

**Studies on the Streptaxidae  
(Mollusca: Gastropoda Pulmonata) of Malaŵi 12  
Four new species of *Gulella* s.l.<sup>1</sup>**

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Key words: Gastropoda; Pulmonata; Streptaxidae; *Gulella*; Malaŵi; East Africa; taxonomy.

*Gulella annibiodiversitatis* spec. nov. is described from a few scattered localities in montane forest above c. 1300 m in southern-central Malaŵi. It is mainly characterized by a smallish (4.9-6.3 mm high), smooth and generally featureless shell without apertural dentition. *Gulella menkhorsti* spec. nov., has a small (2.3-2.9 mm high) and smooth shell with a six-fold dentition and is probably a restricted range endemic; so far it has only been recorded from the Mpita Forest in southern Malaŵi. A single smooth and small shell (2.7 mm) with a seven-fold apertural dentition from the Misuku Hills in northern Malaŵi also does represent a new species, *Gulella crux* spec. nov. Another sample from the same area, introduced as *Gulella nuchalis* spec. nov., has a medium-smallish (about 7.0 mm) and costulate shell with apical spiral sculpture and a six-fold apertural dentition; it is particularly characterized by what looks like an old outer labrum behind the reflected labrum.

### **Introduction**

Continued studies on the streptaxids among the terrestrial molluscs of Malaŵi have revealed the existence of various undescribed species of *Gulella* L. Pfeiffer, 1865, sensu lato. Recently additional material has been received from Messrs H.P.M.G. Menkhorst (Krimpen a/d IJssel) and W.N. Gray (Brixham, U.K.), who donated their collections to the Leiden Museum (now NCB Naturalis, abbreviated RMNH). Valuable Malaŵi material in the Museum of Comparative Zoology/Harvard University (abbreviated MCZ), collected by Arthur Loveridge in the years 1948-1949, has also been made available for examination. Material for comparison was kindly loaned by the Musée Royal de l'Afrique Centrale (Tervuren, Belgium, abbreviated MRAC).

This is an opportunity to publish the descriptions of four new species of *Gulella* s.l. The genus is used here in its broadest sense – the time has not yet come to subdivide it because too few anatomical data are available (there are as yet no published data on the anatomy of the type species) and it would be sensible to wait for more molecular data – all reasons why the species below are simply described as new taxa in *Gulella* s.l. Attention is drawn to Rowson et al. (2010: 93-94), who already have started to unravel this problem.

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<sup>1</sup> For no. 11 in this series vide Bruggen, A.C. van, 2010. Studies on the Streptaxidae (Mollusca: Gastropoda Pulmonata) of Malaŵi 11. *Gulella fortidentata* (Smith), *G. nyikaensis* (Preston), and *G. cruciata* (Von Martens). — *Basteria* 74: 129-139.

The abbreviation l/d stands for the ratio length/major diameter as an indication of the shape of the shell; l/d values are calculated from micrometer readings before conversion to mm.

***Gulella annibiodiversitatis* spec. nov., a new species without apertural dentition**

Specimens of a *Gulella* taxon with a smallish, smooth and generally featureless shell without apertural dentition were collected by the author during field work in Malaŵi in 1988 and 1990. New material from the H.P.M.G. Menkhorst and W.N. Gray collections in the Leiden Museum has supplied additional specimens. An extensive search through material in various collections and relevant literature have shown it to represent a new species.

*Gulella annibiodiversitatis* spec. nov.  
(figs 1-2)

Material. — Malaŵi, Thyolo Dist.: Thyolo Mt., above Satemwa Estate, in leaf litter on thin soil between rocks in rain forest, c. 1300 m, 7.x.1979, leg./don. W.N. Gray, WNG1086, "live animal cream" (RMNH Mol. 131909, holotype, figs 1-2; RMNH Mol. 131911, 3 paratypes); Thyolo Mt., c. 16°05'S 35°03'E, evergreen forest leaf litter, c. 1400 m, 6.viii.1983, leg./don. H.P.M.G. Menkhorst (RMNH Mol. 131912, 1 paratype); Zomba Dist.: Zomba Plateau, Chingwe's Hole Nature Trail, leaf litter, c. 1900 m, 15.v.1988, leg. A.C. & W.H. van Bruggen, STA 1988-01 (RMNH Mol. 131913, 1 paratype); Nkhata Bay Dist.: Viphya Mts., Chamambo Hill evergreen forest E. of road M1 at Chikangawa, leaf litter, 1790-1800 m, 26.vi.1990, leg. A.C. & W.H. van Bruggen, STA 1990-16 (RMNH Mol. 131914, 2 paratypes).

Diagnosis. — A species of *Gulella* s.l. characterized by a smallish to medium-sized (4.9-6.3 mm), slender, smooth and generally featureless shell without apertural dentition.

Description. — Shell (figs 1-2) smallish to medium-sized (4.9-6.3 mm), cylindrical, greatest width below the middle, always more than twice as long as wide, transparent when fresh to whitish when worn. Umbilicus rimate to completely closed. Spire produced, hardly tapering, sides parallel to at most subparallel, not convex, apex flattened, hardly obtusely conical to mamillate, smooth, rarely somewhat pitted. Whorls five-and-three-quarters to six-and-a half, hardly convex, smooth but under high magnification with traces of very faint spiral sculpture, growth lines barely visible, not even behind the labrum. Sutures impressed, fairly shallow, simple and filiform. Aperture subovate, wide open and not obstructed by apertural dentition (i.e. the shell is completely edentate), always somewhat higher than wide, peristome slightly incrassate and reflected, columella with a slight columellar twist. Of course, because of the absence of apertural dentition, there is no external depression behind the labrum.

