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Authors: Lygre, Frøydis, Kongsrud, Jon Anders, and Schander, Christoffer

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Four new species of *Turbonilla* (Gastropoda, Pyramidellimorpha, Turbonillidae) from the Gulf of Guinea, West Africa

Frøydis Lygre[1,2], Jon Anders Kongsrud[1] and **Christoffer Schander[1,2,3]***

[1]Bergen Museum, University of Bergen, Natural History Collections, P.O. Box 7800, 5020 Bergen; Froydis.Lygre@student.uib.no

[2]University of Bergen, Department of Biology, P.O. Box 7800, 5020 Bergen, Norway; Jon.Kongsrud@bio.uib.no

[3]Centre for Geobiology, University of Bergen, Allégaten 41, 5020 Bergen, Norway, and Uni Research AS, P.O. Box 7810, 5020 Bergen, Norway; Christoffer.Schander@bio.uib.no

*Corresponding author

ABSTRACT

Four new species of Pyramidellid gastropods, *Turbonilla nanseni*, *T. willasseni*, *T. halanychi* and *T. hoeisaeteri* are described from the Gulf of Guinea, West Africa, based on shell morphology. The descriptions are a part of an ongoing project describing the pyramidellid fauna of the area, and it is clear that the region hosts a large pyramidellid diversity and additional species of pyramidellids are to be expected. The recent usage of the genus *Turbonilla* is discussed.

KEY WORDS: Gastropoda, Heterostropha, new species, distribution, Atlantic, Gulf of Guinea, GCLME.

INTRODUCTION

Pyramidellimorpha is a large taxon of parasitic gastropods, comprising more than 6000 species divided into more than 350 genera (Schander *et al*. 1999*a*). In addition to a number of studies at the beginning of the 20th century (e.g. Dautzenberg & Fisher 1906; Dautzenberg 1910, 1912, 1913*a*, *b*) the pyramidellid fauna of Europe and West Africa has been intensively studied in recent years (e.g. van Aartsen *et al*. 1998, 2000; Lygre & Schander 2010; Peñas & Rolán 1997, 1998, 1999, 2002; Peñas *et al*. 1999; Schander 1994; Schander *et al*. 1999*b*). Numerous new species have been described from the area, but a large number still remains to be described. New studies also indicate that present knowledge about distribution is incomplete. The present paper describes four new species of pyramidellids from the West African coast.

The Gulf of Guinea has a great variety of marine habitats, which may explain the great diversity of pyramidellid gastropods. The humid tropical climate of the Gulf of Guinea, with its complex hydrographic dynamics, is dominated by seasonal upwelling, warm and low saline surface water and surface and subsurface zonal currents (Hardman-Mountford & McGlade 2003, MacGlade *et al*. 2002). The eastward-flowing Guinea Current transports low-salinity warm water (Binet & Marchal 1993), favouring upwelling during its summer intensification (Philander 1979). The major upwelling season extends from July to September along the northern coast (Ivory Coast, Ghana, Togo and Benin) and from June to September on the east coast (off southern Gabon to Angola). A minor upwelling season also occurs in December–January (Longhurst 1962; Philander 1979, Verstraete 1992).

The nomenclature and phylogenetic position of the Pyramidellidae is confused. Pimenta & Absalão (2004) and Pimenta *et al*. (2009) point out that most of the over 300 supraspecific taxa of the Pyramidellidae (Schander *et al.* 1999*a*, Schander *et al.* 2003) are poorly defined, and that an absence of general consensus about the definitions and

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boundaries of the genera and subgenera contributes to a much confused taxonomy. It has been necessary for most recent authors to shoehorn species into the "supertaxa" *Odostomia*, *Chrysallida*, and *Turbonilla* without any consideration of phylogenetic context. An alternative strategy has been to erect new genera without regard for already existing ones, with the risk of introducing junior synonyms. Our placement of species in *Turbonilla*, should be considered provisional, awaiting a revision of the taxon.

It is not ideal to describe new taxa from shells alone, but this is common practice since in most cases only the shells are known. It has been shown that shell characters in gastropod phylogeny reconstructions are no more prone to homoplasies than are other types of morphological characters (Schander & Sundberg 2001). For identification purposes it would have been ideal to been able to provide DNA barcodes (e.g. Schander & Willassen 2005, Järnegren *et al*. 2007, Mikkelsen *et al.* 2007) for the species described here. But none of these species has so far been found alive.

