Stapafurdius, a new genus of Bulimulidae (Mollusca, Eupulmonata) from Bahia, Brazil, with two new species

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Abstract. The new genus Stapafurdius gen. nov. is introduced collected from Bahia, Brazil, including two new species: S. glaber sp. nov., the type species, occurs in Ibicoara; and S. costiferus sp. nov., from Andaraí regions. The new genus includes species of about 10 mm, elongated shell, reticulated protoconch, elongated peristome, and wide umbilicus. Both species differ mainly by the sculpture, as S. glaber sp. nov. is smooth, while S. costiferus sp. nov. has strong axial sculpture.

Keywords. Taxonomy; Faunistic survey; Morphology; Malacology.

INTRODUCTION

Recent expedition of the collection team of the naturalist José Coltro in calcareous regions from Minas Gerais and Northeast Brazil has brought to light a quantity of new samples, promoting expansions on the geographic distribution of know species, as well as several new taxa (e.g., Simone, in press). This operation is presently facilitated by complete inventories of the Brazilian continental malacofoana (Simone, 2006; Birckolz et al., 2016), in which new taxa can easily be detected.

The present paper refers to samples collected in the central Bahia region, in a semi-dry environment, for which the analysis revealed to belong to a new genus, formally described herein. Two new species are easily detected, one from the Andaraí, and the other from the Ibicoara municipalities.

As the samples are composed only of shells, no information on the internal anatomy is so far possible. However, the shells are informative enough to base the taxonomical analysis. Some doubt, however, remains in the family attribution, an issue stressed in the Discussion section.

MATERIAL AND METHODS

The samples were donated dry and deposited in the malacological collection of the Museu de Zoologia da Universidade de São Paulo (MZSP). The specimens were carefully examined under stereo-microscopes and digitally photographed by Nikon and Canon cameras, as well as by AxioCam ERC5s coupled in the microscope. All images were processed in the Corel software, mainly PhotoPaint®, and by AxioVision multifocal software. A pair of young specimens were selected for Scanning Electron Microscopy; they were covered by gold and examined by ordinary methods, with main concern to the protoconch sculpture. The list of material examined is the type material mentioned in each species description. Most of the generic definition used in the Discussion was based on Pilsbry (1897-1898), beyond the indicated references.

RESULTS

Systematics

Stapafurdius, new genus

http://zoobank.org/62317493-2B7C-47F5-B55B-3EAA45EA79E4

Diagnosis: Shell of ~ 10 mm, relatively elongated, length ~ 3 times width. Color beige with irregular brown spots. Suture well marked. Protoconch mostly sculptured by with delicate net of spiral and axial lines forming aligned squared concave pits, ~ 2.5 whorls. Teleoconch ~ 4-5 whorls. Peristome weakly dislocated externally, weakly deflected, antero-posteriorly elongated (~ twice longer than wide). Umbilicus opened, flanked by middle region of inner lip.

Gender: Masculine.
**Etymology:** The name is the Latinization of the Portuguese word "estapafürdio", meaning something weird, strange or nonsense, an allusion to the strange shape of the shell.

**List of included taxa:** *Stapafurdius glaber* sp. nov. (type species); *S. costiferus* sp. nov.

**Stapafurdius glaber** sp. nov.  
(Figs. 1-12, 24-26)  
http://zoobank.org/B21ABE18-E5FE-4B08-AC63-FA4BS1085F64

**Types:** Holotype MZSP 154048 (Figs. 1-6). Paratypes MZSP 153803, 5 shells, MZSP 154047, 9 shells (Figs. 7-8, 11-12), from type locality.

**Type locality:** BRAZIL. *Bahia*: Ibicóara; Ituaçu, Tanhaçu, 13°55′23″S, 41°16′35″W [Wesley Vailant col., iii/2021] (Fig. 30).

**Etymology:** The specific epithet is from Latin *glaber*, meaning smooth, an allusion to the lack of the shell sculpture.

