size, apex, columella) are sufficiently demonstrated in Figs 2-6.

- *C. tribulationis* (PRESTON, 1911) (VERDCOURT, 1983a: 211, “= ? *gokweanus*”). The measurements of the two figured specimens (Figs 7-8) had to be calculated from the drawings because the shell in question had been lost (Fig. 8), or from the broken shell and the drawing (Fig. 7) because this specimen had broken into two parts. The species also occurs much further north in the D.R. Congo, *viz.* in the Garamba National

No.	locality/Fig.	height x maj. diam.	l/d	aperture	lw	whorls
1	PNU 2330/Fig. 8	1.97 x 0.8	2.50	0.96 x 0.48	1.6	<4
2	PNU 1701/Fig. 7	2.5 x 0.9	2.67	1.15 x 0.51	1.8	<4
3	PNG 267	2.6 x 0.9	2.80	1.25 x 0.62	2.0	4
4	PNG 266	2.7 x 0.9	2.87	1.2 x 0.56	2.1	4
5	PNG 266	2.8 x 1.0	2.81	1.3 x 0.62	2.1	4
6	PNG 267	2.9 x 0.9	3.07	1.25 x 0.62	2.2	>4
7	PNG 266	c. 3.0 x 1.0	c. 3.00	c. 1.25 x 0.62	2.2	>4
8	lectotype/Fig. 9	3.75 x 1.12	3.35	1.29 x 0.68	2.5	4 1/2

Table 2. Measurements in mm of the two figured PNU and five PNG shells of *Cecilioides tribulationis* (PRESTON). The localities are the following: PNU 1701 - Mabwe, Katanga forest, 585 m, 25.XII.1948, leg. W. ADAM; PNU 2330 - Kaziba, gallery forest of the Kaziba River, 1140 m, 18.IV.1949, leg. W. ADAM; PNG 266 - Inv. 266 Sta. I/0/1, 10.XI.1950, Mission H. DE SAEGER; PNG 267 - Inv. 267 Sta. I/0, 18.XI.1950, Mission H. DE SAEGER. The largest PNG shell (No. 7) has the bottom of the labrum damaged. All specimens in RBINS, but No. 5 is a duplicate in RMNH.



Figs 2-6. Shells of African *Cecilioides* species. 2-3, *C. kalawangaensis* DARTEVELLE & VENMANS: 2 - PNU 2382, and 3 - PNU 2330 (both RBINS, see Table 1); 4, *C. virgo* (PRESTON), lectotype (MRAC 16182), Kenya: Naivasha, 3.2 x 1.03 mm, l/d 3.11; 5, *C. pertranslucens* PRESTON *nomen nudum*, 'cotype' (RBINS, DAUTZENBERG coll.), Kenya: between Eusso Nyiro and Mt. Marsabit, 3.9 x 1.1 mm, l/d 3.55; 6, *C. pertranslucens*, (RBINS, DAUTZENBERG coll.), Kenya: between Eusso Nyiro and Mt. Marsabit, 2.5 x 0.85 mm, l/d 2.89. All figures x33.

Park, on the border with the Sudan. In sample Inv. 267 (PNG) both specimens exhibit a solid epiphragm; these were collected in the second half of November, *i.e.* in the dry season (DE SAEGER, 1954: 15-16). (Table 2)

C. tribulationis has now been recorded from Kenya and the D.R. Congo.

C. acicula (MÜLLER, 1774) has been reported to be widely distributed in Southern Africa (CONNOLLY, 1939: 368). This species has not been found in the PNU. Nevertheless, for comparative purposes it was thought worthwhile to include illustrations of shells of this variable taxon (Figs 10-11). In

addition, the holotype of another D.R. Congo species, *C. spencei* DUPUIS, 1923, is refigured (Fig. 12). Good figures of type specimens should contribute to solving the problems of species delimitation in this difficult group.

• *Micractaeon koptawelilensis* (GERMAIN, 1934) (in ADAM files *s.n.* *Microglessula koptawelilensis*, *vide* VAN BRUGGEN & DE WINTER, 1995: 79, 81, Figs 1-17). This widely distributed taxon (Malawi, Zambia, D.R. Congo, Kenya, Cameroon, Ghana) was discussed by VERDCOURT (1993) and by VAN BRUGGEN & DE WINTER (1995). Recently Dr A.J. DE WINTER remarked to the senior author that radula data of *Micractaeon* (see VERDCOURT, 1993) more or less agree with those of the Ellobiidae as discussed by HARBECK

(1996). The shell of *Micractaeon* also resembles that of some ellobiids. All this would entail removal of *Micractaeon* from the Ferussaciidae to the Ellobiidae. The representatives of the latter family mainly inhabit the supratidal zone but there are a few genuine terrestrial forms such as the Carychiinae, by many authors considered a family in its own right, albeit closely allied to the Ellobiidae.

Achatinidae (1 species)

This endemic Afrotropical family is known to be represented by numerous species in Katanga; so far only one has been recorded, but at least half a dozen more should be present in the PNU collections.

• *Burtoa nilotica* (PFEIFFER, 1861) [CROWLEY & PAIN, 1959, record only *B. n. congoensis* CROWLEY & PAIN (Pl. II Fig. 9) from Katanga (pp. 26-28); VAN BRUGGEN, 1988: 9, Fig. 4 on p. 15]. There is abundant PNU material in RBINS identified by the junior author. This species is widely distributed in Central, East and southern Africa from Lake Chad to the southern Sudan southward to beyond the Zambezi R. into Zimbabwe (CROWLEY & PAIN, 1959: 15, map on p. 16).

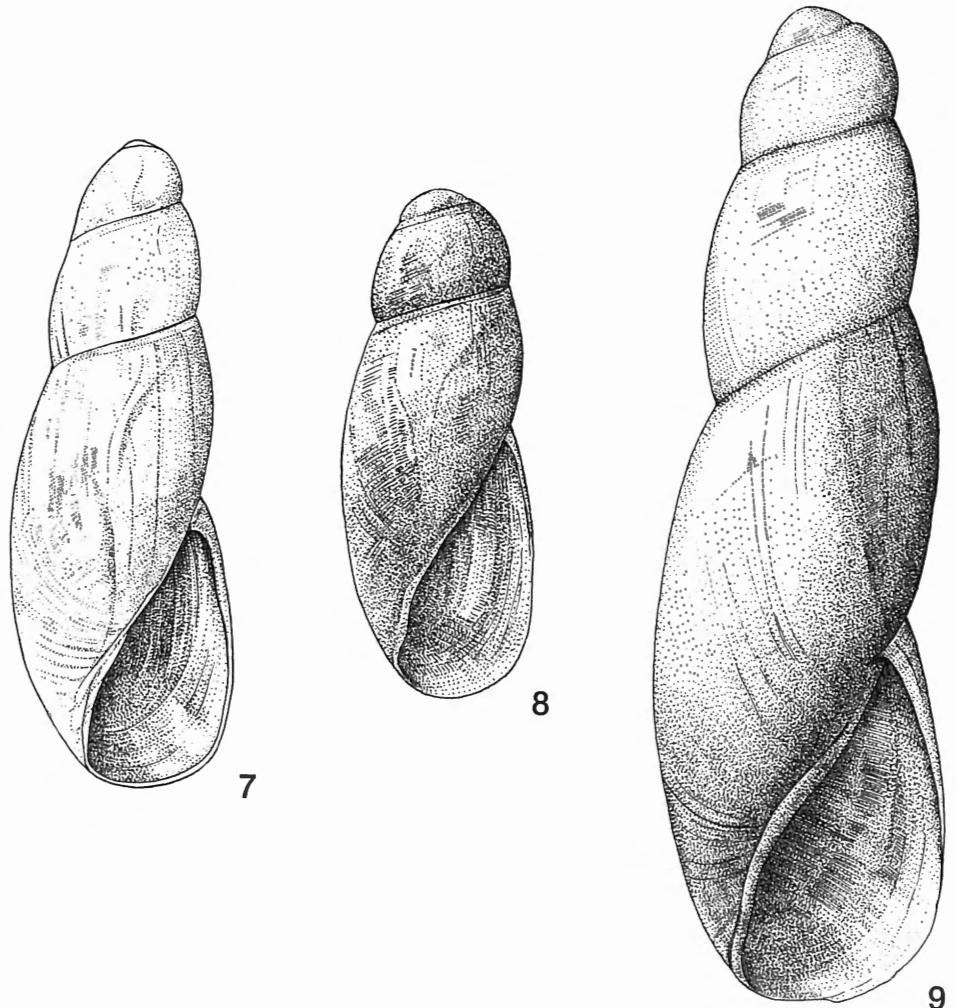
Streptaxidae (35 species, of which 14 'endemic')

This very diverse family is represented in tropical Africa by a large number of species. In fact, it may be the most diverse family of terrestrial snails in this part of the world. So far only 35 species have been identified and much material still awaits identification.

