

Studies on the Streptaxidae (Mollusca, Gastropoda, Pulmonata) of Malaŵi 13. *Gulella menkhorsti* Van Bruggen, 2011, and *Gulella proxima* spec. nov.¹

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INTRODUCTION

Gulella menkhorsti Van Bruggen, 2011, described from the Mpita Forest, Zomba District, Malaŵi, appears to be widely distributed in this country from the south to the north, albeit with an artificial (?) gap in Central Malaŵi. Details referring to individual variation are discussed; particular attention is drawn to the open umbilicus. North of about Mzuzu a species is found characterized by a densely costulate, seemingly similar, shell that on close examination reveals numerous differences such as the presence of a closed umbilicus and a lower columellar process in the aperture: *G. proxima* spec. nov.

Key words: Gastropoda, Eupulmonata, Streptaxidae, *Gulella*, taxonomy, Malaŵi.

¹For no. 12 in this series vide Bruggen, A.C. van, 2011. Studies on the Streptaxidae (Mollusca: Gastropoda Pulmonata) of Malaŵi 12. Four new species of *Gulella* s.l. – Zoologische Mededelingen Leiden 85 (13): 849-864.

Malaŵi harbours a large number of species of the carnivorous eupulmonate family Streptaxidae. Many of these were described in the genus *Gulella* L. Pfeiffer, 1865, sensu lato. With increasing knowledge of the genital anatomy and DNA data, this genus is being split into more natural units (e.g., Rowson & Tattersfield, 2013; De Winter & Vastenhout, 2013). Because of the inavailability of such data in this case, the genus here is employed in its widest sense.

Gulella menkhorsti Van Bruggen, 2011, was described from a population from the Mpita Forest in the Zomba District in Malaŵi. Further scrutiny of *Gulella* material from that country in the Leiden Museum has now revealed more material from a variety of localities in this country. Indeed, it is well represented in the Hazel M. Meredith collection (s.n. *Gulella* VII), but there is also more material in the collections made by Messrs W.N. Gray (Brixham, England) and H.P.M.G. Menkhorst (Krimpen a/d IJssel, The Netherlands).

Both these collections have now been incorporated in the Leiden Museum mollusc holdings. This taxon therefore loses its initial status of a 'restricted range endemic' (Van Bruggen, 2011).

The abbreviation HMM stands for leg./don. H.M. Meredith, RMNH for Naturalis Biodiversity Center, Leiden (formerly National Museum of Natural History), and l/d 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).

ADDITIONAL DATA ON *GULELLA MENKHORSTI*

New data were extracted from the following Malaŵi material (all in RMNH; see Fig. 9: diamonds):

Thyolo Dist., Mt. Thyolo, Mwalantunga Estate, streamhead forest leaf litter, c. 1150 m, 31.viii.1982, leg. J. Chapman [36KYT 255 268]; Mt. Thyolo, Namingombo riverine forest leaf litter, c. 1400 m, 8.vi.1980, HMM (among which a damaged shell, Fig. 1; has been further damaged since); Mulanje Dist., Mt. Mulanje, Litchenya Forest Reserve, Mabuka, riverine forest leaf litter, c. 550 m, 25.i.1986, HMM; Mt. Mulanje, Litchenya Forest Reserve, Mabuka, forest leaf litter, c. 550 m, 11.iv.1987, HMM; Mt. Mulanje, Litchenya Forest Reserve, Mabuka, forest leaf litter, c. 600 m, v.1986, leg. J. Chapman; Mt. Mulanje, Chambe, west face 'shelf' evergreen forest leaf litter, c. 1450 m, v.1986, leg. J. Chapman; Mt. Mulanje, Phalombe Gorge, leaf litter, c. 1500 m, viii.1986, leg. J. Chap-

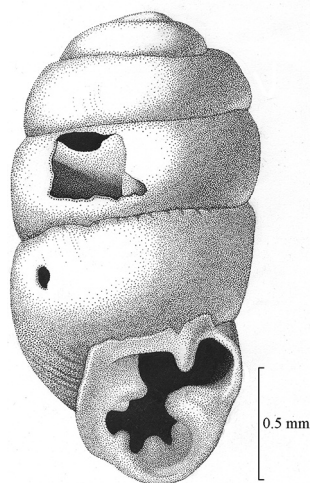


Fig. 1. Drawing of a damaged shell of *Gulella menkhorsti* Van Bruggen, 2011 (RMNH), from Malaŵi, Mt. Thyolo, Namingombo riverine forest leaf litter, by Egbert Koopmans; unfortunately the poor specimen has been further damaged.