**Diagnosis:** Shell rather conic, sculpture missing except for growth lines.

**Description**

**Shell:** About 10 mm, elongated, slightly turriform; width ~ 36% of length. Spire angle ~ 30°, growth increasing relatively uniformly, except for peristome slightly dislocated externally. Color pale beige, with small, punc- tiform brown spot, of apparent random distribution, coalescent in some regions forming irregular axial bands (Figs. 1, 3, 7, 11). Protoconch (Figs. 5, 12, 25, 26) of 2.2 whorls, width 1.2 mm; whorls relatively rounded, su- ture deep; sculpture delicate net of spiral and axial lines, equally predominating, uniform, easily eroded (Fig. 5); ~ 45% of shell width, ~ 8% of shell length; transition with teleoconch relatively clear, prosocline, ~ 20° in relation of longitudinal axis (Figs. 25, 26). Teleoconch of ~ 4 whorls, suture relatively shallow, but well-marked; transverse section rounded (Fig. 6); growth relatively uniform, ex- cept for peristome, slightly dislocated externally to right. Sculpture missing, except for growth lines and scanty ax- ial undulations (Fig. 26); surface relatively glossy, small re- gions of dark spots with weak depression (Figs. 3, 8, 10). Aperture antero-posteriorly elongated, width ~ 40% of length (Figs. 1, 7, 9); peristome slightly prosocline, ~ 10% in relation to longitudinal axis (Figs. 2, 4); outer lip straight in middle, curved in both ends; anterior edge rounded; inner lip relatively similar to outer lip, attached to last whorl only in its superior third, sometimes pro- ducing low callus (Figs. 1, 9), sometimes planar (Fig. 7). Umbilicus opened (Fig. 4), protected on right side by middle region of inner lip (Figs. 1, 7, 9). Immature speci- men bulimuliform (Figs. 11, 24).

**Habitat:** Caatinga and dry Atlantic Rainforest, ~ 500 h high.

**Stapafurdius costiferus** sp. nov.  
(Figs. 13-23, 27-29)  
http://zoobank.org/4AEDCA60-4AZA-4F04-9CC4-6517F1303B78

**Types:** Holotype MZSP 154046 (Figs. 13-18, 21). Paratypes MZSP 153882, 3 shells from type locality (Figs. 19-20, 22-23).

**Type locality:** BRAZIL. *Bahia*: Andaraí, Ubiraitá, 12°35′23″S, 41°00′26″W [Wesley Vailant col., iii.2021] (Fig. 30).

**Etymology:** The specific epithet means “bearing ribs” in Latin, an allusion to the shell axial sculpture.

**Diagnosis:** Shell rather cylindrical, sculpture strong axial cords.

**Description**

**Shell:** About 12 mm, elongated, slightly turriform; width ~ 30% of length. Spire angle initially ~ 25°, be- coming almost cylindrical in two last whorls, i.e., growth increasing relatively uniformly in first 3-4 whorls, gradually becoming same-sized in two last whorls, except for peristome slightly dislocated externally. Color pale beige, with relatively wide, sparse, brown spots, of appar- ent random distribution (Figs. 13-15, 22). Protoconch (Figs. 18, 23, 28, 29) of 2.5 whorls, width 1.1 mm; whorls relatively rounded, suture deep; sculpture delicate net of spiral and axial lines, equally predominating, uniform, easily eroded (Fig. 18); ~ 30% of shell width, ~ 5% of shell length; transition with teleoconch relatively clear, prosocline, ~ 20° in relation of longitudinal axis (Figs. 28, 29). Teleoconch of ~ 5 whorls, suture relatively shallow, but well-marked; transverse section rounded (Fig. 17); peristome dislocated externally to right, from slightly (Figs. 19-20) to well-dislocated (Figs. 13, 15). Sculpture uniform axial cords, ~ 20 in penultimate whorl; each cord well-marked, from suture to suture (except for short region preceding superior suture) (Fig. 27); cords inter- spaces equivalent to double of cords width; interspaces with aligned minute dots parallel to cords (Figs. 21, 28); in last whorl sculpture similar to other regions, contouring inferior last whorl region, fading inside umbilicus (Figs. 13, 16, 20). Aperture antero-posteriorly elongated, width ~ 40% of length (Figs. 13, 20); peristome slightly prosocline, ~ 10% in relation to longitudinal axis (Fig. 14); outer lip straight in middle, curved in both ends; anteri- or edge rounded; inner lip relatively similar to outer lip,
attached to last whorl only in its superior third, sometimes producing low callus (Figs. 20), sometimes planar (Fig. 13). Umbilicus opened (Fig. 16), protected on right side by middle region of inner lip (Figs. 13, 20). Immature specimen subuliniform (Figs. 22, 27).

**Habitat:** Caatinga and dry Atlantic Rainforest, ~ 575 h high.

**Distribution:** Only know from type locality.

**Material examined:** Types.

**Measurements (in mm):**
- Holotype MZSP 154046 (Figs. 13-18, 21): 12.0 by 3.6
- Paratypes MZSP 153882 #1 (Figs. 19-20): 11.1 by 3.5
- #3 (Figs. 22-23): 9.8 by 3.0 mm.