The twist of the columella, visible in front view, may possibly be interpreted as a columellar lamella. However, this is observed in most 'edentulous' taxa, sometimes more or less marked than in the present taxon, and normally in these shells this is not considered part of the apertural dentition.

Measurements of shell: 4.9-6.3 × 2.1-2.5 mm, l/d 2.11-2.66, length last whorl 2.7-3.1 mm, aperture height × major diameter 1.6-2.0 × 1.3-1.6 mm, whorls 5¾-6½ (see table 1).

Animal. — Unknown, but field notes of the W.N. Gray specimen state: "animal cream".



Figs 1-6. Shells of *Gulella* species without apertural dentition. 1-2, *G. annibiodiversitatis* n. sp., holotype, front and side views (height 6.3 mm, RMNH Mol. 131909), Malaŵi, Thyolo Mt. 3-6, *G. ingloria* (Preston, 1913); 3-4, lectotype, front and side views (height 4.4 mm, MRAC 17533); 5-6, paralectotype, front and side views (height 3.8 mm, MRAC 17452), both Kenya, Mt. Nyiro. Note difference between lectotype and paralectotype of *G. ingloria*; it is obvious that these represent two rather than one species. Scale bars figs 1-2: 2 mm, figs 3-6: 1 mm. Photography by Dr A.J. de Winter, layout by Ms Sancia E.T. van der Meij.

Distribution.— So far the new species is only recorded from a few scattered localities in southern-central Malaŵi.

Ecology.— *G. annibiodiversitatis* n. sp. has only been reported from leaf litter in montane forest above c. 1300 m.

Derivatio nominis.— Research on the new species having been completed in 2010,

Table 1. Metric data of the type material of *Gulella annibiodiversitatis* n. sp. (all RMNH). The holotype shell has been indicated by an \*; all other shells are paratypes.

length × maj. diam.	l/d	length last whorl	aperture height × width	number of whorls	locality
4.9 × 2.3 mm	2.11	2.7 mm	1.6 × 1.3 mm	5¾	Chamambo Hill
5.1 × 2.3 mm	2.22	2.8 mm	1.8 × 1.6 mm	6	Chamambo Hill
5.4 × 2.1 mm	2.53	2.7 mm	1.7 × 1.5 mm	5¾	Thyolo Mt. (Gray colln.)
5.6 × 2.5 mm	2.25	2.9 mm	1.9 × 1.5 mm	<6	Zomba Plateau
5.9 × 2.3 mm	2.54	2.8 mm	1.7 × 1.4 mm	6	Thyolo Mt. (Gray colln.)
6.2 × 2.4 mm	2.63	3.1 mm	2.0 × 1.6 mm	6½	Thyolo Mt. (Menkhorst)
6.3 × 2.4 mm	2.66	2.8 mm	1.9 × 1.6 mm	6½	Thyolo Mt. (Gray colln.)
*6.3 × 2.4 mm	2.59	2.7 mm	1.7 × 1.4 mm	6½	Thyolo Mt. (Gray colln.), figs 1-2

the International Year of Biodiversity on our planet, has resulted in it being named: *annibiodiversitatis* = of the Year of the Biodiversity (genitive), i.e. *annus*, Latin = year, and *biodiversitas*, Latin = biodiversity. Alpha biodiversity in tropical land molluscs has been much underrated so that this name, although for a somewhat featureless species, is entirely appropriate.

Discussion.— The absence of apertural dentition results in a reduced number of shell characters; the only features distinguishing the new form are a combination of size, length/width ratio, suture, and sculpture. Initially the shells of the new taxon were interpreted as subadults of species with limited apertural dentition. Indeed, there may be more material in collections that has not been recognized as such – only in *Pupigulella* Pilsbry, 1919, does the full-grown shell really look adult by virtue of its reflected and incrassate apertural lip. Whether absence of apertural dentition is a plesiomorphic character state or not is a moot point. A few of the species of *Gulella* s.l. have juvenile apertural dentition, but the majority do not. It is possible or even probable that ancestral taxa had no trace of apertural processes – on the other hand this type of dentition may also be the result of a process of reduction.

Edentulous taxa of *Gulella* s.l. do occur all over Africa, although these are only very sparsely represented in southern Africa. Edentulous shells do not feature in Connolly (1939), nor in Herbert & Kilburn (2004), nor in southern African taxa described since. Pilsbry (1919) in his Congo treatise classifies two edentulous species with *Paucidentina* Von Martens, 1897, i.e. *G. masisiensis* Pilsbry, 1919: 226, and *G. chapini* Pilsbry, 1919: 227, and he also proposes *Pupigulella* (Pilsbry, 1919: 228), defined as “without apertural teeth, the lip well expanded”. Since Pilsbry’s review some additional edentulous forms from the D.R. Congo have been described (Van Bruggen & Van Goethem, 1999). None of these matches the new taxon from Malaŵi.