So far only a few phylogenetic studies including pyramidellids have been performed based on morphology (Wise 1996, Schander *et al*. 1999*b*) or using molecular methods (e.g. Schander *et al*. 2003, Dinapoli & Klussmann-Kolb 2010, Dinapoli *et al*. 2011). Unfortunately, these analyses suffer from either using too little genetic information or include few and poorly identified terminal taxa, rendering them less useful. Few of the taxa included overlap in the morphological and molecular analyses, preventing the use of, for example, a super-tree approach to gain further information.

Dinapoli & Klussmann-Kolb (2010) and Dinapoli *et al.* (2011) have shown that the taxon Pyramidellimorpha as used in the traditional sense (including Murchisonellidae = Ebalidae) is polyphyletic since Murchisonellidae is not the sister group to Pyramidellimorpha. We here keep the name in a restricted sense, including Amathinidae, Odostomiidae, Pyramidellidae, Syrnolidae and Turbonillidae. Cyclostremelidae described by Moore (1966) may also belong to this clade (Schander *et al*. 1999*a*).

MATERIAL AND METHODS

Material was collected in the exclusive economic zones of Nigeria, Gabon and the Republic of Congo during a cruise with R/V Dr. Fridtjof Nansen in July 2005. Thirty-five stations were sampled using a 0.1 m^2 van Veen grab at between 20 and 217 metres depth. The localities here referred to are listed in Table 1 and shown in Fig. 1. Four replicates were taken at each station. Samples were screened through sieves of mesh size 0.5 or 1 mm. Samples were fixed in 96% alcohol or in 10% borax buffered formaldehyde and were subsequently sorted under a stereo microscope at the Natural History Museum, University of Bergen.

For Scanning Electron Microscopy (SEM) images, the shells were cleaned, dried, mounted onto aluminum stubs with conductive carbon cement, and subsequently sputtered with gold-palladium alloy using a Bio-Rad SEM Coating System. Images were obtained using a Zeiss Supra VP55 microscope and were edited in Adobe Photoshop CS4 Extended.

Protoconch terminology used, is from van Aartsen (1977, 1981) and van der Linden & Eikenboom (1992).

Specimens are deposited at the Natural History Collections, Bergen Museum, University of Bergen (ZMBN). Some paratypes are deposited at the KwaZulu-Natal Museum (NMSA).

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TABLE 1
Sampling stations for material here reported.

Station no.	Country	Date	Latitude	Longitude	Depth (m)
5N13	Nigeria	14.vi.2005	04°01'N	06°58'E	65
5N15	Nigeria	20.vi.2005	04°01'N	07°58'E	64
5G2	Gabon	01.vii.2005	00°19'N	09°19'E	24
5G3	Gabon	01.vii.2005	00°05'N	09°02'E	61
5G16	Gabon	11.vii.2005	03°49'S	10°37'E	69
5CR2	Rep. of Congo	13.vii.2005	04°29'S	10°56'E	162