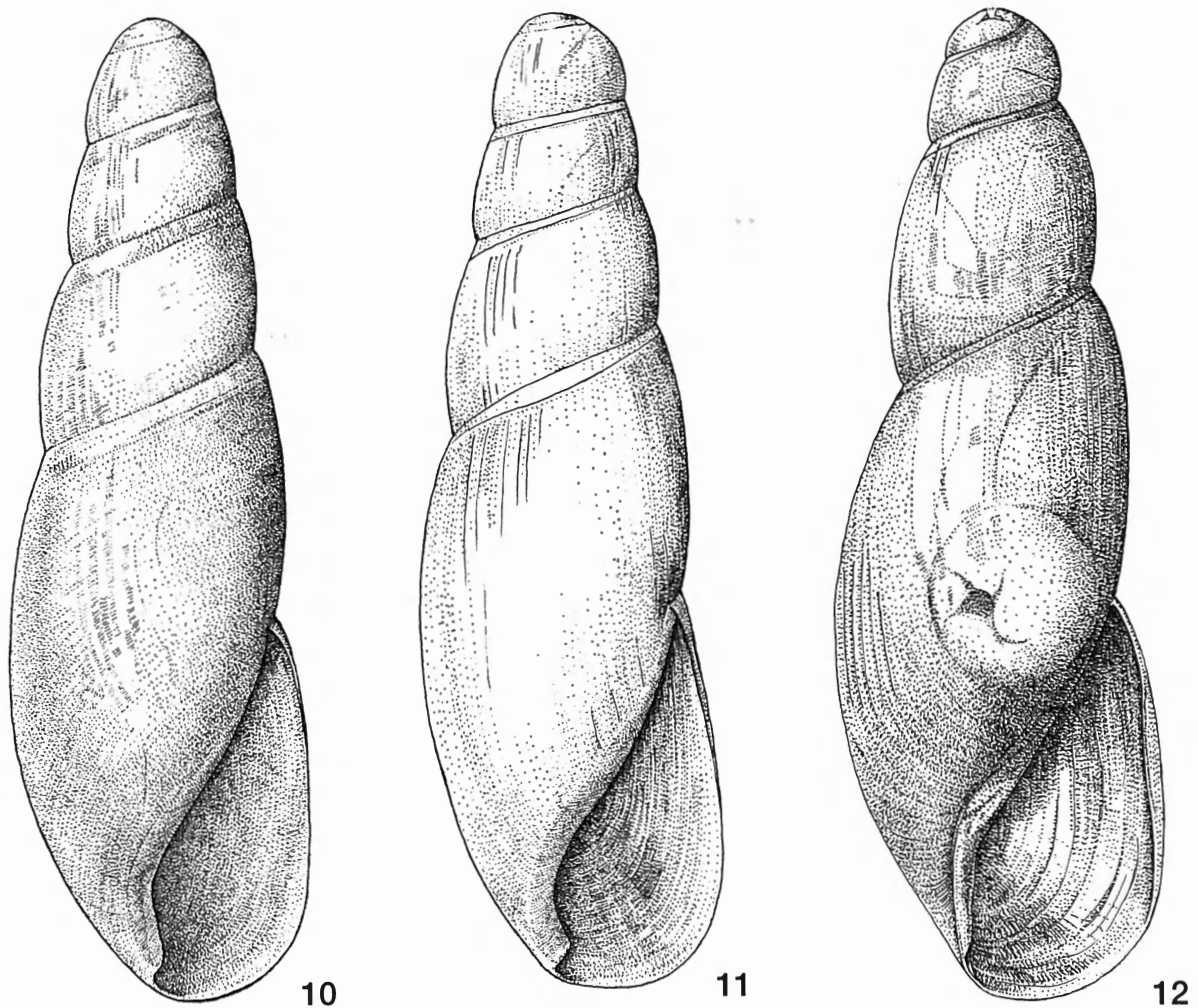
The genus *Streptostele* H. DOHRN, 1866, has suffered from a plethora of nominal taxa (e.g. CONNOLLY, 1922) and few attempts at creating some order (e.g. VENMANS, 1955, 1959; VERDCOURT, 1978; ADAM, 1965: 16-19, sensibly left a lot of material unnamed). PNU specimens identified have been compared to authenticated material.

For *Parneea* one should consult ADAM & VAN GOETHEM (1978) and VAN BRUGGEN (1989); the latter has tried to supply a key for identification of all species.

• *Tayloria moncieuxi* HAAS, 1934 (p. 222, Fig. 2; HAAS, 1936: 16; VERDCOURT, 1958: 268, 270; ZILCH, 1961: 80; ADAM, 1965: 12; RICHARDSON, 1988: 260). This little-known species seems to be a Katanga endemic; so far it has not been recorded from outside this area. VERDCOURT (1958: 270) states "dimensions and figure in original description do not agree". HAAS (1934: 222) gives 11.0 x 21.0 mm (l/d 0.52). The figure has a major diameter of 23 mm; the caption states "3 : 2", which implies a major diameter of 15.3 mm;



Figs 7-9.
Shells of *Cecilioides tribulationis* (PRESTON). 7 - PNU 1701, and 8 - PNU 2330 (both RBINS, see Table 2); 9, lectotype (MRAC 16181, see Table 2), Kenya: Naivasha. Figs 7-8 x33, Fig. 9 x34.



Figs 10-12. Shells of various species of *Cecilioides*. 10-11, *C. acicula* (MÜLLER): 10, South Africa, Kimberley, 3.85 x 1.21 mm, l/d 3.17 [RBINS, 'cotype' of *Cecilioides cygnus* CONNOLLY, a manuscript name for Kimberley material collected by SWAN, which CONNOLLY (1939: 369) later identified with *C. acicula*]; 11, Belgium, Marat (Orp-le-Grand), «dans le gravier de base du Tuffeau de Lincent», 3.81 x 1.21 mm, l/d 3.15 (RBINS). 12, *C. spencei* DUPUIS, holotype, D.R. Congo, «les alluvions de la rivière des Crocodiles», W. of Boma, 4.0 x 1.31 mm, l/d 3.05 (RBINS), note presence of egg. All figures x33.

however, on the photo "8/7" is shown, which implies an actual size of 20.1 mm, which is much nearer the figures in the text. The table below (Table 3) shows the measurements of the largest PNU shells. It appears that the text dimensions of HAAS would normally fit into this series. The sculpture of the shell is very characteristic (Figs 13-15); only the very first nuclear whorl is more or less granulate or pitted after which the costulation becomes increasingly noticeable. There is no peripheral keel on the shell in any stage of development. Fig. 13 depicts a juvenile shell with 4 whorls only (major diameter 5.6 mm). However, in the very sample from which the specimen of Fig. 13 hails, there is another, subadult, shell with 4 1/2 whorls (major diameter 7.6 mm) that shows a sharp mid-peripheral keel, while in all other characters conforming to the general picture of the species. There are no traces of repaired damage or whatever. This is the only shell among a lot of PNU material to show this, reason why this specimen is considered aberrant. Radula and genitalia have been described by ADAM (1965: 12).