On the other hand, there is a number of taxa in East Africa without apertural dentition. First of all in Verdcourt’s 1962 paper one is referred to Keys 2 and 6, both leading nowhere as regards the taxon under discussion. A number of edentulous taxa has been described since (mostly covered in the checklist by Verdcourt, 2006), but there are no forms that look like the newly described taxon.

Incidentally, edentulous forms of *Gulella* also occur on the islands in the western Indian Ocean, i.e. on the Comoros, on Madagascar, on the Mascarene Is. as far east as

Mauritius, etc. Emberton (2002) even devotes a long, well-illustrated, paper to edentate *Paroedentulina* Emberton & Pearce, 2000 (a small *Gulella*-like endemic streptaxid genus) and *Gulella* in Madagascar, of both of which he enumerates a staggering combined total of 103 species. Some of his taxa have a vague likeness to *G. annibiodiversitatis* n. sp., but none are sufficiently close to be considered the same taxon. On the other hand, edentate *Gulella* are decidedly rare in the Comoro Is. (fide Fischer-Piette & Vukadinovic, 1974).

Verdcourt (1985: 114) treats eastern African species with no apertural dentition as a separate (unnamed) 'section' of *Gulella* (see also Verdcourt, 1962: 5) "and even the generic classification of these is unsatisfactory". Of course, absence of apertural dentition may be both a plesiomorphic or an apomorphic character state (see Van Bruggen & Van Goethem, 1997: 6-7), so that edentate species may or may not be related. The new species from Malaŵi has a noticeable twist in the columella which is absent in species discussed by Verdcourt [*G. ngorongoroensis* Verdcourt, 1985; *G. ingloria* (Preston, 1913); *G. puella* Connolly, 1929), as shown by figs 6-8 and 11-13 in Verdcourt, 1985].

The measurements of shells of *G. ngorongoroensis* are the following: 4.3-5.6 × 2.1-2.3 mm, l/d 2.00-2.55, length last whorl 2.3-2.7 mm, aperture height 1.4-1.7 mm, whorls 6. Although the new taxon does conform to the numerical data of the new species, there are significant differences. The suture in Verdcourt's species is "not crenulate" and there is no columellar twist in the aperture. *G. ngorongoroensis* may well be a local endemic; according to Verdcourt (2004: 46) it has so far only been recorded from the Ngorongoro area in Tanzania.

The types of *Ennea ingloria* Preston, 1913, are in the Tervuren Museum: MRAC 17533, "TYPE", Kenya, "Mt. Nyiro/to the South of/Lake Rudolph/8300 ft" (1: subadult? – sharp labrum without reflection: 4.4 × 2.2 mm, l/d 1.97, last whorl 2.5 mm, aperture height × major diameter 1.4 × 1.4 mm, 6½ whorls; lectotype according to Schouteden, 1936: 502; see figs 3-4); MRAC 17452, "Mt. Nyiro/83000 [SIC] ft/S of Lake Rudolph" (1: subadult? – sharp labrum without reflection, rudimentary angular process in the form of a mere lamelliform tubercle, fairly worn shell: 3.8 × 2.1 mm, l/d 1.80, length last whorl 1.9 mm, aperture height × major diameter 1.0 × 1.1 mm, 5½ whorls; paralectotype, figs 5-6).

From the figures (figs 3-6) it is clear that this type material represents two different taxa. The lectotype is a more or less cylindrical shell with a broad apex, while the paralectotype has an elongate-ovoid shell with a slightly tapering apex. According to Verdcourt (2006: 46) this, indeed inglorious, taxon is only known from "K[enya] (Mt. Nyiro; Ngong Hills), T[anzania] (Meru)". Given the differences between lectotype and paralectotype Mt. Nyiro in Kenya is now considered the only reliable locality. Differences with *G. annibiodiversitatis* are evident, i.e. both shells carrying the name *G. ingloria* are much smaller, the l/d values are lower, the aperture is smaller, and there are fewer whorls.

Finally, *G. puella* is utterly different because of its shape (l/d always well under 2.00) and size (3.0-3.7 mm). Verdcourt (2006: 46) gives the following range for this taxon: "K[enya] (Naivasha; Turi; Kericho), T[anzania] (Ngorongoro)".

As regards distribution, the new species is only recorded from a few scattered localities in montane forest above c. 1300 m in southern-central Malaŵi. Occurrence in kindred types of forest is to be expected at least in the adjoining areas of Mozambique (Mt. Thyolo being almost on the border with this country) and probably also south-eastern Tanzania.

***Gulella menkhorsti* spec. nov.,  
a possibly restricted range endemic from the Mpita Forest**

Among recently received Malaŵi material from Mr Menkhorst (see above) there is a sample of a characteristic taxon of *Gulella* s.l. from a well-known locality, which taxon obviously had not been reported before.