man; Mt. Mulanje, Phalombe River, forest leaf litter, c. 1400 m, viii.1986, leg. J. Chapman; Mt. Mulanje, Nasato stream-lithophytic forest leaf litter, c. 1200 m, 13.iii.1986, leg. J. Chapman; Mt. Mulanje, Nasato, forest leaf litter, 1100-1200 m, i-ii.1986, leg. J. Chapman; Mt. Mulanje, Likulezi Gorge, riverine forest leaf litter, c. 1040 m, 4.ix.1986, HMM; Mt. Mulanje, Mchese-Migowe River valley, riverine forest leaf litter, 1000-1500 m, 8.vi.1984, leg. Dr J.H. Seyani; Blantyre Dist., Mt. Soche, evergreen forest leaf litter, c. 1450 m, 15.ix.1983, leg. Dr R.J. Dowsett (figs 6-8); Mt. Soche NE. side, submontane forest leaf litter, c. 1500 m, 27.viii.1982, leg. J. Chapman [36LYT 170 480]; Blantyre, Ndirande, evergreen forest leaf litter, c. 1750 m, 14.ix.1983, leg. Dr R.J. Dowsett; Blantyre, Ndirande Mt., leaf litter at base of tree in rain forest, c. 1600 m [5000 ft], leg./don. W.N. Gray (W.N. Gray colln. No. 1082); Blantyre, Ndirande Mt., leaf litter in wild garden of W.N. Gray's residence (corner Chileka Road and Ndirande Ring Road), c. 1200 m, 6.viii.1983, leg./don. H.P.M.G. Menkhorst; Chiradzulu Dist., Chiradzulu, Lisau evergreen forest leaf litter, c. 1300 m, 3.i.1982, leg. H. Patel; Chiradzulu, Lisau evergreen forest leaf litter, c. 1300 m, 14.i.1982, HMM; Chiradzulu, east slope above boma, forest leaf litter, c. 1500 m, 28.vi.1982, leg. J. Chapman; Zomba Dist., Mpita Forest near Thondwe, leaf litter, c. 1000 m, 23.x.1981, leg. J. Chapman (topotype!); Zomba-Namitembo road, Namitembo River, riverine forest litter, c. 1000 m, 24.iv.1984, HMM; Zomba Plateau, leaf litter near Ku Chawe Inn, c. 1400 m, 4.viii.1983, leg./don. H.P.M.G. Menkhorst; Zomba Plateau, Mulunguzi River bridge, evergreen forest leaf litter, c. 1000 m, 23.x.1981, leg. J. Chapman; Zomba Plateau, Mulunguzi River bridge, evergreen forest leaf litter, c. 1000 m, 15.ix.1986-25.iii.1987, leg. P. Kamkodo; Zomba Plateau, Mulunguzi River bridge, *Newtonia* riverine forest leaf litter, c. 1000 m, 22.iii.1986, HMM; Zomba, forest road, mbawa (*Khaya nyasica*) gully, forest leaf litter, c. 1100 m, 31.iii.1986, HMM; Zomba, Naisi forest road, deep gully, riverine forest leaf litter, c. 1100 m, i.1986, HMM; Zomba, forest road *Ficus* gully leaf litter, c. 1100 m, 10.viii.1986, HMM; Machinga Dist., Chikala Mt., saddle west side, evergreen forest leaf litter, c. 1100 m, 2.xii.1982, leg. H. Patel; Nkhata Bay Dist., South Viphya, Lichelemu River, transitional forest leaf litter, c. 1250 m, 6.vi.1986, HMM (here syntopic with *G. proxima* n. sp.); Mwenitete Farm on S. side of Mzuzu-Nkhata Bay road, riverine forest leaf litter, c. 1100 m, 20.ix.1983, HMM; Kaningina Forest Reserve, off Nkhata Bay road, riverine transitional forest leaf litter, c. 1400 m, 5.vi.1986, HMM; riverine forest c. 10 km [6 miles] east of Mzuzu on Nkhata Bay road, leaf litter, c. 1100 m, vii.1981, HMM.

The southern districts of Thyolo and Mulanje have been

fairly intensely sampled and many localities are close together. The above enumeration is roughly from south to north. However, the Thyolo and Mulanje district records are shown per district rather than strictly from south to north. Notate bene, the name of the district is only shown once for the first record from that district.