Locality/coll.	height x major diameter	l/d	whorls	notes
PNU 1084/RBINS	6.8 x 12.7	0.54	5	—
PNU 1084/RBINS	7.2 x 13.1	0.55	5+	—
PNU 1255/RMNH	8.3 x 14.0	0.59	5+	—
PNU 1288/RBINS	8.4 x 13.8	0.61	5	—
PNU 1084/RMNH	9.6 x 16.7	0.57	<5 3/4	aperture damaged
PNU 1255/RBINS	10.3 x 18.4	0.56	5 3/4	aperture damaged

Table 3. Measurements in mm of the largest available PNU shells of *Tayloria moncieuxi* HAAS. The localities are the following: PNU 1084 (ex PNU, *i.e.* just beyond the borders of the PNU) - Kiwakishi, in the cave, 1100 m, 5-10.VII.1948, leg. W. ADAM; PNU 1255 - Kilwezi, rocks near the source, 1000 m, VIII.1948, leg. W. ADAM; PNU 1288 - Kilwezi, gallery forest of the Lufira River, 700 m, VIII.1948, leg. W. ADAM.

• *Gonaxis (Gonaxis) lata* (SMITH, 1880) (p. 347, Pl. 31 Figs 4-4a, *s.n.* *Ennea lata*; DUPUIS & PUTZEYS, 1901b: LI, Fig. 21, *s.n.* *Streptaxis translucidus*; PILSBRY, 1919: 174, 175 *s.n.* *Marconia translucida*; VERDCOURT, 1983a: 229). Only recorded from the D.R. Congo and Tanzania.

• *G. (G.) translucida* (DUPUIS & PUTZEYS, 1901) (1901b: LI, Fig. 21) (VERDCOURT, 1983a: 229). Recorded from the D.R. Congo and Uganda.

• *Streptostele (Streptostele) bacillum* PILSBRY 1919 (p. 188, Pl. 21 Fig. 9; VENMANS, 1959: 44, Fig. 4; VERDCOURT, 1983a: 230). This taxon is known from the D.R. Congo and Uganda.

• *S. (S.) centralis* PILSBRY, 1919 [p. 186, Pl. 21 Figs 5-5a (8); VERDCOURT, 1983a: 230]. Known to occur in the D.R. Congo and "East Africa" (no more precise data, fide VERDCOURT, 1983: 230).

• *S. (Raffraya) fallooni* CONNOLLY, 1922 (p. 503, Pl. 14 Fig. 3; VERDCOURT, 1983a: 231 - identification with some doubt). This taxon has been reported to occur in Kenya and the D.R. Congo.

• *S. (R.) horei* SMITH, 1890 (PUTZEYS, 1899: 56, Figs 5-6; DUPUIS & PUTZEYS, 1901a: XLI, Figs 15-16, *s.n.* *Ennea albida*; PILSBRY, 1919: 189, Pl. 21 Figs 6-6a; VENMANS, 1955: 7, Fig. 3; VENMANS, 1959: 45; VERDCOURT, 1983a: 231). *S. horei* is widely distributed in the D.R. Congo, but has also been reported from Tanzania.

• *Ptychotrema (Ennea) bequaerti* (DAUTZENBERG & GERMAIN, 1914) (ADAM, VAN BRUGGEN & VAN GOETHEM, 1994: 74, Figs 1-3, 32-33). So far only known from the D.R. Congo and Uganda (fide VERDCOURT, 1983a).

• **P. (?Ennea) ganzae* ADAM & VAN GOETHEM, 1978 (p. 25, Fig. 17; ADAM, VAN BRUGGEN & VAN GOETHEM, 1994: 96).

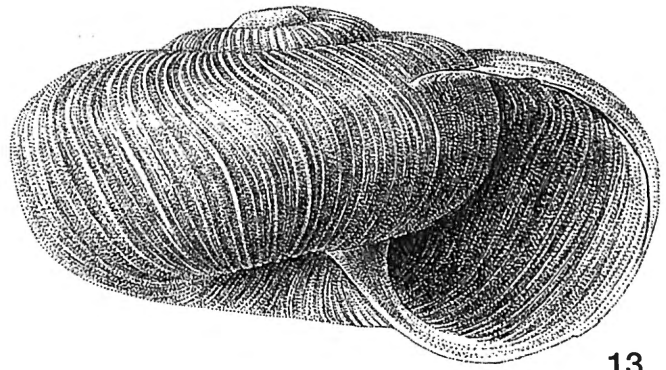


Fig. 13. Front view of juvenile shell of *Tayloria moncieuxi* HAAS, PNU 1860-1863, Mt. Kabulumba, woodland on rocky slope, 920 m, 1949, leg. W. ADAM (RBINS), major diameter 5.6 mm, whorls 4.

• **P. (?Ennea) kibarae* ADAM & VAN GOETHEM, 1978 (p. 22, Fig. 15; ADAM, VAN BRUGGEN & VAN GOETHEM, 1994: 96).

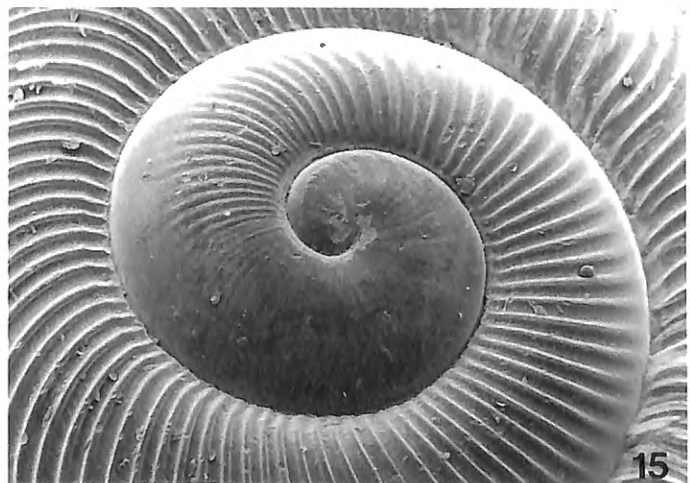
• *P. (E.) pseudosilvaticum* ADAM, VAN BRUGGEN & VAN GOETHEM, 1994 (p. 87, Figs 26-29, 48-49). This taxon has only been recorded from the D.R. Congo from Uele to Katanga.

• **P. (Haplonepion) upembae* ADAM, VAN BRUGGEN & VAN GOETHEM, 1993 (p. 143, Figs 1-4, 24-31, 50-54).

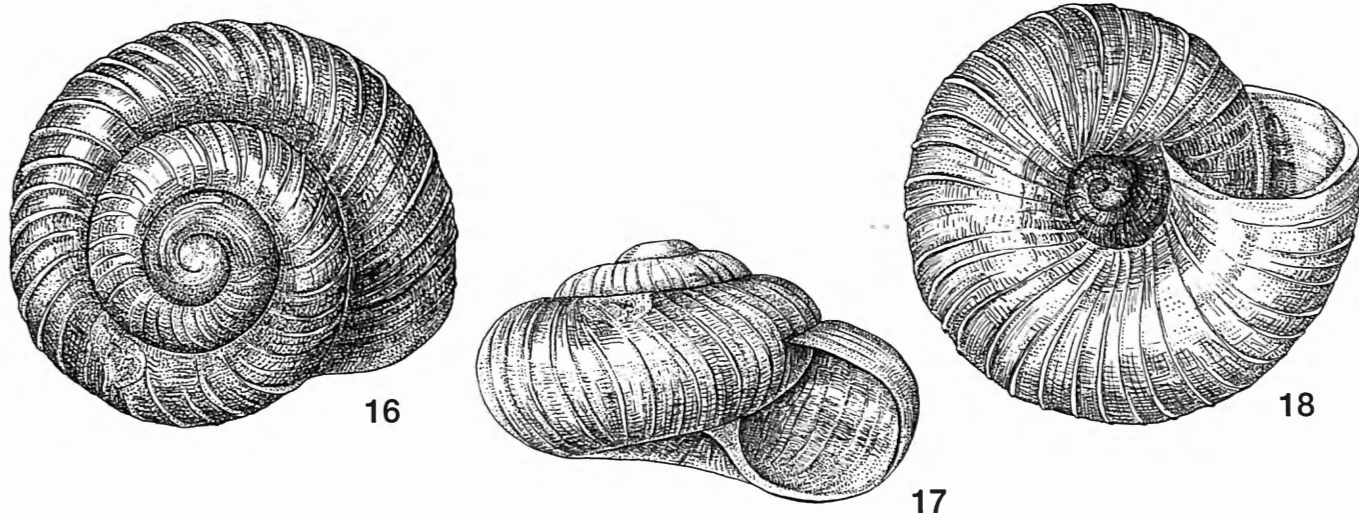
• **P. (Parennea) conicum* ADAM & VAN GOETHEM, 1978 (p. 37, Fig. 28; VAN BRUGGEN, 1989: 44, 45, 47).