*Gulella menkhorsti* spec. nov.  
(figs 7-11)

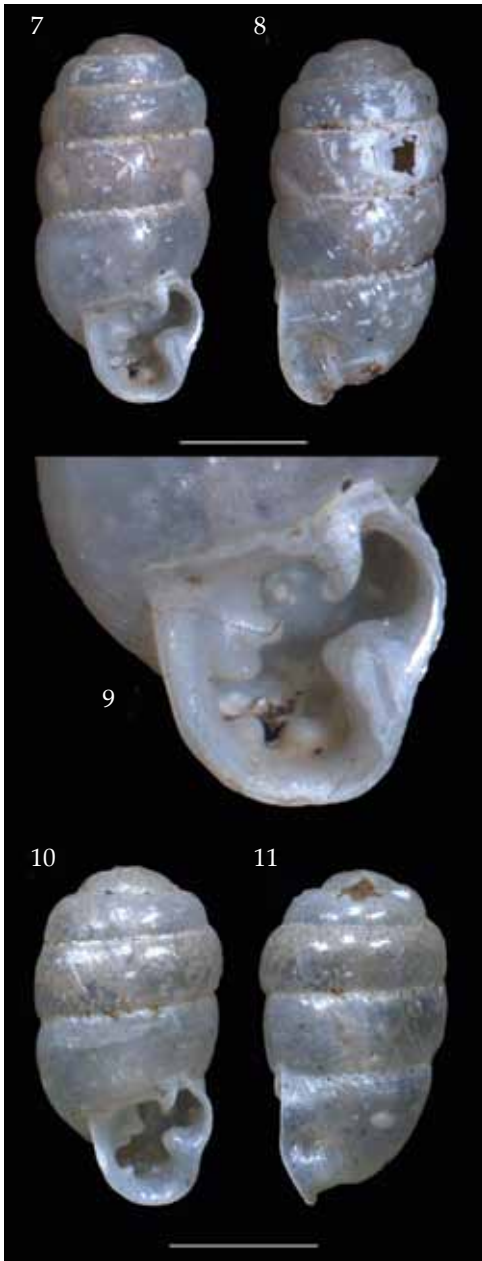
Material. — Malaŵi, Zomba Dist.: Mpita Estate near Thondwe close to lowland seasonal evergreen forest, leaf litter, c. 1100 m, 14.viii.1983, leg./don. H.P.M.G. Menkhorst (RMNH Mol. 131915, holotype, figs 7-9; RMNH Mol. 131916, 19 paratypes, figs 10-11; National Museum of Wales NMW.Z 2011.008.00001, 2 paratypes; RMNH, 2 juvenile shells, excluded from the type series).

Diagnosis. — A species of *Gulella* s.l. characterized by a small (<3 mm), almost smooth, (sub)cylindrical shell with six-fold apertural dentition consisting of angular lamella, labral complex, two basal denticles and a double columellar lamella.

Description. — Shell (figs 7-11) comparatively small (<3 mm), cylindrical to subcylindrical, greatest width about the middle, about twice as long as wide, transparent when fresh to whitish when worn. Umbilicus slightly open and slit-like. Spire produced, sides parallel to at most subparallel, not convex, apex flattened, hardly obtusely conical to mamillate, smooth, rarely somewhat pitted. Whorls five to just less than six, more or less convex, smooth but with faint growth striae, most noticeable behind the labrum. Sutures impressed, fairly shallow, increasingly crenellate from the apex downward. Aperture subovate, slightly higher than wide, peristome slightly in-crasate and reflected, fairly open but somewhat obstructed by a six-fold dentition: a strong, perpendicular inrunning angular lamella on the right of the paries; a large and squarish labral complex corresponding to a noticeable depression behind the labrum, forming a very large sinus with the angular lamella; two squarish basal processes, one mid-basal, fairly deeply situated and almost hidden, and one left basal, much more superficially situated; a fairly large, medium deeply situated columellar process, consisting of a mamillate main process with in the middle a horizontal inrunning lamella. There is no juvenile dentition.

Table 2. Metric data of six shells of the type lot of *Gulella menkhorsti* n. sp. [all from Mpita Estate, RMNH Mol. 131915 (holotype, figs 7-9) and 131916 (paratypes, smallest shell figs 10-11)]. The holotype shell has been indicated by an \*, all other shells are paratypes.

length × maj. diam.	l/d	length last whorl	aperture height × width	number of whorls
2.3 × 1.2 mm	1.85	1.4 mm	0.9 × 0.7 mm	5
2.5 × 1.3 mm	1.90	1.4 mm	1.0 × 0.9 mm	5+
2.7 × 1.3 mm	2.05	1.6 mm	1.0 × 0.9 mm	5½
2.8 × 1.4 mm	2.05	1.4 mm	1.0 × 0.9 mm	<6
*2.8 × 1.4 mm	2.05	1.5 mm	1.0 × 1.0 mm	5½
2.9 × 1.4 mm	2.16	1.6 mm	1.0 × 0.9 mm	5½



Figs 7-11. Shells of *Gulella menkhorsti* n. sp., all from the type locality Malaŵi, Mpita Forest, 7-9, holotype, front and side views and close-up of aperture (height 2.9 mm, RMNH Mol. 131915); 10-11, paratype, front and side views (height 2.3 mm, RMNH Mol. 131916). Scale bars 1 mm. Photography by Dr A.J. de Winter, layout by Ms Sancia E.T. van der Meij.

Measurements of shell: 2.3-2.9 × 1.2-1.4 mm, l/d 1.85-2.16, length last whorl 1.4-1.6 mm, aperture height × diameter 0.9-1.0 × 0.7-1.0 mm, whorls 5-<6 (see table 2).