The original description (Van Bruggen, 2011: 854) states "Umbilicus slightly open and slit-like." In fact, the umbilicus is noticeably open (Fig. 7) and this obviously is a more or less overlooked specific character. Also, looking into the umbilicus, it gives the impression of a somewhat oblique columella.

Shell measurements of all shells throughout Malaŵi (inclusive of the type series) may now be summarized as follows: 2.3-3.1×1.2-1.4 mm, l/d 1.77-2.30, whorls 5-<6. The l/d values do seem to vary a lot: mean l/d 2.03, average l/d (44 specimens measured) 2.02 – i.e., normally the shell is roughly twice as high as wide. Incidentally, the full extent of variation is sometimes found in a single sample. The smallest and largest shells of a sample of four (Mt. Mulanje, Litchenya Forest Reserve, Mabuka, forest leaf litter, c. 550 m, 11.iv.1987, HMM) measure 2.4 × 1.3 mm, l/d 1.77, 5 whorls, and 2.9 × 1.2 mm, l/d 2.30, 5 ½ whorls.

Obviously, formation of definitive apertural dentition is an ongoing process of deposition of shell material until the labral development is arrested by proper reflection of the lip. Therefore apertural dentition may not be complete in subadult shells. Sometimes the labral complex shows a pronounced lower cusp, suggesting an extra denticle to the right of the right basal denticle, leading to interpretation of the apertural dentition as 7-fold. A series (Namitembo R., 24.iv.1984) has the right basal process sometimes hardly developed (5-fold dentition!); these are all smallish shells. A large shell, 3.1 × 1.3 mm with less than 5 ¾ whorls (Mbawa gully, 31.iii.1986), has the right hand labral process hardly developed, resulting in a 5-fold dentition. On the other hand, a small shell, 2.4 × 1.3 mm with 5 whorls (Mabuka riverine forest, 25.i.1986), already exhibits a fully developed set of apertural dentition (5-fold). Figs 5-6 depict a typical specimen from Mt. Soche with fully developed apertural dentition.

The specimen from the W.N. Gray collection (Ndirande

Mt.) carries a note reading "animal pink/orange".