• **P. (Parennea) dubium* ADAM & VAN GOETHEM, 1978 (p. 47, Figs 35-36; VAN BRUGGEN, 1989: 44, 45, 47).

• **P. (Parennea) goossensi* ADAM & VAN GOETHEM, 1978 (p. 14, Fig. 6; VAN BRUGGEN, 1989: 45-47).

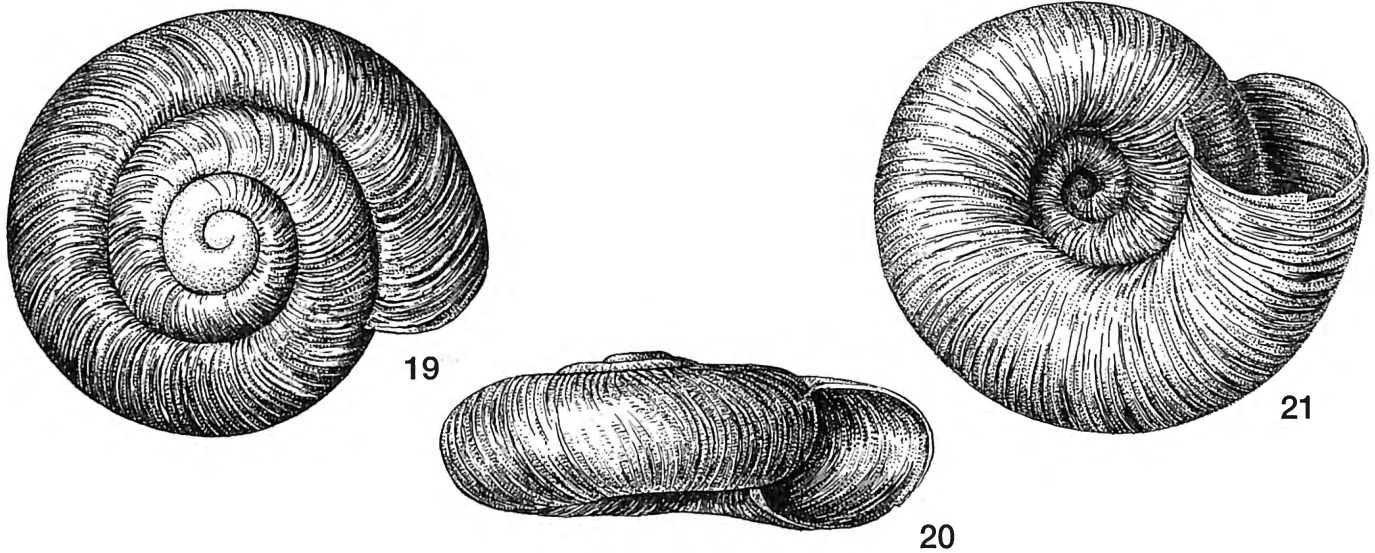


Figs 14-15. S.E.M. photographs of apices of shells of *Tayloria moncieuxi* HAAS. 14, PNU 1433, Masombwe, gallery forest of the Kafwi River, 1120 m, 4-16.X.1948, leg. W. ADAM (RBINS); 15, PNU 2562, Ganza, gallery forest of the Kisamba River, left tributary of the Lukoka River, below the Kamadula River, c. 900 m, 4.VII.1949, leg. W. ADAM (RBINS). Photographs K. WOUTERS, both figures x56.



Figs 16-18. Three views of shell of *Paralaoma caputspinulae* (REEVE), PNU 773, Katongo, gallery forest, 1750 m, 12.IV.1948, leg. W. ADAM (RBINS), x33.

- *P. (Parennea) jacquelineae* ADAM & VAN GOETHEM, 1978 (p. 26, Fig. 18; VAN BRUGGEN, 1989: 45-47).
- *P. (Parennea) kazibae* ADAM & VAN GOETHEM, 1978 (p. 24, Fig. 16; VAN BRUGGEN, 1989: 45, 47).
- *P. (Parennea) lufirae* ADAM & VAN GOETHEM, 1978 (p. 38, Fig. 29; VAN BRUGGEN, 1989: 45-47).
- *P. (Parennea) pelengeense* ADAM & VAN GOETHEM, 1978 (p. 38, Fig. 30; VAN BRUGGEN, 1989: 45-47).
- *P. (Parennea) pseudomukulense* ADAM & VAN GOETHEM, 1978 (p. 10, Fig. 2; VAN BRUGGEN, 1989: 45, 47).
- *P. (Parennea) subglabratum* ADAM & VAN GOETHEM, 1978 (p. 17, Figs 8-9; VAN BRUGGEN, 1989: 45-47). Only known from the D.R. Congo.
- *P. (Parennea) wittei* ADAM & VAN GOETHEM, 1978 (p. 33, Fig. 23; VAN BRUGGEN, 1989: 45, 47).
- *Gulella albinus* VAN BRUGGEN & VAN GOETHEM, 1999 (p. 42, Fig. 14).
- *G. (G.) decussatula* (PRESTON, 1913) (VAN BRUGGEN & VAN GOETHEM, 1997: 14, Figs 22-26). Widely distributed in Central-East Africa: D.R. Congo, Uganda, Kenya.
- *G. (G.) haullevillei* (DAUTZENBERG & GERMAIN, 1914) (VAN BRUGGEN & VAN GOETHEM, 1997: 16, Figs 28-30). Only recorded from Central and S.E. D.R. Congo.
- *G. (G.) planidens* (VON MARTENS, 1892) (VAN BRUGGEN & VAN GOETHEM, 1997: 21, Figs 52-53; in ADAM files incorrectly *s.n. G. laevigata*). This is one of the most widely distributed species of *Gulella*; we quote VAN BRUGGEN & VAN GOETHEM (1997: 21): "West, Central and East Africa, as far west as Senegal, northeastward to (continental) Tanzania, and southward to Zimbabwe and Mozambique."
- *G. (G.) sexdentata* (VON MARTENS, 1869) (VAN BRUGGEN & VAN GOETHEM, 1997: 24, Figs 58-61). The distribution has been discussed in detail by VAN BRUGGEN & VAN GOETHEM (1997: 24-25) and may be summarized as an East African taxon occurring from eastern South Africa northward to Tanzania/Zanzibar and westward to the PNU and the west shores of Lake Tanganyika in the D.R. Congo.
- *G. (Costigulella) kazibae* ADAM, 1984 (p. 5, Figs 3-7, 9). Distribution: D.R. Congo (Katanga) and Angola (RMNH, unpublished data).
- *G. (Paucidentina) coarti* (DAUTZENBERG & GERMAIN, 1914) (VAN BRUGGEN & VAN GOETHEM, 1997: 13, Figs 18-19). *G. coarti* has not yet been reported from outside Katanga.
- *G. (Plicigulella) bistruplicina* PILSBRY, 1919 (VAN BRUGGEN, 1996: 332; VAN BRUGGEN & VAN GOETHEM, 1997: 9, Figs 6-7). According to VAN BRUGGEN (1996) this species is confined to the northern and eastern D.R. Congo and Uganda.
- *G. (Pupigulella) pupa* (THIELE, 1911) (VAN BRUGGEN & VAN GOETHEM, 1997: 23, Fig. 56). This is a basically West/Central African form occurring from Liberia eastward to western Uganda and Tanzania.
- *G. (Silvigulella) osborni* PILSBRY, 1919 (VAN BRUGGEN & VAN GOETHEM, 1997: 21, Fig. 51). VAN BRUGGEN & VAN GOETHEM (1997: 21) write "Probably widely distributed in the forest belt of West, Central and Central/East Africa."
- *G. (S.) turiformis* VAN BRUGGEN & VAN GOETHEM, 1999 (p. 40, Fig. 13).
- *G. (Tortigulella) lessensis* PILSBRY, 1919 (VAN BRUGGEN & VAN GOETHEM, 1997: 17, Figs 32-40). This form seems to be confined to Eastern/Southeastern D.R. Congo and West Kenya.