Animal. — Unknown.

Distribution. — So far this taxon has only been recorded from the Mpita Estate in the Zomba District (Malaŵi) (see discussion below).

Ecology. — *G. menkhorsti* has only been collected in leaf litter on the Mpita estate.

Derivatio nominis. — This new taxon is named after Henk P.M.G. Menkhorst, a noted collector and malacologist who has contributed a lot of valuable land snail material of Malaŵi to the relevant holdings of the NCB Naturalis/Netherlands Centre for Biodiversity, Leiden.

Discussion. — The new species has a diagnostic apertural dentition, which may be coded as follows according to Verdcourt's (1962) criteria: 1; 1; 2; 1(2). A scrutiny of Verdcourt's basic East African keys (1962: Keys 10, 11, 12) does not lead to satisfactory results. The student is referred to the key in Van Bruggen (1996: 331-333) in case the more or less double columella is considered to point to the 'subgenus' *Plicigulella* Pilsbry, 1919. Here also no reasonable conclusions may be reached. Pilsbry's (1919) D.R. Congo monograph is not of assistance either in determining the position of the present taxon.

Numerous *Gulella* taxa have been described since the above standard treatments. Manuscript keys to the *Gulella* s.l. taxa in southern Africa (after Connolly, 1939), in Malaŵi/Zambia (all taxa described), in the D.R. Congo (after Pilsbry, 1919), and in East Africa (after Verdcourt, 1962, and Verdcourt & Venmans, 1956) are used by the present au-

thor to filter out potentially new taxa. The only taxon remotely similar to *G. menkhorsti* n. sp. is *G. ulugurensis* Verdcourt, 1962. Verdcourt (1962) figures various types of apertural dentition of this fairly variable taxon on his pl. I figs 1-2; these figures show some similarity to the apertural dentition of the new species but differences are evident and consistent, particularly as regards the basal processes. In addition this obviously restricted range endemic (Uluguru Mts. in Tanzania) has a noticeably larger shell with more sculpture. My colleague Dr Ben Rowson of the National Museum of Wales (Cardiff, U.K.) when shown photos confirmed the separate identity of the new taxon.

The Mpita Forest, an impressive if spatially limited seasonal evergreen lowland forest on the Mpita tobacco estate, has been repeatedly been visited by collectors (mainly Ms. Hazel M. Meredith and her co-workers in the period 1975-1988) and a number of land snail species, prominent among which *Achatina immaculata* Lamarck, 1822, has been collected here. Few species of *Gulella* s.l. have been identified so far in the leaf litter, such as e.g., *G. streptostelopsis* Van Bruggen, 2007. Some specimens still have to be evaluated, but representatives of this genus are not altogether common here and there is no great diversity either.

The Mpita Forest is not featured in Chapman & White (1970), but Chapman (1988) has written an insightful paper on this relict patch. He states (p. 6) "Among Malawi's lowland forest relicts, Mpita approaches most closely, in structure and physiognomy, the dry semi-deciduous lowland forest relicts of Dedza (Chongoni) and the Dowa Hills". On the other hand, White et al. (2001: 60, 62) list Mpita as "lowland rain forest"

#### **A single shell from the Misuku Hills with seven-fold apertural dentition:**

##### ***Gulella crux* spec.nov.**

A single smooth and small shell with a seven-fold apertural dentition from the Misuku Hills in northern Malaŵi, a source of many novelties among the land snails, has long defied identification. It obviously does represent a new species, which is now described below.

##### *Gulella crux* spec. nov.

(figs 12-13)

Material.— Malaŵi, Chitipa Dist., Misuku Hills, Mughesse evergreen forest, leaf litter, c. 1800 m, 12.ix.1986, leg. Mrs Isobyl la Croix (RMNH Mol. 131917, holotype, figs 12-13).

Diagnosis.— A species of *Gulella* s.l. characterized by a small (< 3.0 mm), smoothish (i.e. with faint costulation), shell with seven-fold apertural dentition consisting of parietal denticle, angular lamella, labral complex, two basal denticles, and a double columellar lamella.

Description.— Shell (figs 12-13) comparatively small (< 3 mm), subcylindrical, greatest width about the middle, under twice as long as wide, transparent when fresh.

Figs 12-13. Holotype shell of *Gulella crux* n. sp., front and side views (height 2.7 mm, RMNH Mol. 131917), Malaŵi, Mughesse Forest. Scale bar 1 mm. Fig. 12a shows details of aperture (highly enlarged), shell slightly tilted. Photography by Dr A.J. de Winter, layout by Ms Sancia E.T. van der Meij. ►





Umbilicus open but narrow. Spire produced, sides subparallel, not convex, apex flattened, obtusely conical to mamillate, smooth and very slightly pitted. Whorls six, slightly convex, seemingly smooth but with vague and fine costulation, most noticeable behind the labrum. Sutures impressed, filiform and hardly subcrenellate. Aperture subovate to squarish, about as high as wide, peristome slightly incrassate and reflected, somewhat obstructed by seven-fold dentition: a strong, almost perpendicular, in-running angular lamella on the right of the paries; a large, almost bulbous labral complex corresponding to an outside depression behind the labrum, forming a large sinus with the angular lamella; an insignificant deeply situated process in the right basal region, more or less hidden by the labral complex; a centre-left basal process; a superficial mid-columellar denticle; a more deeply situated mamillate columellar complex; a fairly small, hardly superficial, mid-parietal denticle.