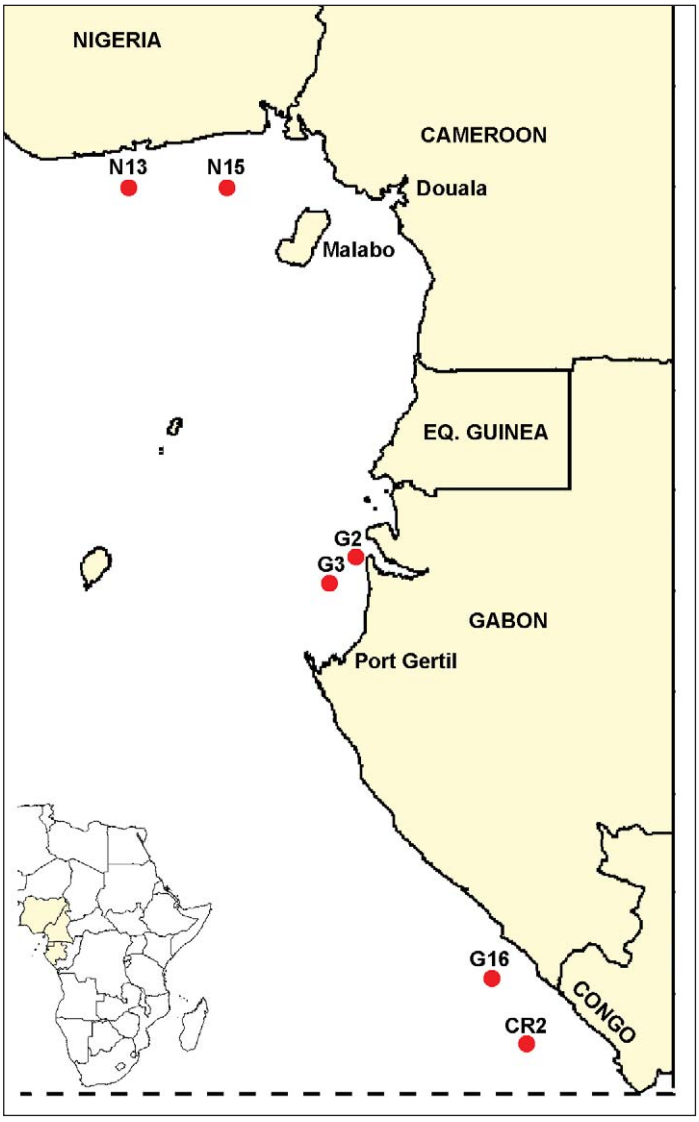


Fig. 1. Study area and sampling sites.

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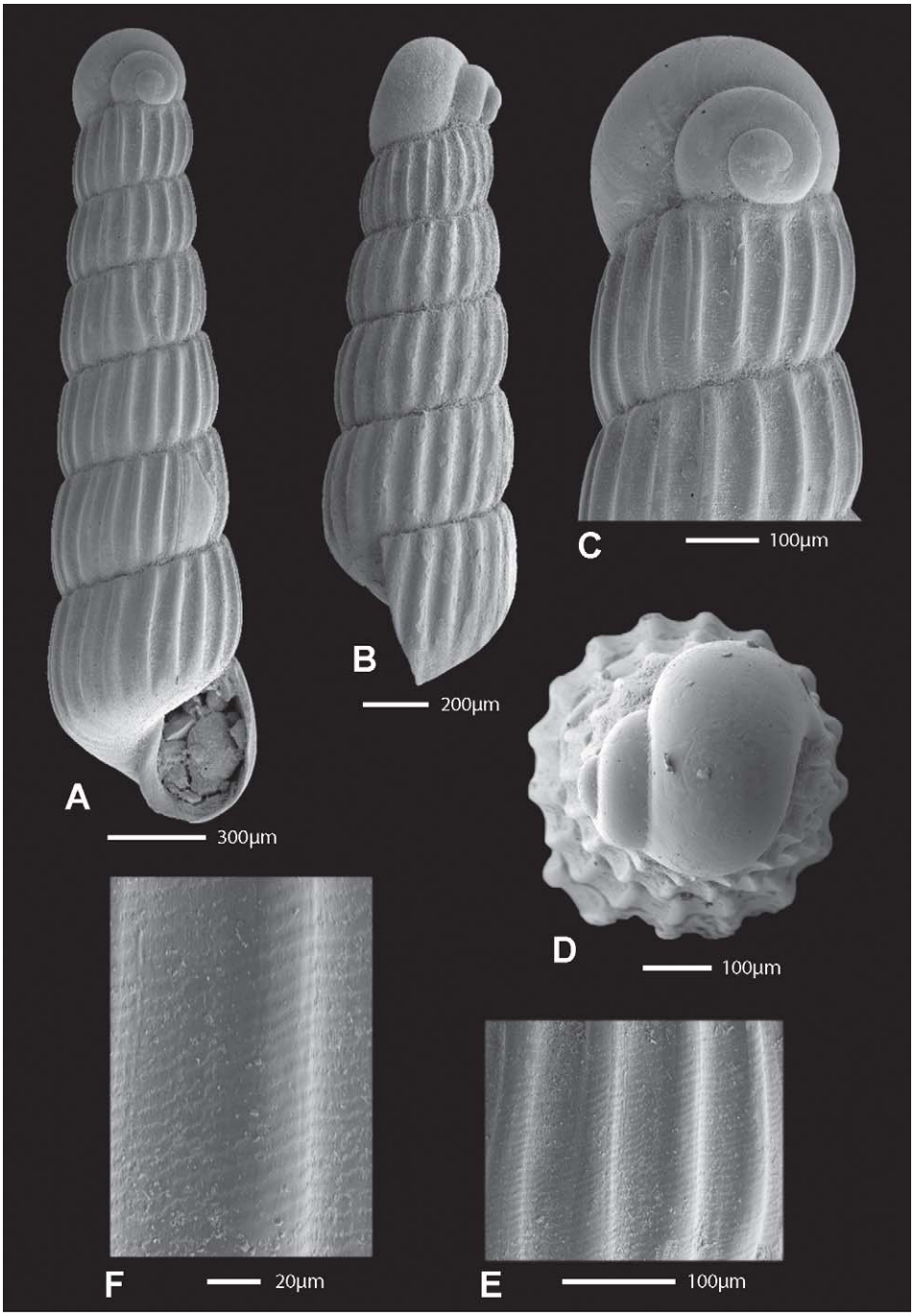


