FOUR NEW SPECIES OF STREPTAXIDAE FROM MFAMOSING LIMESTONE HILLS IN SOUTHEASTERN NIGERIA

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Abstract *Four new species of Streptaxidae (Mollusca, Gastropoda Pulmonata) are described from the threatened limestone hills in Mfamosing, Cross River State, southeastern Nigeria. The described species are* Costigulella mfamosingi, Gulella odietei, G. ogbeifuni, and G. (Conogulella) egborgei.

Key words *Mollusca, Streptaxidae,* Gulella, Costigulella, Conogulella, *Nigeria*

INTRODUCTION

Limestone hills (karsts) renowned for their rich molluscan diversity and high level of endemism (Clements *et al*., 2006) are often under threat of commercial exploitation for cement and other industrial uses. Most of the few limestone hills in West Africa are found in the Calabar region of Mfamosing and Odukpani (Reijers, 1998). In the rainy season of 2009 and 2010, the author and students collected land molluscs from the limestone hills in Mfamosing, Cross River State, Nigeria. Analyses of the samples and searching through the relevant literature of West African snails, revealed that some of the species are new and are herein described. Paratypes will be distributed to the collections of the National Museum of Wales, Cardiff, UK and Museum of Natural History, Leiden, the Netherlands. Drawings have been made with the aid of a Wild M8 stereo microscope with a camera lucida device. All the species were collected from litter and soil on limestone hills in Mfamosing.

ABBREVIATIONS

H	shell height;
D	shell width;
H/D	shell height:shell width ratio;
W	number of whorls. For collection: UNIBEN, Zoological Museum, Department of Animal and Environmental Biology, University of Benin, Benin City, Nigeria.

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SYSTEMATICS

Family Streptaxidae Gray 1860

Genus ***Costigulella*** Pilsbry 1919

Costigulella mfamosingi sp. nov. (Fig. 1)

Holotype Dry shell held at Zoological Museum, UNIBEN 2010–01).

Type locality Mfamosing limestone hills (05° 04' 42.9" N, 08° 30' 05.5"E, elevation 37 m) 22.vi.2010. C.O. Oke.

Figure 1 *Costigulella mfamosingi* sp. nov. from Mfamosing limestone hills, Nigeria. Shell height 3.03 mm.

Paratypes Dry shells held at Zoological Museum, UNIBEN 2010–02), 14 adults, 1 juvenile shell, (05° 04' 45.9" N, 08° 30 02.3 E, elevation 27 m), 22.iv.2010.

Diagnosis A small species of *Costigulella* with shell H×D=3.03–3.48 mm×1.94–2.26 mm, whorls 4–4½, with an inverted apex and aperture with six denticles; a large inrunning angular lamella, an obliquely descending palatal fold, a small basal denticle, an upper outer columellar process, a deeply situated lower columellar denticle and a tiny parietal denticle left to the angular lamella.

Description (shell) Adult shell small, subcylindrical (H = 3.03–3.48 mm, mean 3.26 mm ± 0.14; D = 1.94–2.26 mm, mean 2.11 ± 0.09, N=11), transparent when fresh, umbilicus closed, with 4–4½ convex whorls. Shell width greatest at last whorl. Embryonic shell (W=1–1¼, diameter 0.32 mm): apex obtuse, slightly concave, the first half of the apex smooth, the rest with widely spaced oblique riblets (approx. 7). Lower whorls with distinct, regularly spaced slightly oblique and straight costulae, with approximately 5 per mm on the last whorl. Interstices much wider than costulae and with very fine, regularly spaced spiral threads. Suture crenulate. Aperture more or less quadrate, peristome dilated, with six denticles – a large, deep inrunning, slightly curved angular lamella which is biramous in front, an obliquely descending inrunning palatal tooth which corresponds to a noticeable outside depression behind outer lip, a deeply set small basal denticle, a fairly large incrassate, upper and outer columellar process that extends from the columellar margin to the inner surface of the middle of the columella, a deeply situated concave lower columellar denticle and a tiny parietal tubercle left of the angular lamella. Between the angular lamella and the palatal fold is a well formed sinulus.

Etymology The new species is named after its type locality, Mfamosing.