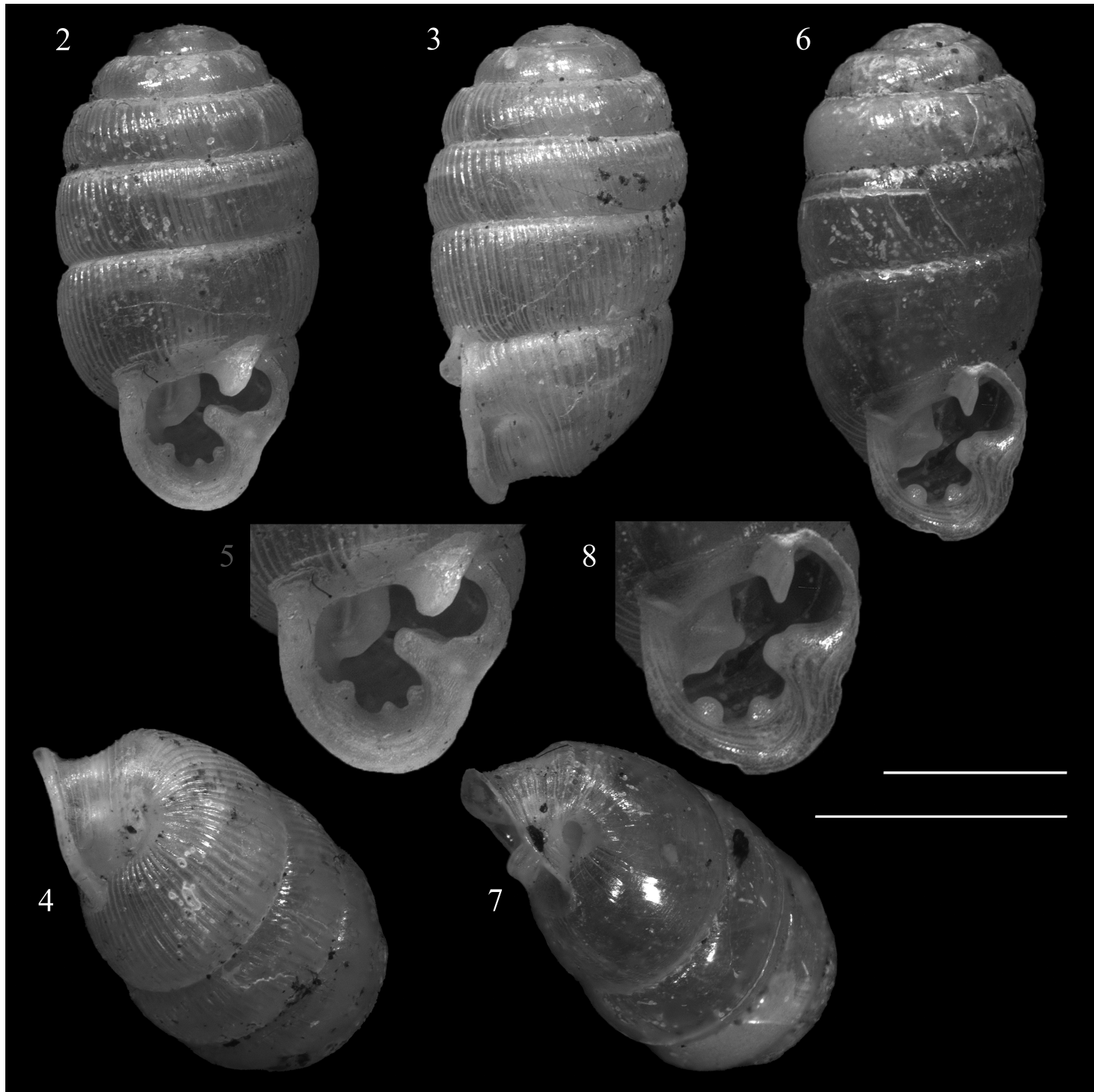
As regards distribution (Fig. 9: diamonds), it now appears that *G. menkhorsti* occurs throughout much of southern and central Malaŵi from the deep south (Thyolo Dist.) to the central-north part of the country (Nkhata Bay Dist.), although there are no records from the forests on the Nyika Plateau, which is remarkable. Many of the forests on this plateau have been sampled but so far this taxon has not been found there. There are a few other examples of such a type of distribution, e.g., *Ptychotrema (Parennea) pervagatum* Van Bruggen, 1989 (vide Van Bruggen, 1989: 15, 21 and fig. 19). Of course, the Nyika Plateau is characterized by major height and possibly also vegetation differences. As the map shows, there is also a considerable gap between the southern tip of Lake Malaŵi and the Mzuzu area. Is this due to a dearth of collectors or is there another reason for absence here? Hypsometric distribution is 550-1750 m.

The distribution in Malaŵi suggests a wider range outside this country and it is confidently forecasted to occur in adjoining areas in central Mozambique and south-western Tanzania, and perhaps also in eastern Zambia.

A NEW SPECIES OF *GULELLA* WITH A SHELL
SEEMINGLY SIMILAR TO THAT OF *G. MENKHORSTI*

The few available specimens of what at first sight was called a 'costulate form of *G. menkhorsti*' (sorting number *Gulella* VIIa, i.e. considered to be close to *Gulella* VII = *G. menkhorsti*), at second sight are easily discriminated from shells of this taxon. The whorls are finely and closely costulate. *G. menkhorsti* shells do not show costulation on the whorls; at most the suture is (sub)crenellate and, as in many species with a smooth shell, there are a few incassate growth lines behind the labrum which may be interpreted as riblets. As regards other characters such as shell measurements, shell shape, umbilicus, and finer details of apertural dentition, there appears to be little overlap between both forms.

A warning should be sounded here: seeming similarity in some shell characters does not necessarily reflect relationship. Detailed data suggest a clear-cut separation between the two forms, reason why the costulate form is now for-



mally recognized as a distinct species.

The new taxon is obviously restricted to the north and has so far only been recorded in Malaŵi northward from about Mzuzu (Fig. 9: daisies).

Gulella proxima spec. nov. (Figs 2-5, 9)

Material examined (all in RMNH; see fig. 9: daisies). – Malaŵi, Nkhata Bay Dist., South Viphya, Lichelemu River near Cobbs Falls, south bank riverine thicket leaf litter, c. 1250 m, 6.vi.1986, HMM (paratype, RMNH 329334); South Viphya, Lichelemu River near Cobbs Falls, south bank transitional leaf litter, c. 1250 m, 6.vi.1986, HMM (paratype, RMNH 329335) (here syntopic with *G. menkhorsti*); Mzimba Dist., Roseveare garden near Mzuzu, riverine forest leaf litter, c. 1300 m, 10.vi.1984, HMM (holotype, RMNH 329333, figs 2-5); Lunyangwa Forest Reserve, riverine forest leaf litter, c. 1300 m, 3.vi.1986, HMM (paratype, RMNH 329336); Chitipa Dist., Misuku Hills, Wilindi, evergreen forest leaf litter, 1700-1900 m, 19.ix.1983, HMM (1 damaged shell + 1 juv., both excluded from type series).