Fig. 2. *Turbonilla nanseni* sp. n.: (A) holotype; (B) paratype, teleoconch, station G16, Gabon; (C) holotype, protoconch; (D) paratype, protoconch, station G16, Gabon; (E, F) holotype, details of sculpture.

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TAXONOMY

Family Turbonillidae Bronn, 1849
Subfamily Turbonillinae Bronn, 1849
Genus *Turbonilla* Risso, 1826

Turbonilla s. l. as commonly used is doubtless a polyphyletic assemblage (Lygre & Schander 2010). Schander *et al*. (1999*a*) listed more than 40 genera in Turbonillinae. However, knowledge of most of these genera is little and the literature is confused. Therefore, we are currently unable to divide the West African species in a proper phylogenetic way, but are forced to place the new species in *Turbonilla s. l.* A similar approach was also taken by Penãs and Rolán (2010). A proper revision of the family Turbonillidae is urgently needed. There is currently no universally accepted taxonomy for the pyramidellidae. Here we follow Schander *et al*. (1999*a*), but for an alternative opinion see Bouchet *et al*. (2005).

Turbonilla nanseni sp. n.

Fig. 2

Etymology: This species is named in honour of the research vessel R/V Dr Fridtjof Nansen, used for the collection of all the material used in this study (http://www.imr.no/om_havforskningsinstituttet/fasiliteter/fartoy/dr._fridtjof_nansen/en).

Diagnosis: Tall, high spired with large protoconch, convex whorls, and strong axial ribs crossed by microstriae.

Description: Shell tall, slender, conical towards subcylindrical, milky white and shiny with rounded apex. Protoconch of type A-II, diameter 380 µm, protruding nucleus. Teleoconch whorls slightly convex. Suture incised, not deep, slightly undulating, noticeably oblique. Axial ribs not very elevated, thin, straight or slightly curved, opisthocline; closely set, broader than interspaces; disappearing at periphery of ultimate whorl. Base smooth. Microsculpture of undulating spiral striae in interspaces and on ribs. Aperture subrectangular. Inner lip slightly folded. Columellar tooth absent. No umbilicus.

Holotype: GABON: station G16, 03°49'S: 10°37'E, -69 m (ZMBN 86948). Length 2.42 mm, width 0.6247 mm.

Paratypes: Two from type locality in ZMBN (86949, 86950). One in NMSA (L8456/T2747).

Distribution: Nigeria and Gabon, -63–69 m.

Comparison: *Turbonilla fulgidula* (Jeffreys, 1884) shows some resemblance to *T. nanseni*, but the whorls are slightly straighter in this species, and it has a subsutural shelf. The axial ribs have broader interspaces and are less opisthocline. *T. pseudomarteli* Peñas & Rolán, 1997 has a subsutural shelf and broader, more diffuse axial ribs. *T. bengoensis* Peñas & Rolán, 1997 has a smaller and more submerged protoconch, the whorls are slightly straighter and the axial ribs have broader interspaces.

Turbonilla willasseni sp. n.

Fig. 3

Etymology: This species is named in honour of Dr Endre Willassen, curator of invertebrates at the Bergen Museum, who is always supportive of our work.