**DISCUSSION**

There is almost no doubt that *Stapafurdius* gen. nov. is a new genus, as nothing similar exists in South America. The most similar genera are discussed below. The main problem is, however, to attribute a family to the new

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**Figures 1-12.** *Stapafurdius glaber* sp. nov., shell of types. (1-6) Holotype MZSP 154048 (L 10.5 mm). (1) frontal view. (2) right view. (3) dorsal view. (4) inferior view. (5) protoconch and first teleoconch, profile, scale = 1 mm. (6) apical view. (7-8) paratype MZSP 154047#1 (L 10.2 mm), frontal and dorsal views. (9-10) paratype MZSP 153803#1 (L 11.0 mm): frontal and dorsal views. (11-12) paratype MZSP 154047#3, immature shell (L 7.5 mm), (11) frontal view. (12) detail of protoconch and first teleoconch whorl, profile, scale = 1 mm.
genus. Tentatively it has been considered Bulimulidae. However, this family has recently suffered radical changes, mostly based on molecular approaches (e.g., Breure et al., 2010; Breure & Romero, 2012; Bouchet et al., 2017). However, these changes have not been accompanied by efforts to provide visible diagnostic features to the taxa, precluding the analyses of taxa lacking molecular known sequences. Those papers (and references therein), however, are good bases for showing how weak is the orthalicoidean systematics, that some of considered genera are clearly polyphyletic, and they need to be divided. The introduction of new genera appears inevitable. The general bulimuloid shape of *Stapafurdius* gen. nov., and the peristome lacking teeth are the main reasons for considering it a bulimulid. However, as reported below, some of the genera that need to be compared by their conchological similarity belong to other orthalicoidean families.

The last whorl of *Stapafurdius* gen. nov., having an umbilicus and antero-posteriorly elongated peristome, is similar to *Anctus* Martens, 1860 (Simone, 2006: 173), considered a bulimulid or orthalicid, but it differs by the elongated spire and outline, and pale protoconch, as *Anctus* has obese shell, with dark, not-sculptured protoconch. Elongated peristomes are also found in some species of *Moricandia* Pilsbry & Vanatta, 1898 (Simone, 2006: 171-172), odontostomid, from which *Stapafurdius*

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**Figures 13-23.** *Stapafurdius costiferus* sp. nov., shell of types. (13-17) Holotype MZSP 154046 (L 12.0 mm). (13) frontal view. (14) right view. (15) dorsal view. (16) inferior-slightly left view. (17) apical view. (18) protoconch and first teleoconch, profile, scale = 1 mm. (19-20) Paratype MZSP 153882#1 (L 11.1 mm): dorsal and frontal views. (21) holotype, detail of sculpture of penultimate whorl, scale = 1 mm. (22-23) paratype MZSP 153882#3 (L 9.8 mm). (22) frontal view. (23) protoconch and first teleoconch, profile, scale = 1 mm.
gen. nov. differs in being much smaller, less elongated, and by the opened umbilicus; the elongated peristome of Moricandia actually is oblique, while that of Stapafurdius gen. nov. is longitudinal; the protoconch of Moricandia has a similar sculpture as Stapafurdius gen. nov., but Stapafurdius gen. nov. differs in having the sculpture still more delicate, and in having rounded whorls, while Moricandia has a blunt middle carina, keeping the apex rather umbilicated. The tall spire, the elongated peristome, the opened umbilicus, and the pigmentation also differ Stapafurdius gen. nov. from Bulimulus Leach, 1814, Protoglyptus Pilsbry, 1897, both bulimulid, and from Rhinus Martens, 1860, simpulopsid (Simone, 2006, and references therein; Breure & Romero, 2012). Rhinus and Bulimulus also have reticulated protoconchs, however their sculpture is rougher and slightly more irregular. The odontostomid subgenus Ventania Parodiz, 1940, also has species with elongated outline, and peristome lacking teeth, however, the elongated peristome and the opened umbilicus differ Stapafurdius gen. nov. from it. From the odontostomid Clessinia Döring, 1875, Stapafurdius gen. nov. differs in having the elongated peristome, the opened umbilicus, lack of palatal tooth in the peristome, and by more delicate protoconch sculpture, as Clessinia has clear predominance of strong axial cords. From the odontostomid Spixia Pilsbry & Vanatta, 1898, Stapafurdius gen. nov. differs by the elongated peristome (Spixia has a rounded one), in lacking peristome teeth (all Spixia have strong teeth in the aperture), by the cylindrical anterior portion (Spixia has a continuous shell increment), and by the reticulated protoconch (Spixia has only strong axial cords as protoconch sculpture). From the odontostomid Bahiensis Jousseaume, 1877, Stapafurdius gen. nov. mainly differs by the external position of the peristome, dislocated because of the ample umbilicus, while Bahiensis has the peristome centrally positioned, practically lacking umbilicus; besides, Bahiensis has the peristome widely expanded, while Stapafurdius gen. nov. almost lack expansions; similarly, Stapafurdius gen. nov. has resem-