Diagnosis. – A species of *Gulella* s.l. characterized by a small (<3 mm), costulate shell with six-fold apertural dentition consisting of angular lamella, labral complex, two basal processes, a lower columellar process and a columellar process.

Description. – Shell (Figs 2-5) comparatively small (<3 mm), subcylindrical, greatest width about the middle, about twice as long as wide, transparent when fresh to whitish opaque when worn. Umbilicus closed (Fig. 4). Spire produced, sides parallel to at most subparallel, hardly convex, apex flattened, obtusely conical to mamillate, embryonal shell smooth or slightly pitted. Whorls five to just less than six, post-embryonic whorls more or less convex, finely and

Figs 2-8. *Gulella* spec. in Malaŵi. 2-5, *Gulella proxima* spec. nov., holotype, Mzimba Dist., Roseveare garden near Mzuzu, riverine forest leaf litter, length 2.7 mm (RMNH 329333); 6-8, *G. menkhorsti* Van Bruggen, 2011, Mt. Soche, 15.ix.1983 (RMNH), length 2.8 mm. Scale bars 1.0 mm; large scale bar refers to figs 5 and 8, smaller scale bar refers to figs 2-4 and 6-7. Photos by Dr A.J. de Winter, composition of plate by Ms Sancia van der Meij.

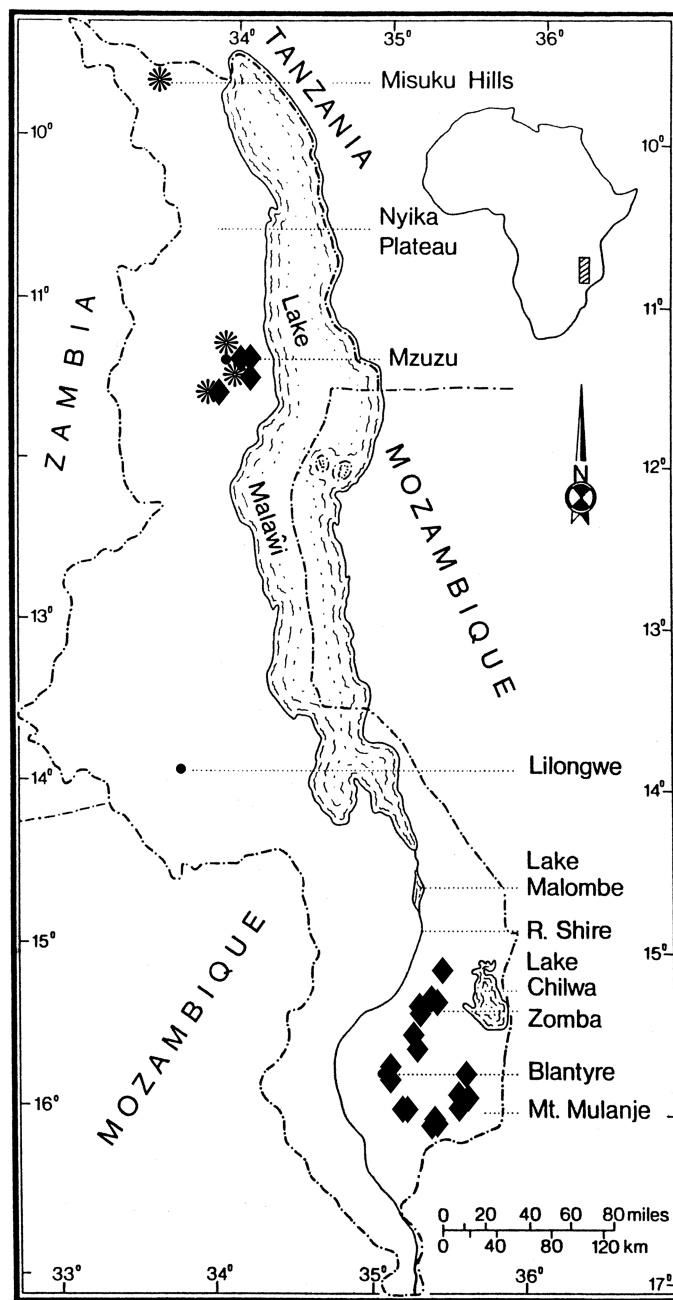


Fig. 9. Map of Malaŵi showing known distribution of *Gulella menkhorsti* Van Bruggen, 2011 (diamonds) and of *G. proxima* spec. nov. (daisies). Map by Ms Sancia van der Meij.