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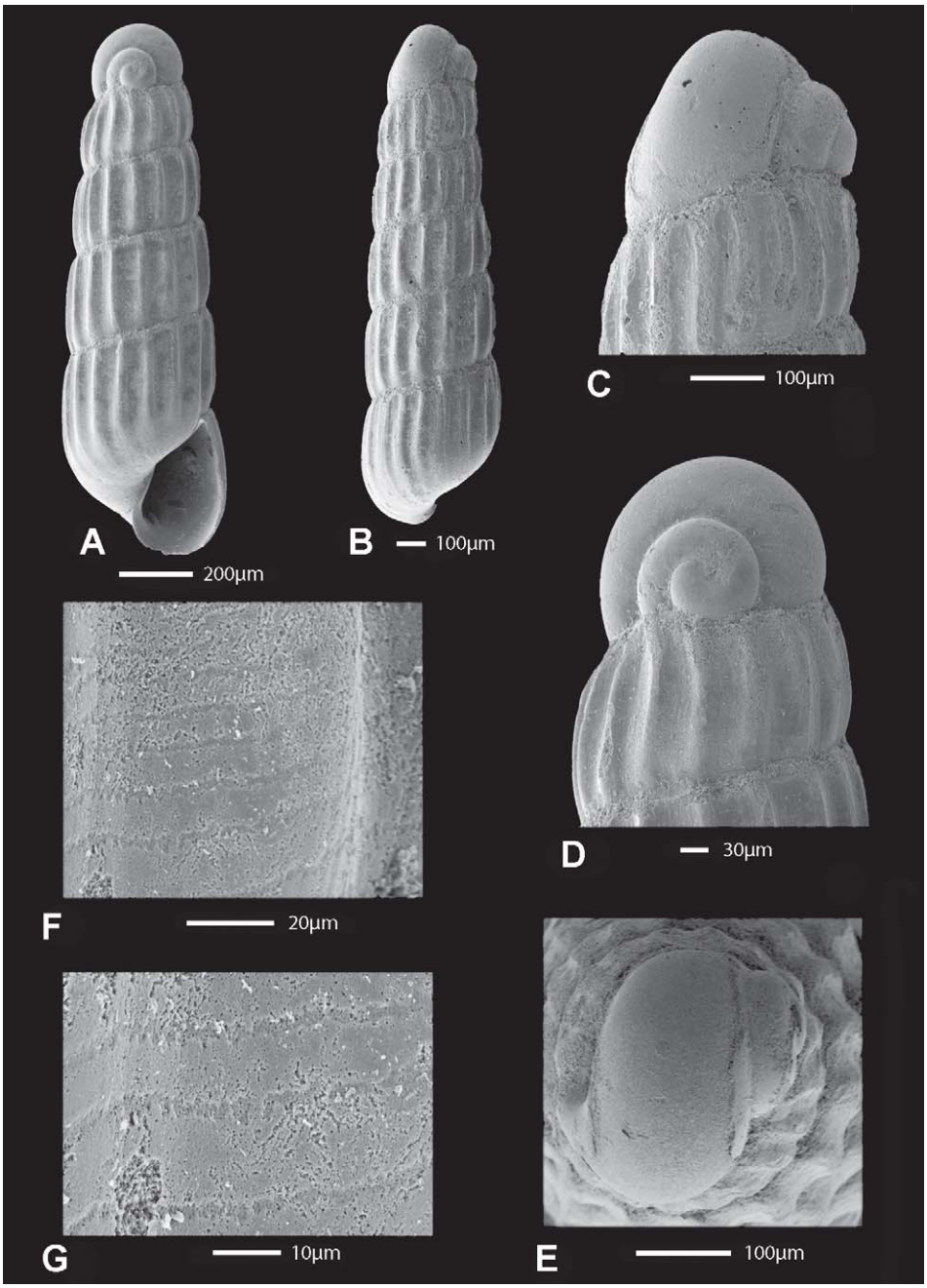


Fig. 3. *Turbonilla willaseni* sp. n.: (A) holotype; (B) paratype, teleoconch, station G2, Gabon; (C) paratype, protoconch; (D) holotype, protoconch; (E) paratype, protoconch, station G2, Gabon; (F, G) holotype, details of sculpture.

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Diagnosis: Tall, high spired with large protoconch, almost straight whorls, and, strong axial ribs crossed by microstriae.

Description: Shell small, slender, conical, white with rounded apex. Protoconch of type A-II, diameter 230 µm, semisubmerged. Whorls straight. Suture shallow. Axial ribs elevated, straight and orthocline. Axial ribs and interspaces equally broad. Ribs disappearing at periphery of ultimate whorl. Microsculpture of superficial spiral striae. Aperture oval, narrowing apically. Columellar tooth absent. No umbilicus.