Measurements of shell:  $2.7 \times 1.4$  mm, l/d 1.90, length last whorl 1.5 mm, aperture height  $\times$  diameter  $0.9 \times 0.9$  mm, whorls 6.

Animal. — Unknown.

Distribution. — So far this taxon has only been recorded from the Mughesse Forest in the Misuku Hills in northern Malaŵi.

Ecology. — *G. crux* n. sp. has only been reported from leaf litter in montane forest at c. 1800 m.

Derivatio nominis. — *crux*, a Latin noun (i.e. a noun in apposition), meaning 'cross', referring to the name of the collector Mrs Isobyl la Croix ('croix' being French for 'cross'), one of Ms. Meredith's star collectors in northern Malaŵi.

Discussion. — Only a single shell is available for study. In Verdcourt's system (see above) the formula for the apertural dentition would be 2; 1; 2; 2. At first sight identification with *G. perissodonta* (Sturany, 1898) might be a possibility.

Some information is available on *G. perissodonta* (Van Bruggen, 1969: 46-50; 2006: 123-125; Herbert & Kilburn, 2004: 184-185), which, indeed, is a variable taxon. The shells are subject to variation in size (length 2.7-6.2 mm, i.e. the largest shells are more than twice as long as the smallest), shape (l/d 1.74-2.47, i.e. shell shape varies from squat and obese to slender and cylindrical), and pattern of apertural dentition (maximum 9-fold, but may be reduced to 8-fold or even 7-fold). The single shell of the new species *G. crux* would easily fit in here because its length (2.7 mm), shape (l/d 1.90), and apertural dentition (7-fold) are fully covered by the variability of *G. perissodonta*. The individual processes in the aperture of *G. crux*, however, are slightly different from those of *G. perissodonta*; there is no sinular denticle and the sinus is seemingly proportionally larger, the labral complex consists of a single large process, the deeply situated (single) basal denticle is insignificant, and the superficial mid-columellar denticle is quite well-developed and prominent.

What remains is the sculpture of the whorls and its attendant sutures. For *G. perissodonta* this has been described by Van Bruggen (1969: 46) as "Whorls . . . sculptured with close, oblique costulae; sutures from shallow to fairly deep, crenellate." In *G. crux* the whorls are seemingly smooth but with vague and fine constulation, and the sutures are impressed, filiform and hardly subcrenellate. Also, the single shell of the latter has already 6 whorls while a shell of that size in the former would always have at the most  $5\frac{1}{2}$  whorls.

Close comparison with a series of *G. perissodonta* in the Leiden Museum shows that on the whole the differences between this and the new species are consistent. Apart

from the size difference (i.e. very few shells of the former are as small as that of *G. crux*) and the sculpture of the whorls, the outer columellar process is always much less significant in *G. perissodonta*. The overall general impression is that the shell of *G. perissodonta* is noticeably 'coarser' than that of *G. crux*.

Biogeographically, in view of the known distribution of *G. perissodonta* (northernmost localities: Cabo Delgado and Vumba Is. on the coast of Mozambique close to the border with Tanzania, fide Muratov, 2010, and Van Bruggen, 2003), *G. crux* might represent a western outlier of the former. Van Bruggen (1969: 49) writes that "*G. perissodonta* favours a comparatively dry climate with a sparse vegetation; indeed it may be considered a typical savanna dweller." Later, Herbert & Kilburn (2004: 185) explicitly state that *G. perissodonta* "occurs in drier habitats, particularly savanna woodland mosaic, in leaf litter and under stones and logs". Ecologically, therefore, occurrence in fairly dry savanna woodland type vegetation from sea level to <1000 m, and in the wet montane forests of the Misuku Hills at c. 1800 m, does not seem to be compatible.

The conclusion here is that the shell under discussion is close to that of *G. perissodonta*, but does show sufficient differences for it to be considered to represent another taxon, here called *G. crux*. In addition, the above discussed differences in ecology point in the direction of the latter being a separate entity.

#### ***Gulella nuchalis* spec. nov., a species with a peculiar structure behind the labrum**

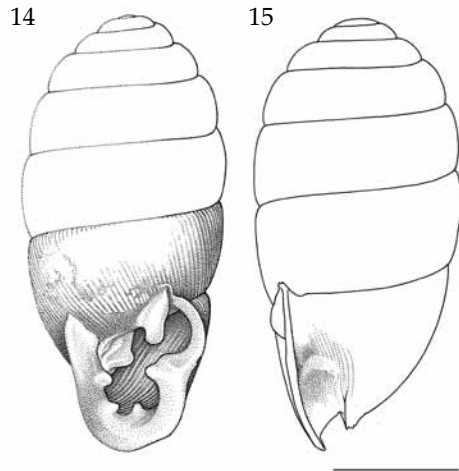
Arthur Loveridge was the first collector in Malaŵi (1948-1949) since the initial nineteenth century explorations (1891-1896) by Alexander Whyte, the collector employed by the pioneer Sir Harry Johnston. The Loveridge party consisted of Arthur Loveridge, his wife Mary V. Sloan and her sister Hilda (Billy) L. Sloan (see Loveridge, 1953, 1954, all material in MCZ). Although mainly interested in vertebrates, they were quite successful as regards land mollusc collecting. So far the present author has described five species as new from their collection [*Ptychotrema loveridgei* Van Bruggen, 1990, *Cerastus procrastinationis* (Van Bruggen, 1993), *Gulella microrutshuruensis* Van Bruggen, 1995, *G. loveridgei* Van Bruggen, 1996, and *G. sursum* Van Bruggen, 2001]. In addition, in various papers other Loveridge material has contributed to better understanding of other taxa. Another sample from the Loveridge collection does represent an obviously new taxon of *Gulella* s.l. with a peculiar structure behind the labrum of the shell.