Figs 19-21. Three views of shell of *Trachycystis iredalei* PRESTON, PNU 2381, Ganza, gallery forest of the Lukoka and the Kamandula, 860 m, 30.V-8.VII.1949, leg. W. ADAM (RBINS), x23.7.

• *G. (Wilmattina) shabae* ADAM & VAN GOETHEM, 1978 (p. 58, Fig. 48; VAN BRUGGEN, 1993: 105). Only known from the PNU and Malawi.

Punctidae (2 species)

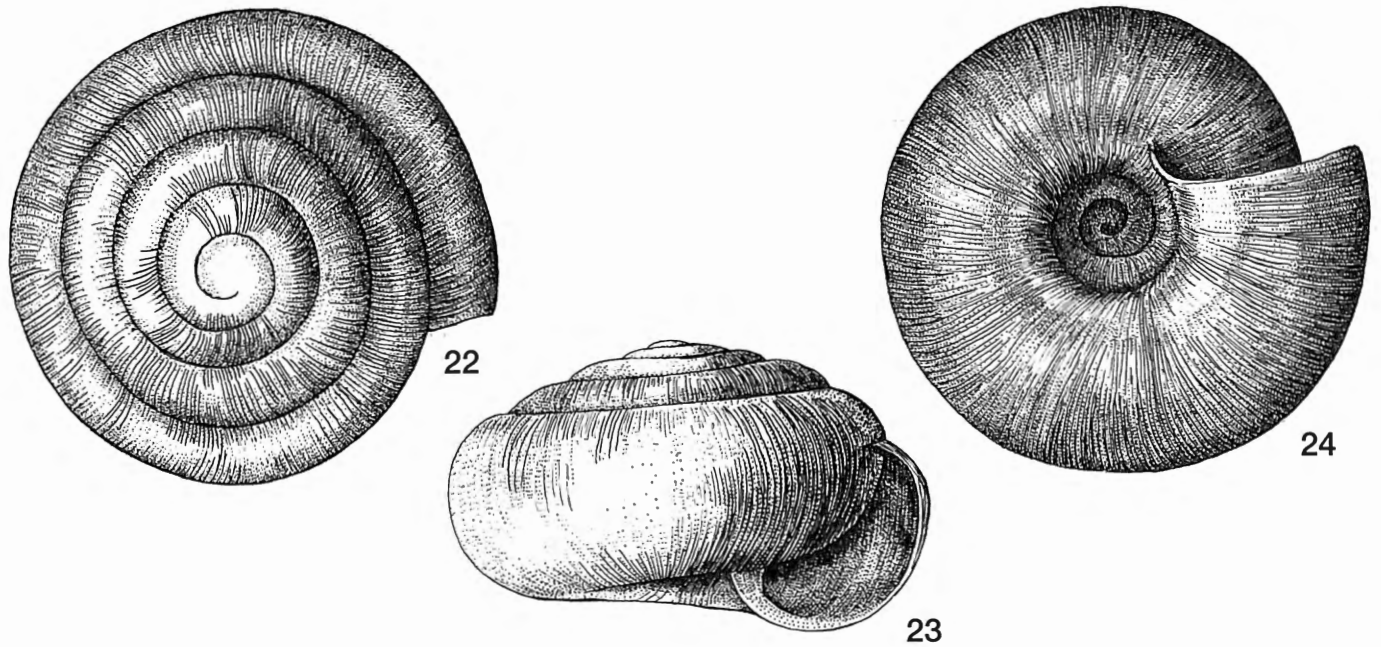
• *Punctum pallidum* CONNOLLY, 1922 (VERDCOURT, 1983a: 220, s.n. "*Punctum* sp. cf. *pallidum*"; VAN BRUGGEN & MEREDITH, 1984: 161; VAN BRUGGEN, 1988: 11; VERDCOURT 1991a: 357; 1991b: 373 Figs 14a-c; VAN BRUGGEN & VAN GOETHEM, 2001: 100, Figs 10-15). *P. pallidum* has no spiral sculpture on the nepionic whorls. This is a widely distributed form: Mozambique, Malawi, Zambia, D.R. Congo.

• *Paralaoma caputspinulae* (REEVE, 1852) [in ADAM files s.n. *Punctum hottentotum* (MELVILL & PONSONBY, 1891); VERDCOURT, 1983a: 220, s.n. "*Punctum* sp. cf. *hottentotum*"; VAN BRUGGEN & MEREDITH, 1984: 161, s.n. *Toltecia* cf. *hottentota*; VERDCOURT, 1991a: 355; 1991b: 373, Figs 7a-c, 374, figs. 19a-b, 20a-c, Figs 19 and 20 with question marks, all s.n. *Punctum hottentotum*; VAN BRUGGEN, 1993: 109]. The nepionic whorls of the shell exhibit spiral sculpture (Figs 16-18). The figured shell (PNU 773) measures 1.06 x 1.68 mm, l/d 0.63, aperture 0.6 x 0.8 mm, 3 3/4 whorls. The largest specimens from various localities (PNU 512 - Kafwe, gallery forest, 1780 m, 17.III.1948, leg. W. ADAM, RBINS 5, RMNH 2; PNU 910 - right tributary of Musepangi River, 1500 m, 20.V.1948, leg. W. ADAM, RBINS 2; PNU 1080 - ex PNU Masombwe, small patch of gallery forest along Kafwe River, 1120 m, 5-10.VII.1948, leg. W. ADAM, RBINS 3) have a major diameter of 1.5-1.8 mm and <3-3 3/4 whorls. This species (or perhaps complex of species) enjoys a very wide distribution throughout Africa and elsewhere - "an almost world-wide complex" (VAN BRUGGEN, 1993: 109).

Charopidae (3 species, of which 1 'endemic')

• *Trachycystis iredalei* PRESTON, 1912 [p. 187, pl. XXXII Fig. 8; VERDCOURT, 1983a: 220; 1991a: 357; 1991b: 373 Figs 12a-c (lectotype), 13a-c; TATTERSFIELD, 1996: 165, 166, 171, 179]. The figured shell (Figs 19-21, PNU 2381) is 1.04 x 2.70 mm, l/d 0.38, aperture 0.73 x 0.99 mm, < 4 whorls. The largest shell from PNU 2510 (Mware, in the gorge, 950 m, 20.VI.1949, leg. W. ADAM, RBINS) is not fully adult: 0.75 x 2.0 mm, l/d 0.37, aperture 0.62 x 0.68 mm, 3 1/2 whorls. The five largest examples from PNU 2381 (Ganza, gallery forest of the Kamandula and Lukoka Rivers, 860 m, 30.V-4.VII.1949, leg. W. ADAM, RBINS, duplicates in RMNH) are larger and have the following major diameter: 2.2-2.5 mm, with whorls varying from slightly less than 4 to slightly more than 4. Figs 19-21 show the noticeably depressed shell and its transverse sculpture. The apical whorls are pitted and the modest spiral element is very vague and only discerned under high magnification. The umbilicus is wide and deep, showing almost all whorls. Distribution: D.R. Congo and Kenya, and perhaps also Cameroon (DE WINTER & GITTEBERGER, 1998: 240).