Holotype: GABON: station G2, 00°19'N:09°19'E, -24 m (ZMBN 86951). Length 1.51 mm, width 0.45 mm.

Paratypes: Two from type locality in ZMBN (86952, 86953). Two in NMSA (L8457/T2748).

Distribution: Gabon and Congo, -24–162 m.

Comparison: *Turbonilla fulgidula* is similar to this species, but has a subsutural shelf and more prominent microsculpture than *T. willasseni*. The protoconch of *T. willasseni* is slightly larger than in *T. fulgidula*. A yet undescribed species also show some similarity to *T. willasseni*. However, this species has a larger, more protruding protoconch.

Turbonilla halanychi sp. n.

Fig. 4

Etymology: This species is named in honour of Dr Kenneth M. Halanych, Auburn University. A great invertebrate phylogeneticist, and a good friend.

Diagnosis: Tall, high spired with large protoconch, slightly convex whorls, and, weakly defined axial ribs crossed by microstriae.

Description: Shell tall, slender, conical or subcylindrical, white and shiny with rounded apex. Protoconch of type A-II, diameter 290 µm, semisubmerged. Whorls almost straight. Initial whorl sloping slightly to the right, giving shell a somewhat crocked appearance. Suture superficial, noticeable oblique in upper whorls. Axial ribs not much elevated, straight, orthocline or slightly opisthocline; tightly spaced, broader than interspaces. Ribs disappearing at periphery of ultimate whorl. Base smooth. Microsculpture consisting of spiral striae seen in interspaces and on ribs. Microsculpture continue on base. Aperture rhomboid. Columellar tooth absent. No umbilicus.

Holotype: NIGERIA: station N15, 04°01'N:07°58'E, -64 m (ZMBN 86954). Length 2.25 mm, width 0.55 mm.

Paratypes: Four from type locality in ZMBN (86955–86958). Three in NMSA (L8458/T2749).

Distribution: Nigeria, Gabon and Congo, -64–162 m.

Comparison: This species is similar to *T. bengoensis*, but the protoconch is slightly larger and not as submerged. The whorls are more convex and the axial ribs broader. *T. pseudomarteli* has a more globular protoconch, the axial ribs are broader and a subsutural shelf is present.

Turbonilla hoeisaeteri sp. n.

Fig. 5

Etymology: This species is named in honour of our friend Tore Høisaeter, University of Bergen. Tore is a good friend and has made many important contributions to our knowledge of gastropods in the Atlantic.