length × maj. diam.	l/d	number of whorls	locality in Malaŵi	specimen
2.7 × 1.3 mm	2	5 ½	Lichelemu R., riverine thicket	paratype RMNH 329334
2.7 × 1.4 mm	1.91	5 ½	Roseveare gardens near Mzuzu	holotype RMNH 329333, Figs 2-5
2.8 × 1.3 mm	2.14	5 ¼	Lunyangwa Forest Reserve	paratype RMNH 329336
2.8 × 1.3 mm	2.05	5 ½	Lichelemu R., transitional forest	paratype RMNH 329335

Table 1. Metric data of the type series (i.e., all available adult shells) of *Gulella proxima* spec. nov.

densely costulate, interstices narrower than costulae. Sutures impressed, fairly shallow, crenellate. Aperture (Fig. 5) subovate to triangular, slightly wider than high or equally high and wide, peristome incrassate and reflected, aperture fairly open but somewhat obstructed by a six-fold dentition: a strong, prominent, almost perpendicular inrunning, angular lamella on the right of the paries; a large labral complex, just above the middle of the labrum, stretching far into the aperture (but in front view not touching the columellar complex), corresponding to a noticeable depression behind the labrum, forming a very large sinus with the angular lamella; two squarish or triangular basal processes, fairly deeply situated, one right-basal, and one mid-basal; a slightly larger, columellar process, fairly deeply situated; a fairly large, deeply situated lower columellar process, in front view leaving a little space between the labral and columellar complexes. There is no juvenile apertural dentition.

Measurements of shell: 2.7-2.8 × 1.3-1.4 mm, l/d 1.91-2.15, whorls 5 ¼-5 ½ (n = 4, see table 1).

Animal. – Unknown.

Distribution. – Malaŵi, northward from about Mzuzu (see Fig. 9: daisies).

Ecology. – All specimens are derived from forest leaf litter. Hypsometrical distribution is 1250-1900 m.

Derivatio nominis. – The name, an adjective, is based on the Latin adjective *proximus* = closest, nearest, next-door, and refers to the superficial similarity of the shell of the new taxon to that of *G. menkhorsti* and also to the fact that both species are at least occasionally syntopic.

Discussion. – With regard to density of ribbing, in front view the holotype shell exhibits about 32 costulae on the

body whorl. The aperture of this specimen measures (height × width) 0.8 × 0.9 mm. The body whorl in front view is slightly larger than half the total length of the shell.

The apertural dentition of *G. menkhorsti* is in so far different that in this taxon the lower columellar process is not present and the main columellar process is composed of a main process with an inrunning lamella. Only one juvenile shell of *G. proxima* is available (Misuku Hills, Wilindi); this specimen does not exhibit juvenile dentition.

A further difference is that the sutures in *G. proxima* are impressed, while those of *G. menkhorsti* are less impressed or hardly show this phenomenon. However, this is difficult to quantify. Also, there seem to be differences in body colour of the live animal – this is suggested by dried remains inside the shell.

In view of the distribution of *G. proxima* occurrence in suitable localities in adjoining areas in Tanzania and Zambia is to be expected.

The first two localities are very close together [co-ordinates WC 995084]. According to the field notes of Hazel Meredith the south bank riverine thicket and the north bank transitional forest of the Lichelemu River both were sampled on 6.VI.1986. *Gulella menkhorsti* was found in both leaf litter samples, *G. proxima* only in the first one.

As regards taxa with similar shells, these are few and far between. The combination of characters of the new species (small size, costulate sculpture, apertural dentition with two columellar processes), again, is unique among *Gulella* s.l. Slight similarity, such as with *G. menkhorsti*, is met with here and there in this part of Africa. For instance, *G. albinus* Van Bruggen & Van Goethem, 1999 (Upemba National Park,

south-eastern D.R. Congo) is within the size range and has an apertural dentition somewhat similar to that of *G. proxima*, but it is only weakly costulate and differs in considerable detail as regards the aperture and its dentition.

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