• *Trachycystis* n. sp. Among the material sorted from leaf litter samples ADAM had selected a small specimen (unfortunately a singleton) which he rightly considered to represent a new species; this he had illustrated (Figs 22-24). The shell has the following data: Katongo, in gallery forest, 1750 m, 15-21.IV.1948, leg. W. ADAM (PNU 749). The major diameter is 2.00 mm and it has c. 5 whorls. Unfortunately in the course of the years the shell has started desintegrating. The periostracum bearing the costulate sculpture appears to be deciduous and is peeling off the shell. Today the specimen hardly looks like the professional drawings made in the fifties of last century and description as a new taxon now seems inopportune. Nevertheless, publication of the figures serves to draw attention to the existence of this species which may enjoy a distribution beyond the borders of the PNU.



Figs 22-24. Three views of the shell of *Trachycystis* n. sp., PNU 749, Katongo, in gallery forest, 1750 m, 15-21.IV.1948, leg. W. ADAM (RBINS), x34.

• *Prositala butumbiana* (VON MARTENS, 1895)². In the ADAM files this species was found *s.n.* *Prositala fernandopoensis* (GERMAIN, 1915) [p. 288; first figures: GERMAIN, 1916: 231, Pl. IX Fig. 11, Pl. X Figs 9-11 - the figure with details of the sculpture is absolutely useless; ZILCH, 1959: 220, Fig. 780, *s.n.* *Prositala fernandopoensis*, family Endodontidae; 1960: 647, Fig. 2266, *s.n.* *Halolimnohelix* (*Massaihelix*) *butumbiana*, Bradybaenidae]. The main paper on this species is VERDCOURT (1983b) who for the first time has satisfactorily figured the characteristic sculpture (his Pl. 14 Figs 1-4). The distribution as shown in his Fig. 2 is now extended by the records for Ivory Coast (DE WINTER, 1990: 308), Malawi (VAN BRUGGEN, 1993: 106), and PNU (present paper) (Fig. 25). The species has been recorded from Sierra Leone, Ivory Coast, Cameroon, Fernando Po (now Bioco or Bioko), D.R. Congo, Uganda, Kenya, Malawi.

Helicarionidae (2 species)

• *Kaliella barrakporensis* (PFEIFFER, 1852) (GODWIN-AUSTEN, 1882: 2, 19, Pl. I Figs 1-3b, Pl. II Fig. 1, Pl. V Figs 3, 11; GERMAIN, 1923: 39, Pl. II Figs 60-61; VERDCOURT,

1983a: 221; VAN BRUGGEN & MEREDITH, 1984: 162; VAN BRUGGEN, 1988: 12). Very widely distributed: South Africa, Mozambique, Zimbabwe, Zambia, Angola (RMNH, unpublished data), Malawi, D.R. Congo, Uganda, Kenya, Tanzania, Madagascar into S. Asia.

• *Kaliella iredalei* PRESTON, 1912 (p. 187, Pl. XXXI Fig. 12; GERMAIN, 1923: 42, Pl. II Fig. 49; VERDCOURT, 1983a: 221; VAN BRUGGEN & MEREDITH, 1984: 162; VAN BRUGGEN, 1988: 12; TATTERSFIELD, 1996: 165, 166, 171, 179). The three largest shells of PNU 1080 (Masombwe, small patch of gallery forest along the Kafwi River, 1120 m, 5-10.VII.1948, leg. W. ADAM, RBINS, duplicates in RMNH) measure 2.1-2.2 x 2.2-2.3 mm, l/d 0.89-0.97, <5-5 whorls. The absence of a carinate periphery is emphasized in the original description. The sculpture consists of a characteristic pattern of very fine transverse striae resulting in a silky appearance. The spiral element is hardly visible from above; it may be discerned just below the sutures here and there, but it is very marked on the bottom of the shell below the periphery. Distribution: Zambia, Malawi, D.R. Congo, Uganda, and Kenya.

Urocyliidae (testacea, *i.e.* shell-bearing snails - 2 species)

A considerable number of testaceous species of this Afrotropical endemic family has been recorded from throughout Africa South of the Sahara. So far only two species have been identified in the PNU collections.

• *Trochonanina mozambicensis* (PFEIFFER, 1855) (PILSBRY, 1919: 247; CONNOLLY, 1939: 157; VAN BRUGGEN, 1966: 346; VERDCOURT, 1983a: 223; VAN BRUGGEN & MEREDITH,

2. The correct name for this species should be *Massaihelix butumbiana* (VON MARTENS, 1895), because *Massaihelix* GERMAIN, 1913, has priority over *Prositala* GERMAIN, 1915. The type species of the latter, *Prositala fernandopoensis* GERMAIN, 1915, is a synonym of *Helix butumbiana* VON MARTENS, 1895, which is the type species of *Massaihelix*. Here we follow VERDCOURT (1983) in referring to this snail as *Prositala butumbiana*; relevant (recent) literature does likewise, reason why we hesitate to use the nomenclatorially correct name. B. VERDCOURT (2001, *in litt.*) suggested "that a proposal is to made conserve *Prositala* and reject the totally inappropriate name *Massaihelix*."