Remarks The subgeneric "section" *Costigulella* Pilsbry 1919 was raised to generic level by Winter (2008) after a revision of the group. The new species is similar to the previously described species of *Costigulella* in having the initial half of the embryonic whorl smooth while the rest is vertically ribbed (Pilsbry, 1919; Degner, 1934; Ortiz de Zarate Lopez & Ortiz de Zarate Rocandio, 1955; Adam, 1984; Winter, 2008). It differs from all previously described species on account of its size, apex and apertural dentition. It is similar in size only to *G. langi* Pilsbry 1919 and *G. pooensis* (Ortiz de Zarate Lopez & Ortiz de Zarate Rocandio 1955) which are above 3.00 mm, but differs from *G. hedwigae* Degner 1934, *G. kazibae* Adam 1984, and *C. primennilus* Winter 2008 which are very minute, being less than 2.5 mm. The inverted shape of the apex distinguishes the new species from all previously described species. In addition, *C. mfamosingi* differs from previously described species on account of the apertural dentition. The presence of the large inner columellar process and the tiny parietal tubercle, together with the absence of the subcolumellar tubercle within the baso-columellar curve in the new species separate it from all previously described species (Pilsbry, 1919; Degner, 1934; Ortiz de Zarate Lopez & Ortiz de Zarate Rocandio, 1955; Adam, 1984 and Winter, 2008).

Genus *Gulella* Pfeiffer 1856

Gulella odietei sp. nov.
(Figs 2–3)

Holotype Dry shell held at Zoological Museum, UNIBEN, 2010–03.

Type locality Mfamosing limestone hills (05° 04' 42.9" N, 08° 30' 05.5" E, elevation 37 m, 05° 04' 45.9" N, 08° 30' 02.3" E elevation 27 m), 22–23. vi.2010. C.O. Oke.

Paratypes Dry shells held at Zoological Museum, UNIBEN, 2010–04, 16 adults.

Diagnosis A small, subcylindriform, costulate species of *Gulella* with the first 1½ embryonic whorls smooth, others with fine, regular costulae; lower whorls with strong, widely spaced costulae. Aperture with seven-fold dentition consisting of an angular lamella, two palatal denticles, a basal denticle, two columellar processes and a parietal denticle to the left of the angular lamella.

Description Shell small, subcylindrical, translucent, whitish, H=4.06–4.90 mm, mean 4.41 ± 0.23, D=2.39–258 mm, mean 2.52 ± 0.06 (N=16). Whorls 6–6½, convex, widest at penultimate whorl. The first 1½ embryonic whorl more or less smooth, the remaining embryonic whorls

Figure 2 *Gulella odietei* sp. nov., Mfamosing limestone hills, Nigeria. Shell height 4.06 mm.

Figure 3 *Gulella odietei* sp. nov., side view.

with fine, close-set, regular, costulae. Lower whorls with strong, oblique and not too regular, costulae, 5 per mm on the last whorl. Interstices more or less smooth, wider than the ribs. Suture crenulate. Aperture quadrate, with seven-fold dentition consisting of an angular lamella, two labral processes on a common base (which correspond to a deep, long depression behind the shell), a basal tubercle, two columellar processes, the upper being much larger and deep entering, and a parietal denticle to the left of the angular lamella. Between the angular lamella and the upper palatal fold is a conspicuous sinulus.

Etymology The new species is named after Prof. W. O. Odiete, University of Lagos, for his contribution to malacology in Nigeria.

Remarks The new species is similar in shape to *G. (Gulella) lamyi* Dautzenberg & Germain 1914 and *G. (Gulella) mikenoensis* Preston 1913 but differs on account of its apertural dentition. The presence of the parietal denticle and well developed lower columellar processes distinguish the new species from other species described under the subsection *Gulella* by Pilsbry (1919) and Bruggen & Van Goethem (1997). The strong costulae and apertural dentition also separate it from *G. decussatula* Preston 1913 and *G. haullevillei* Dautzenberg & Germain 1914.

Gulella ogbeifuni sp. nov.
(Fig. 4)

Holotype Dry shell held at the Zoological Museum, UNIBEN 2010–06.

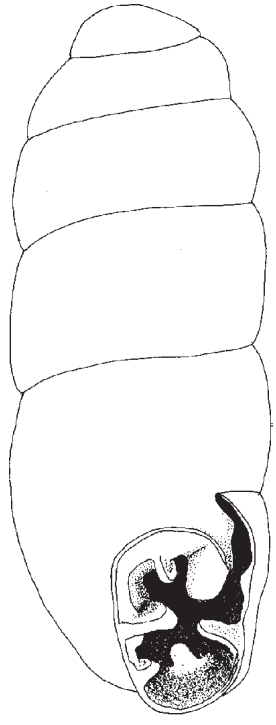

Figure 4 *Gulella ogbeifuni* spec. nov. holotype (UNIBEN). Shell height 2.71 mm.

Type locality Mfamosing limestone hills (05° 04' 42.9" N, 08° 30' 05.5" E, elevation 37 m), 22-VI-2010, found under leaf litter, Theophilus Ogbeifun.