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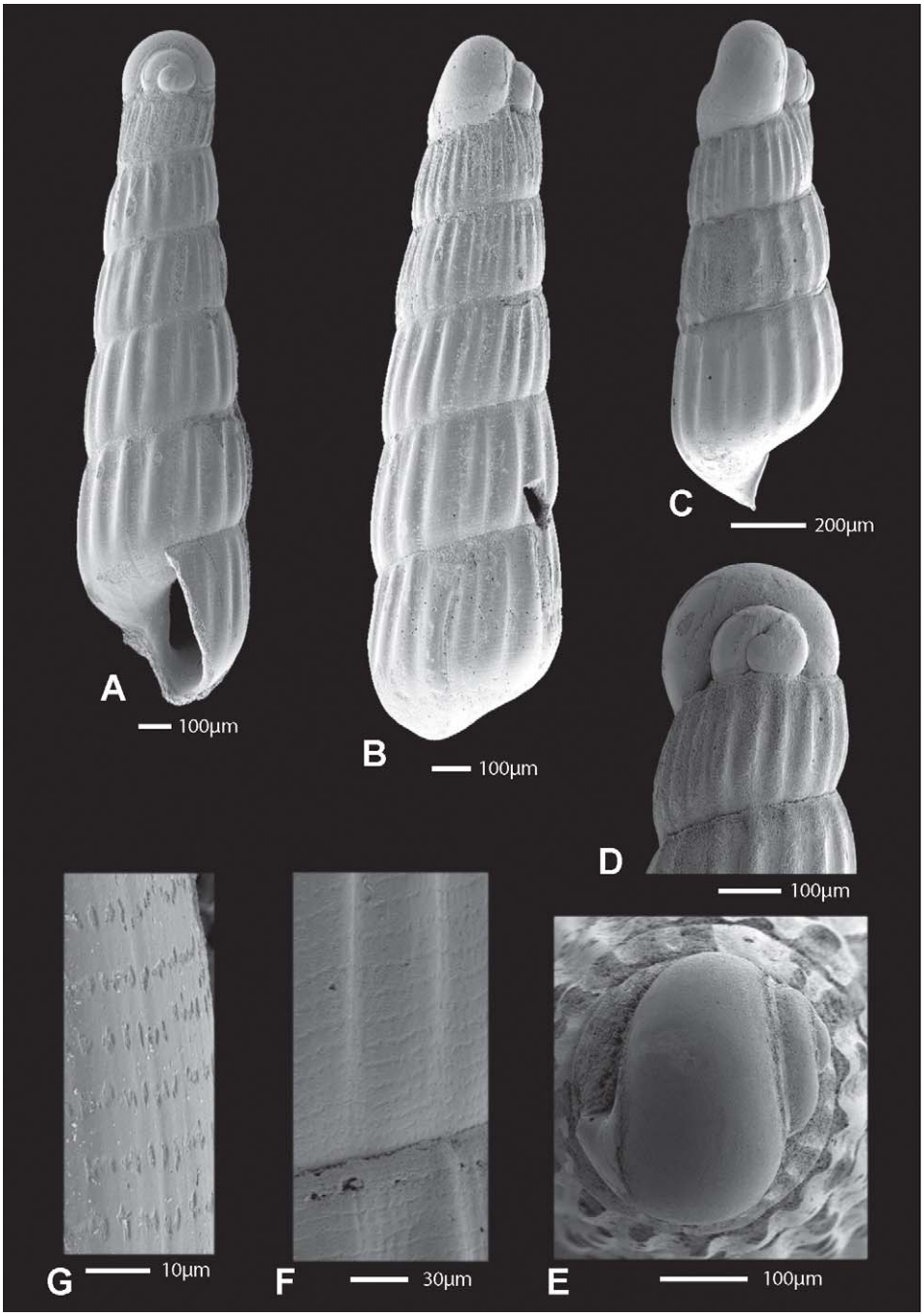


Fig. 4. *Turbonilla halanychi* sp. n.: (A) holotype; (B) paratype, teleoconch, station N15, Nigeria; (C) paratype, protoconch, station N15, Nigeria; (D, E) paratypes, protoconchs, station N15, Nigeria; (F, G) paratypes, details of sculpture, station N15, Nigeria.

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Diagnosis: Tall, high spired with large protoconch, clearly convex whorls, and, strong axial ribs with well developed striae present in the interspaces.

Description: Shell very small, slender, conical, white and shiny with rounded apex. A diffuse coloured band in the lower half of the whorls can be seen in some specimens.