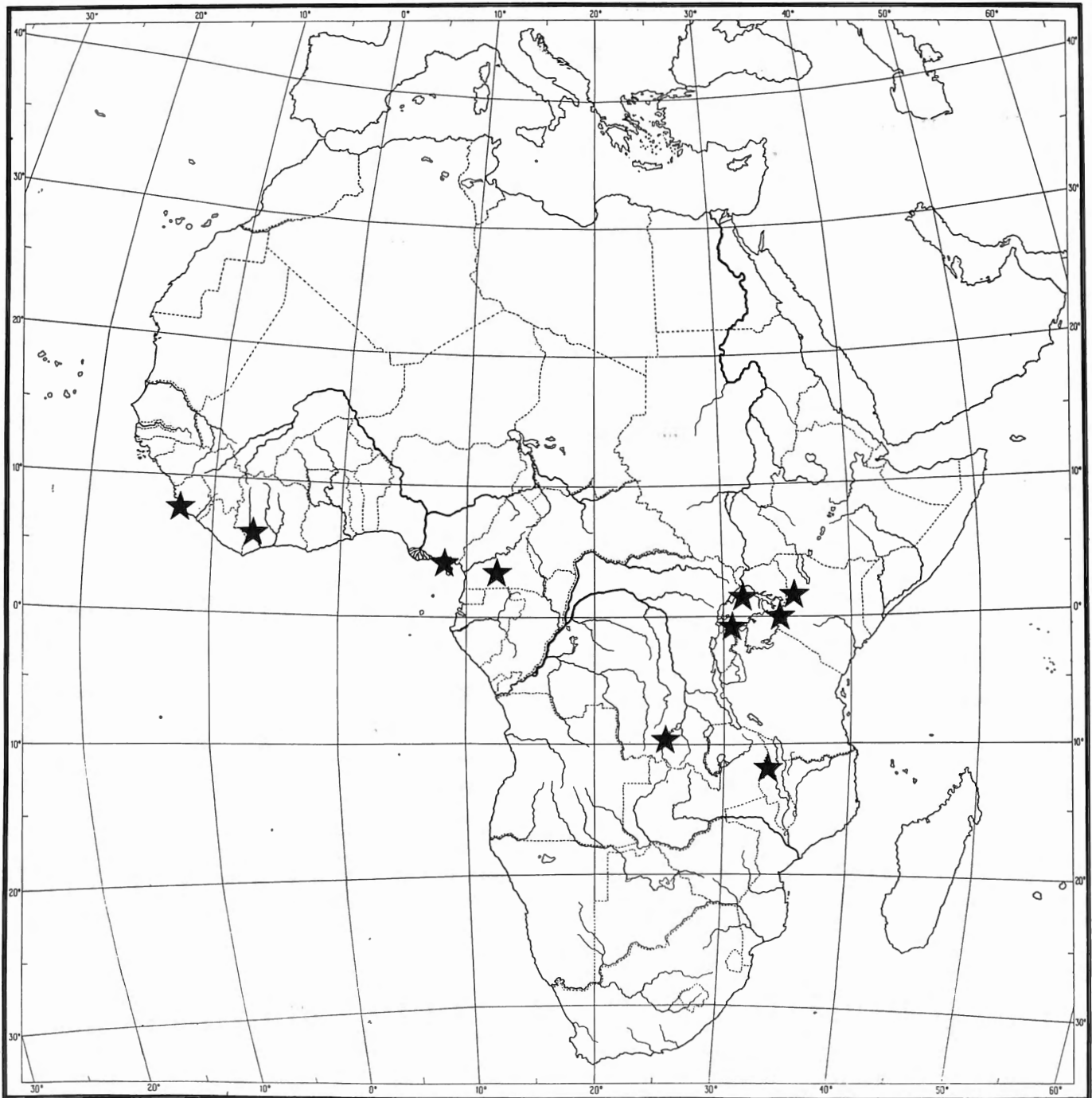


Fig. 25. Distribution of *Prositata butumbiana* (VON MARTENS). This distribution may be related to the probable extent of forest during a pluvial maximum [cf. map shown in Fig. 2 in VERDCOURT, 1983b, with localities added for Ivory Coast, D.R. Congo (PNU) and Malawi]. H. VAN PAESSCHEN del.

1984: 162; VAN BRUGGEN, 1988: 12). The senior author has seen PNU material that definitely belongs to this widely distributed species: D.R. Congo, Uganda, Kenya, Tanzania (inclusive of Zanzibar), Mozambique, Malawi, Zambia, Zimbabwe, South Africa, Swaziland. VERDCOURT (1983: 223) rightly warns "numerous records but much misidentified and circumscription needs revising". Reliable figures of the shell of this taxon are uncommon; we refer to the original descrip-

tion (PFEIFFER, 1855: 91, Pl. Mollusca XXXI Fig. 9) and to ZILCH (1959: 329, Fig. 1205); both figures are unsatisfactory giving no details of the sculpture.

• *Trochozonites (Teleozonites) adansoniae* (MORELET, 1848) (MORELET, 1858: 13, Pl. 1 Fig. 4; PILSBRY, 1919: 255, Fig. 119; ZILCH, 1960: 331, Fig. 1211; VERDCOURT, 1983a: 223; GASCOIGNE, 1994: 2, 5). The type material (BM 93.2.4.433-4) from 'Gabon' consists of two specimens, the

lectotype (Figs 26-28) and a slightly smaller paralectotype. These have the following measurements: lectotype - 5.2 x 4.9 mm, l/d 1.08, lw 3.1 mm, aperture 2.1 x 2.7 mm, whorls 5 3/4; paralectotype - 5.0 x 4.6 mm, l/d 1.08, lw 2.7 mm, aperture 1.7 x 2.5 mm, whorls 5 1/2. These shells show the oblique costulation almost from the beginning (the nepionic whorls are smooth or somewhat pitted). The body whorl is sharply keeled; on the bottom there are mere growth striae and a very vague spiral element, the costulation rapidly disappearing towards the rimate umbilicus. The sutures are deeply incised. It is obvious that the type material consists of immature shells. The largest Angola specimen (RMNH, Dundo, ANG 10510.2) measures 7.25 x 6.6 mm, l/d 1.09, and has 7 whorls. This is a widely distributed species ranging from Cameroon to Gabon, Annobon Island, Angola (RMNH, unpublished data), D.R. Congo, Uganda and Kenya.

Urocyclidae (Urocyclinae) (urocyclid slugs -5 species, of which 1 'endemic')

For this group of slugs VAN GOETHEM's monograph (1977) should be consulted.

- *Dendrolimax osborni* PILSBRY, 1919 (VAN GOETHEM, 1977: 111, 298, Figs 139-194, Pl. 2 Figs 3-7). This slug is widely distributed from southern Sudan to the Zimbabwe eastern escarpment.

- **Upembella adami* VAN GOETHEM, 1969 (p. 2, Figs 1-13; VAN GOETHEM, 1977: 122, 298, Figs 200-209, Pl. 2 Figs 8-9).

- *Nupnus improvisus* VAN GOETHEM, 1975 (p. 867; VAN GOETHEM, 1977: 246, Figs 565-582). This species is solely known from a restricted area in Central/Eastern and South/Eastern D.R. Congo and adjoining areas of Zambia.

- *Nupnus wittei* VAN GOETHEM, 1975 (p. 868; VAN GOETHEM, 1977: 250, 297, 298, Figs 583-598). So far this slug has been reported to occur in the south-eastern districts of D.R. Congo.

- *Nupnus blandulus* VAN GOETHEM, 1975 (p. 869; VAN GOETHEM, 1977: 253, 297, 298, Figs 599-613, Pl. 3 Figs 15-16). Only recorded from southern D.R. Congo.

Conclusions

ADAM was mainly interested in snails with small shells so that the picture that emerges above is skewed towards the elements of the cryptofauna, *i.e.* shells obtained from leaf litter samples, etc. Another of his interests was the family Streptaxidae - obviously streptaxid snails were selected for study in preference to other groups. It so happens that the senior author is also particularly interested in both the terrestrial gastropods of the Afrotropical cryptofauna and the family Streptaxidae world-wide.

The checklist (Table 4, 70 species), augmented with the species enumerated in Tables 5 (*c.* 28) and 6 (*c.* 22), makes for a total of *c.* 120 species.

Family	species also known from outside PNU	'endemics'	total
Cyclophoridae	—	1	1
Maizaniidae	2	—	2
Vertiginidae	5	4	9
Chondrinidae	1	—	1
Valloniidae	3	—	3
Cerastidae	—	1	1
Ferussaciidae	3	—	3
Achatinidae	1	—	1
Streptaxidae	21	14	35
Punctidae	2	—	2
Charopidae	2	1	3
Helicarionidae	2	—	2
Urocyclidae	6	1	7
Total	48	22	70

Table 4. Number of species of land molluscs identified in the PNU collections.

Family	additional species to be expected
Cerastidae	<i>c.</i> 6
Achatinidae	<i>c.</i> 6
Charopidae	<i>c.</i> 3
Helicarionidae	<i>c.</i> 1
Urocyclidae	<i>c.</i> 12
Total	<i>c.</i> 28

Table 5. Families obviously underrepresented in the above checklist with conservatively estimated additional species to be expected to occur in the PNU.

Family	additional species to be expected
Hydrocenidae	<i>c.</i> 1
Pomatiasidae	<i>c.</i> 3
Veronicellidae (slugs)	<i>c.</i> 2
Subulinidae	<i>c.</i> 10
Succineidae	<i>c.</i> 2
Euconulidae	<i>c.</i> 2
Bradybaenidae	<i>c.</i> 2
Total	<i>c.</i> 22

Table 6. Families not represented in the above checklist with conservatively estimated additional species to be expected to occur in the PNU.