#### *Gulella nuchalis* spec. nov. (figs 14-18)

Material. — Malaŵi, Chitipa Dist., Misuku Hills, Matipa Forest, Wilindi Ridge, c. 6000 ft. (= c. 2000 m), 22.ix-18.x.1948, leg. A. Loveridge [MCZ 298196, Acc. 532, holotype (figs 14, 16, 17), 27 paratypes (figs 15, 18; 20 in MCZ and 7 paratypes of this series, RMNH Mol. 131918), 2 juvenile shells, excluded from the type series].

Diagnosis. — A species of *Gulella* s.l. characterized by a medium-sized (about 7 mm), costulate shell with apical spiral sculpture and with six-fold apertural dentition consisting of angular lamella, a weakly two-pronged labral complex, a mid-basal denticle, two outer and one inner columellar processes; behind the labrum of the shell there is a process that might be interpreted as the remains of a former labrum.

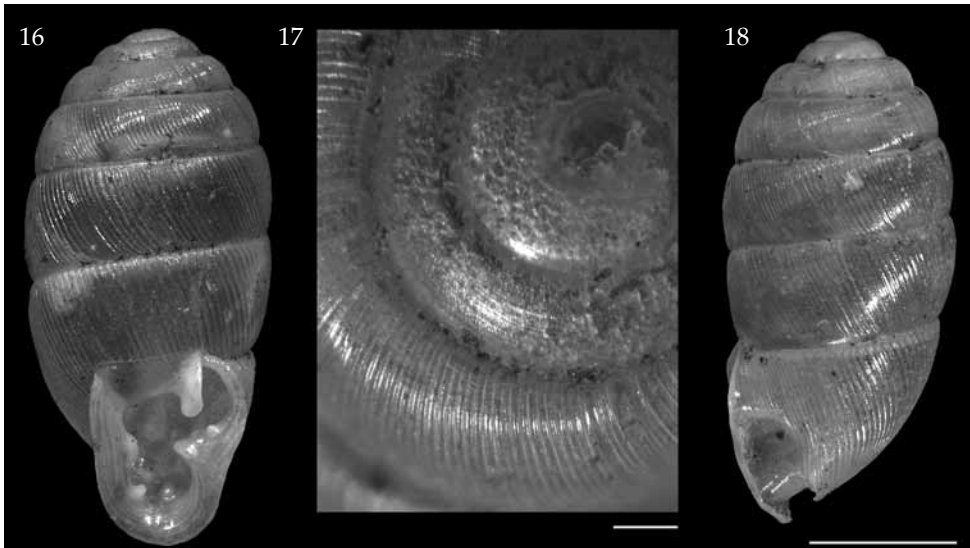
Description.— Shell (figs 14-18) medium-sized (about 7 mm), subcylindrical, greatest width about the middle of the shell, about twice as long as wide, transparent when fresh to whitish when worn. Umbilicus slightly open and slit-like, shell therefore rimate. Spire produced, sides parallel to at most subparallel, not convex, apex flattened, obtusely conical to mamillate, with clearly marked fine spiral sculpture (fig. 17). Whorls from slightly more than six to somewhat less than seven, more or less convex, finely costulate (sometimes major and minor riblets may be distinguished), remains of spiral sculpture visible between the costulae. Sutures well impressed, subcrenellate to filiform. Aperture squarish to subovate, always higher than wide, with well reflected peristome, somewhat obstructed by six-fold dentition, consisting of a strong inrunning and perpendicular angular lamella, a large, fairly superficial weakly two-pronged labral complex (corresponding to a noticeable pit behind the labrum), forming a large sinus with the angular lamella, a fairly deeply situated mid-basal denticle, two more superficial outer columellar denticles (one of which may also be considered to be left-basal), and a strong, mamillate inner columellar process. A short distance behind the labrum in the umbilical region there is what superficially looks like an old reflected labrum (figs 15, 18); this hump does not correspond to an inside depression. Juveniles do not show apertural dentition.



Figs 14-15. Shells of *Gulella nuchalis* n. sp., Malaŵi, Wilindi Ridge. 14, paratype, front view (height 6.6 mm, MCZ 298196); 15, paratype, side view (height 6.8 mm, RMNH Mol. 131918; see also fig. 18). H. Heijn del., 1991. Scale bar 2 mm. The shell shown in fig. 14 unfortunately was broken after photography.