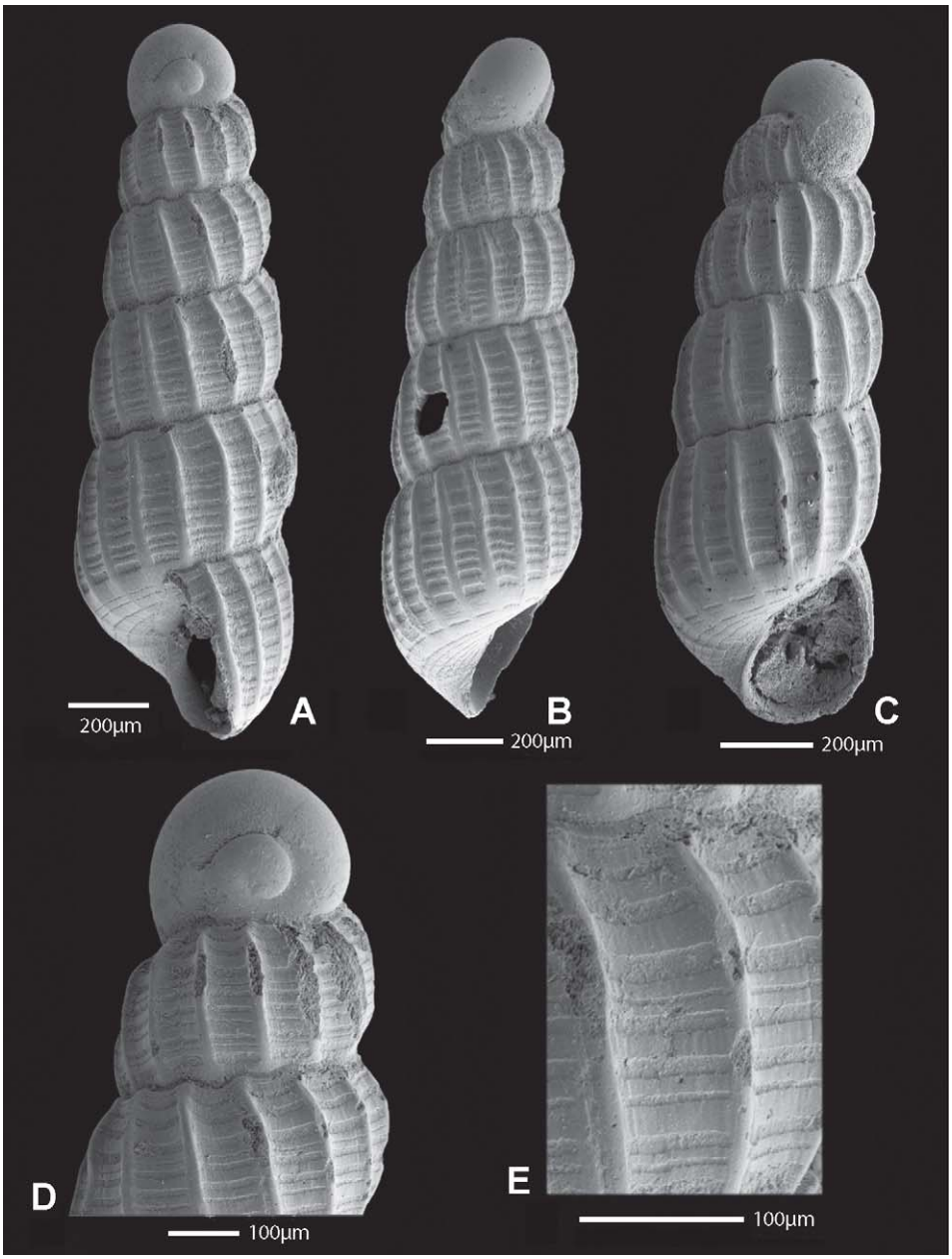


Fig. 5. *Turbonilla hoeisaeteri* sp. n.: (A) holotype; (B, C) paratypes, teleoconchs, station G2, Gabon; (D) holotype, protoconch; (E) holotype, details of sculpture.

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Protoconch of type A-I, diameter 305 µm. Whorls convex. Suture marked but not deep, undulating. Axial ribs elevated, thin, straight but curving left apically, prosocline. Ribs not equidistant; interspaces much broader than ribs. Axial ribs disappearing at periphery of ultimate whorl. Spiral sculpture of rectangular grooves, not equal or equidistant. Very fine vertical microstriae present on bands between grooves. Narrow spiral grooves present on base. Aperture oval, apically narrowed. Columellar tooth absent. No umbilicus.

Holotype: GABON: station G16, 03°49'S:10°37'E, -69 m (ZMBN 86959). Length 2.08 mm, width 0.54 mm.

Paratypes: Four from type locality in ZMBN (86960–86963). Three in NMSA (L8459/T2750).

Distribution: Nigeria and Gabon, -24–69 m.

Comparison: This species is similar to *T. parsysti* Peñas & Rolán, 2002 from West African waters, but is smaller and more slender. The whorls are more convex and not turreted. The axial ribs are not as prosocline apically in the whorls as they are in *T. parsysti*. The aperture is smaller and more oval.

DISCUSSION AND CONCLUSIONS

In spite of great efforts in recent years our knowledge of the pyramidellid fauna of West Africa is still far from complete. Our knowledge of the species composition and the distribution of the species is poor, and even more acute is our lack of knowledge of the biology of the species present where only a few species have been studied (Schander *et al.* 1999*b*). Pyramidellids, as well as other microgastropods, are common in the area but are often overlooked or ignored due to their small size and complicated taxonomy. This study is a part of an ongoing revision of the pyramidellids of West Africa, and we already have additional material awaiting description in our collections. We hope that future studies will also include soft part anatomy and molecular data.

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