This compares favourably with what is known for Zambia (VAN BRUGGEN, 1988: only 54 species - malacologically a very poorly known country!) and Malawi (VAN BRUGGEN

unpublished preliminary data: c. 150 species). Incidentally, the Kruger National Park (South Africa) harbours only c. 57 species (VAN BRUGGEN, 1966, 1968; also personal communication by Dr W.F. SIRGEL, Stellenbosch University, South Africa). It is slightly larger than the PNU, but probably with a lesser variety in habitats (altitude 200-839 m as compared to 585-1850 m). In addition, the Kruger National Park is situated in a much drier climatic zone (average annual rainfall 375-744 mm as compared to 1200-1400 mm) (for general data on the Kruger National Park see BRAACK, 1996; for do. on the PNU see DE WITTE, 1966, and VAN MEEL, 1966).

It is worthwhile to survey the general distribution of the 48 non-'endemic' species identified so far.

Four species are very widely distributed, also outside Africa: *Pupisoma harpula*, *Parazoogenetes orcula*, *Paralaoma caputspinulae*, and *Kaliella barrakporensis*. These surely are ancient elements as may be another two which enjoy a very wide distribution in Africa: *Nesopupa bisulcata* and *Gastrocopta klunzingeri*.

VERDCOURT (1983b: 180-181), in discussing the distribution of *Prositala butumbiana* (see above, Fig. 25), draws attention to the extent of forest stretching over Africa during a pluvial maximum. We quote (p. 181): "Only 14 East African species show this East-West distribution e.g. *Gulella avakubiensis* (PILSBRY), *G. conospira* (VON MARTENS), *G. pupa* (THIELE), *G. tudes* (VON MARTENS), *Trochozonites adansoniae* (MORELET) and *T. bifilaris* (DOHRN)." Of the six examples given by this author, two (*Gulella pupa* and *Trochozonites adansoniae*) are now also known to inhabit the PNU. To this list should be added, of course, *Prositala butumbiana*, but also *Micracteon koptawelilensis*, *G. planidens* (perhaps), and *G. osborni*. This makes for a total of six species reflecting relationships with the great African forest belt in past and present.

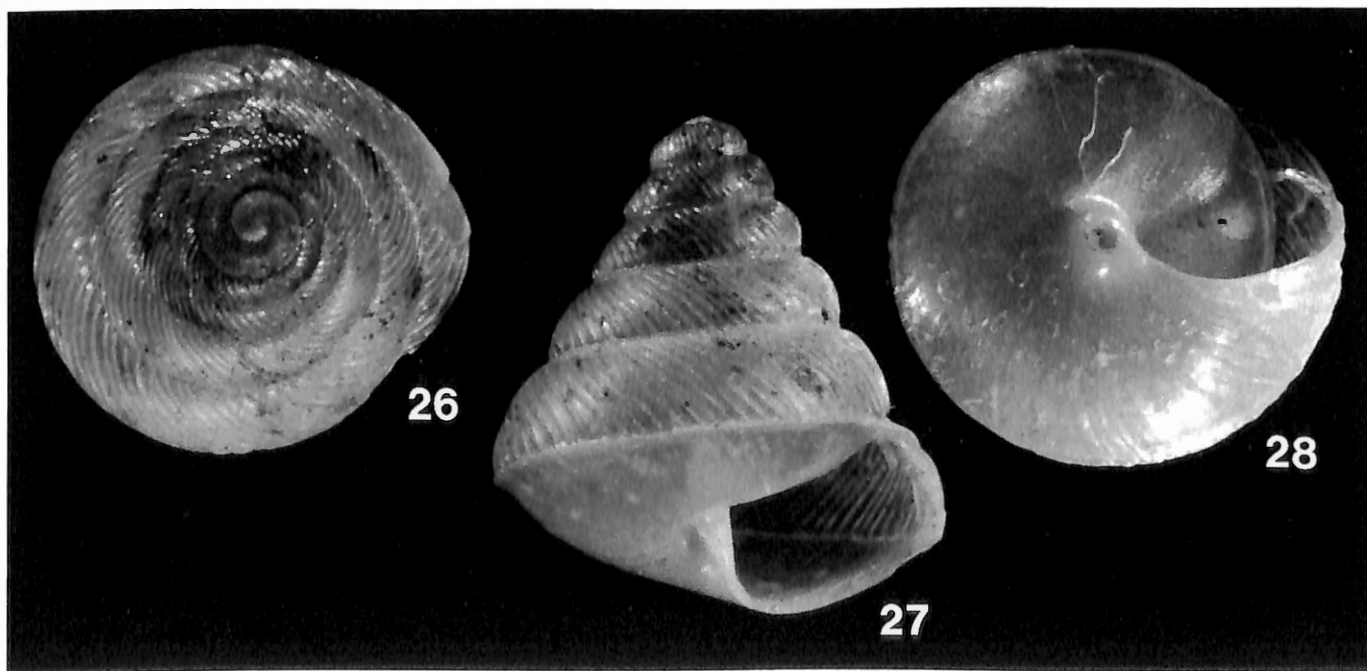
Another contingent of five (six) species exhibits a wide distribution in southern, central and eastern Africa: [*Nesopupa griqualandica*, represented by a well-marked subspecies], *N. corrugata*, *Burtoa nilotica*, *Gulella sexdentata*, *Punctum pallidum*, and *Trochonanina mozambicensis*.

Finally, there is a large number of species, 31 in all, that reflect a distribution limited to Central Africa *sensu lato*, viz.,

<i>Maizania elatior</i>	<i>Ptychotrema bequaerti</i>
<i>M. kazibae</i>	<i>P. pseudosilvaticum</i>
<i>Nesopupa ganzae</i>	<i>P. subglabratum</i>
<i>Truncatellina pygmaeorum</i>	<i>Gulella decussatula</i>
<i>T. upembae</i>	<i>G. haullevillei</i>
<i>Acanthinula straeleni</i>	<i>G. kazibae</i>
<i>Ceciloides kalawangaensis</i>	<i>G. coarti</i>
<i>C. tribulationis</i>	<i>G. bistruplicina</i>
<i>Tayloria moncieuxi</i>	<i>G. lessensis</i>
<i>Gonaxis lata</i>	<i>G. shabae</i>
<i>G. translucida</i>	<i>Trachycystis iredalei</i>
<i>Streptostele bacillum</i>	<i>Kaliella iredalei</i>
<i>S. centralis</i>	<i>Dendrolimax osborni</i>
<i>S. fallooni</i>	<i>Nupnus improvisus</i>
<i>S. horei</i>	<i>N. wittei</i>
	<i>N. blandulus</i>

Many of these species have limited distributions, *i.e.* are as yet unknown outside the D.R. Congo (*Ptychotrema pseudosilvaticum*, *P. subglabratum*, *Gulella haullevillei*, *Nupnus blandulus*), while *Tayloria moncieuxi*, *Gulella coarti* and *Nupnus wittei* have so far not yet or hardly been recorded from outside Katanga. These data have to be taken at their face value in the context of existing knowledge.

Finally, the perceived relationships of the 'endemic' species are almost all in the realm of West, West-Central and Central Africa. Genera/subgenera such as *Cyathopoma*, *Ptycho-*



Figs 26-28. Three views of lectotype shell of *Trochozonites adansoniae* (MORELET), 'Gabon', A. MORELET coll. (BM 93.2.4.433-4), 5.2 x 4.9 mm. Photographs A. 'T HOOFT, highly enlarged.

trema, *Silvigulella*, and *Upembella* reach their southernmost limits in Katanga or at most in (northern) Malawi.

The PNU is now much degraded (*vide* HASSON & WOLANSKI, 1999), most of the big game has been poached out of existence and serious inroads have been made on the forest type vegetation. However, there appears to be hope for the future. From a malacological point of view this national park should be treasured as the type locality of more than 30 species of land snails ('endemics' plus species originally described from the PNU and subsequently also found elsewhere).

Perhaps for the first time in the Afrotropical Region land molluscs were sampled by means of studying the results of extensive sieving of leaf litter (in 1948-1949 in the PNU). In terms of investment of money and human effort the malacological research in this national park may be termed a great success for which, indeed, credit is largely due to Dr William ADAM.

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