Table 3. Metric data of nine shells of the type lot of *Gulella nuchalis* n. sp. (all from Matipa-Wilindi Ridge, MCZ 298196 and RMNH 131918). The holotype shell has been indicated by an \*, all other shells are paratypes.

length × maj.diam.	l/d	length last whorl	aperture height × width	number of whorls	collection
6.4 × 3.2 mm	1.98	3.7 mm	2.5 × 2.1 mm	6+	MCZ
6.4 × 3.2 mm	2.02	3.5 mm	2.6 × 2.0 mm	6+	RMNH
6.5 × 3.3 mm	1.96	3.7 mm	2.6 × 2.1 mm	6+	MCZ
6.6 × 3.2 mm	2.09	3.9 mm	2.6 × 2.2 mm	6¾	RMNH, figs 15, 18
6.8 × 3.4 mm	2.02	3.7 mm	2.4 × 1.9 mm	6½	RMNH
*7.0 × 3.4 mm	2.09	3.9 mm	2.7 × 2.1 mm	6¾	MCZ, figs 16, 17
7.1 × 3.2 mm	2.19	3.9 mm	2.7 × 2.0 mm	<7	MCZ
7.2 × 3.2 mm	2.23	3.6 mm	2.4 × 2.1 mm	<7	RMNH
7.4 × 3.2 mm	2.27	3.9 mm	2.6 × 2.2 mm	<7	MCZ



Figs 16-18. Shells of *Gulella nuchalis* n. sp., Malaŵi, Wilindi Ridge. 16, holotype, front view (height 6.6 mm, MCZ 298196; see also fig. 14); 17, do., apical view, highly enlarged; 18, paratype, side view (height 6.8 mm, RMNH Mol. 131918; see also fig. 15). Scale bar figs 16, 18: 2 mm, fig. 17: 0.2 mm. Photography by Dr A.J. de Winter, layout by Ms Sancia E.T. van der Meij.

Measurements of shell: 6.4-7.4 × 3.1-3.4 mm, l/d 1.96-2.27, length last whorl 3.4-3.9 mm, aperture height × width 2.3-2.7 × 1.9-2.2 mm, whorls 6+<7 (see table 3).

Animal. — Unknown.

Distribution. — So far this taxon has only been recorded from the Matipa Forest in the Misuku Hills in northern Malaŵi.

Ecology. — *G. nuchalis* n. sp. has only been reported from leaf litter in montane forest at c. 2000 m.

Derivatio nominis. — *nuchalis*, a Latin adjective of Arabian descent = pertaining to the nape or neck, referring to the peculiar structure shown behind the labrum of the shell.

Discussion. — All sorts of combinations of characters in *Gulella* s.l. keep on turning up all over Africa. The peculiar structure behind the labrum in *G. nuchalis* n. sp. probably has not yet been recorded. Of course, it is the combination of apertural dentition characters and apical spiral sculpture with this structure that makes the taxon under discussion seemingly unique (for a general discussion on shell characters in *Gulella* s.l. refer to Van Bruggen & Van Goethem, 1997: 7) and therefore a hitherto undescribed taxon. This outside hump does not correspond to an inside depression, pit or whatever.

Pilsbry (1919) is one of the few authors who supplies illustrations of some species of *Gulella* from the side, i.e. showing the shell laterally in addition to a ventral view. In some cases these figures give an indication of the phenomenon described above, but never as pronounced as in *G. nuchalis*. He calls this a “wave” on p. 221 (with reference to fig. 89b of *Gulella disseminata cymatonotus* Pilsbry, 1919): “the last [whorl] tapering

downward, flattened dorsally, having a strong rounded wave on the right side and base some distance behind the lip, which is preceded by a rather broad contraction". Lower down on the same page he writes: "Neither of Preston's descriptions [of *G. disseminata* and *G. ingeziensis*] mentions the broad swelling or wave on the back, preceding the contraction behind the peristome." Pilsbry's fig. 91b of *G. lessensis* Pilsbry, 1919, on p. 222, also shows this phenomenon, albeit less marked, and he states on p. 223: "the last [whorl] tapering downwards, slightly contracted behind the lip, a low wave parallel to the lip preceding the contraction." There are probably other cases in the literature where this particular 'wave' has been recorded.

The apertural dentition formula according to Verdcourt is either 1; 1; 1; 3 or 1; 1; 2; 2, depending on whether one process is interpreted to be a left-basal rather than an outer columellar process. The labral complex is weakly two-pronged and may be interpreted as the merger of two processes, so that the formula reads as follows: 1; 2; 1; 3 or 1; 2; 2; 2, resulting in a seven-fold apertural dentition. In addition, there may be an additional cusp on the right side of this complex (see fig. 16) so that the formula then is: 1; 3; 1; 3 or 1; 3; 2; 2, adding another process. The shell may then be considered having a eight-fold apertural dentition.

As regards similar shells one should check on taxa with a costulate shell in the size range of 6 to 8 mm with apical spiral sculpture and six or seven-fold apertural dentition. It appears that there are no described taxa with this combination of characters in southern Africa, Mozambique, Malaŵi, Zambia, East Africa and the D.R. Congo.

Details of the type locality are described in Van Bruggen, 1990 (pp. 100-101). The new taxon is unlikely to be a Malaŵi endemic – indeed, species described from southern Tanzania have been found in the Misuku Hills [e.g., *Gulella cruciata* (Von Martens, 1900), vide Van Bruggen, 2010].

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