Figures 24-29. Stapafurdius gen. nov. young shell SEM images. (24) S. glaber sp. nov. paratype MZSP 154047, whole dorsal view, scale = 1 mm. (25) same, detail of apical region, dorsal-slightly apical view, scale = 500 µm. (26) same, detail of transition protoconch-teleoconch, scale = 100 µm. (27) S. costiferus sp. nov. paratype MZSP 153882, whole dorsal view, scale = 1 mm. (28) same, detail of apical region, dorsal-slightly apical view, scale = 500 µm. (29) same, detail of protoconch and first teleoconch whorl, scale = 200 µm.
closer to Stapafurdius and of sp. nov. (2 = Ubiraitá). Stapafurdius expanded, mainly anteriorly, which is not observed in tooth-lacking peristome, but the peristome is always being really more delicate; also, some Bahiensis have despite Bahiensis, blance of the protoconch sculpture of Stapafurdius glaber indication of places of occurrence of Map of Brazil with states outlined. Bahia indicated by “BA”, with Figure 30. 6/7 with other orthalicoidean genus can be somehow confused much that some species have scalariform last whorl. No elongated forms of and also have elongated shape, and some are even slightly a wider range of shapes and protoconchs; some species occurs in Brazil – Pilsbry, 1898; Simone, 2006), and has near the Pacific coast of South America (no Bostryx bilicus. additionally, typical Drymaeus lack or have pressed umbl.ture, but more robust, with stronger axial and spiral lines; also has reticulate sculp- ters in being much smaller and by the delicate sculpture, gen. nov. Diversus has a clear bulimuloid shape), and elongated protoconch; the protoconch of Drymaeus has a clear bulimuloid shape), and elongated protoconch; the protoconch of Drymaeus has a reticulate sculp- but more robust, with stronger axial and spiral lines; additionally, typical Drymaeus lack or have pressed um- bilicus. Bostryx is a genus occurring in the Andean region and near the Pacific coast of South America (no Bostryx occurs in Brazil – PilBry, 1898; Simone, 2006), and has a wider range of shapes and protoconchs; some species also have elongated shape, and some are even slightly cylindric, however, their peristome are never elongat- ed; their protoconchs vary from smooth to reticulated, however, even the reticulated forms do not have a so delicate sculpture like that of Stapafurdius gen. nov.; the elongated forms of Bostryx usually have deep suture, so much that some species have scalariform last whorl. No other orthalicoidean genus can be somehow confused with Stapafurdius gen. nov. Focusing the protoconch of Stapafurdius gen. nov., it looks the single genus with so delicate sculpture, constituted of squared aligned pits, instead of being composed of minute axial and spiral lines like the other orthalicoideans that possess reticulated protoconchs. The elongated peristome, based on the experience in collecting Anctus, is related to the habit of the snail to dovetail it in narrow dry bushes, very common in Northeast Brazilian region. The animal can, thus, hibernate during the dry season. The elongated peristome does not appear a defense mechanism, which more usually is the presence of teeth (Simone, 2018).

The protoconch of Stapafurdius gen. nov. is similar to most bulimulid and allied genera, in having the delicate net of spiral and axial lines equally predominating. The main exclusivity is the paucispiral condition (slightly more than 2 whorls) while most genera have more than 3 whorls.

Both Stapafurdius gen. nov. species easily differ from each other by the shell sculpture, as S. glaber sp. nov. is smooth (Figs. 1–3), while S. costiferus sp. nov. has strong axial sculpture (Figs. 13–15). Additionally, S. costiferus sp. nov. has slightly more elongated outline (width ~ 30% of length, against ~ 36% of S. glaber sp. nov.), and its protoconch is slightly longer, 2.5 whorls (against 2.2 of S. glaber), despite being slightly smaller (1.1 mm, against 1.2 mm of S. glaber sp. nov.).

The genus Stapafurdius gen. nov. so far appears to be endemic to the central Bahia dry region (Fig. 30). This present discovery joins several recent ones describing new species and even new genera (e.g., Simone, 2013, in press; Simone & Oliveira, 2021; Simone & Salvador, 2021), showing how weak is the knowledge on the Brazilian malaco fauna. Possibly protective efforts must be implemented to preserve such species and environments. The proper description of the fauna is a first step.

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