Paratype Held at the Zoological Museum, UNIBEN 2010–07, 1 adult shell.

Diagnosis A small, cylindrical species of *Gulella* with seven-fold apertural dentition: a strong angular lamella, two palatal denticles, the upper being a small tubercle, the lower prominent, a basal denticle, two columellar folds, the upper being more developed and a parietal denticle left of the angular lamella.

Description Shell H=2.65–2.71 mm×W=0.97 mm, spire elongate, narrow, tapering to a rounded summit. Whorls 5, fairly convex to straight, suture impressed. Sculptured with faint microscopic oblique growth lines. Apex smooth. Aperture ovate, greatly obstructed by seven-fold dentition; a strong inrunning angular lamella, a tiny upper palatal tubercle near the peristome with a conspicuous sinulus, a deep-inrunning lower palatal fold, a basal denticle, a lower columellar fold close the peristome, a deep-inrunning upper columellar fold and a small parietal fold left to the angular lamella. There is a conspicuous sinulus between the angular lamella and the upper palatal tubercle.

Etymology The new species was named after its collector, Theophilus Ogbeifun, a student of the Department of Animal and Environmental Biology, University of Benin, Benin City, Nigeria.

Remarks The new species is similar in size and shape to *G. kuiperi* de Winter 2006, *G. mongolae* Ortiz de Zarate Lopez & Ortiz de Zarate Rocandio 1955, and *G. stolidodea* Degner 1934 with respect to its narrow, tapering spire, absence of a pit-like depression on the back of the shell and some aspects of its apertural dentition. The presence of the parietal fold left of the angular lamella in the new species clearly separates it from all the above-mentioned species. In addition, the two separate (unfused) columellar denticles and the absence of the transverse palatal plica in the new species separate it from *G. kuiperi*. The new species is similar to *G.* (*Silvigulella*) *osborni* only on account of the smooth apex and narrow, tapering spire. The strong costulae in *G. osborni* makes it difficult to place the new species within the subgenus *Silvigulella*.

Subgenus *Conogulella* Pilsbry 1919

Gulella (Conogulella) egborgei sp. nov.
(Figs 5–6)

Holotype Dry shell held at the Zoological Museum, UNIBEN 2010–05.

Type locality Mfamosing limestone hill (05° 04' 42.9" N, 08° 30' 05.5" E, elevation 37 m), 22-VI-2010, found under leaf litter, C.O. Oke, no paratypes.

Diagnosis A small, obovate, costulate species of *Gulella*, apex with spiral sculpture, lower whorls with close-set, regular costulae; aperture with nearly complete peristome with six-fold dentition consisting of a strong, sinuous deep-entering angular lamella, an outer palatal tooth, an inner obliquely descending palatal fold, a deeply set basal tooth, two columellar processes, an outer columellar fold and an inner columellar denticle.

Figure 5 *Gulella (Conogulella) egborgei* sp. nov., leaf litter, Mfamosing limestone hills, Nigeria. Shell height 5.61 mm.

Figure 6 *Gulella (Conogulella) egborgei* sp. nov., side view.

Description Shell small (H 5.61 mm×W 3.35 mm), of 7 whorls, ovate with apex tapering to a rounded summit. Surface of apical whorls (first 2 ½ whorls) as viewed under a light microscope (x 40 magnification) finely, spirally striate. First half whorl is smooth, others with four spiral threads. The surface of subsequent whorls with curved, regular, close-set costulae (ribs). Peristome more or less quadrate, somewhat laterally constricted, nearly complete, reflected. Aperture with six-fold dentition: a strong sinuous, deep-entering angular lamella, which projects a little out of the aperture when viewed from the side; a weak palatal swelling or tooth, set behind the peristome; an inner large, obliquely descending palatal fold (corresponding to the depression behind the peristome on the palatal side of the body whorl); a deeply-set basal tooth; a strong outer columellar tooth (corresponding to the depression on the columellar side of the body whorl) and an inner, deeply situated columellar fold.

Etymology The new species is named after late Prof A.B.M. Egborge, University of Benin for this contribution to biodiversity studies in Nigeria and for establishing the Zoological Museum, University of Benin, Benin City, Nigeria.

Remarks The new species is similar to *G. conospira* von Martens 1892 on account of its spiral apical sculpture which justifies its placement in the *Conogulella* but differs from it on account of its apertural dentition. The new species also differs from *G. opoboensis* Preston, sometimes treated in *Conogulella* on account of its apertural dentition. The quadrate aperture, the strong sinuous angular lamella, the palatal and columellar folds clearly separates the new species from the latter.

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