

Notes on a new collection of Streptaxidae (Gastropoda: Stylommatophora) from Brazil, with descriptions of two new species of *Streptaxis*

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Abstract

A large collection of mollusks was recently acquired by the Museu de Zoologia da Universidade de São Paulo (Brazil) from a commercial company. In this collection, the specimens of the family Streptaxidae from Brazil are both diverse and relatively abundant and are examined here. Herein are reported new records of 11 species, greatly extending the geographical range of the following: *Rectartemon depressus* (Heynemann, 1868), *R. iguapensis* (Pilsbry, 1930), *R. piquetensis* (Pilsbry, 1930) and *Streptartemon extraneus* (Haas, 1955). Additionally, two new species are described: *Streptaxis leirae* **sp. nov.** and *Streptaxis megahelix* **sp. nov.**

Key words: geographic distribution, new records, *Streptaxis leirae* **sp. nov.**, *Streptaxis megahelix* **sp. nov.**, Pulmonata.

Zusammenfassung

Eine große Sammlung von Mollusken wurde vor kurzem von einer Handelsfirma des Museu de Zoologia da Universidade de São Paulo (Brasilien) erworben. In dieser Sammlung sind die Exemplare der Familie Streptaxidae aus Brasilien sowohl vielfältig als auch relativ reichlich und werden hier untersucht. Hier werden 11 neue Artenrekorde gemeldet, die die geografische Verteilung der folgenden Arten stark erweitern: *Rectartemon depressus* (Heynemann, 1868), *R. iguapensis* (Pilsbry, 1930), *R. piquetensis* (Pilsbry, 1930) und *Streptartemon extraneus* (Haas, 1955). Zusätzlich werden zwei neue Arten beschrieben: *Streptaxis leirae* **sp. nov.** und *Streptaxis megahelix* **sp. nov.**

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1 Introduction

A large collection of mollusks was recently acquired by the Museu de Zoologia da Universidade de São Paulo (MZSP; São Paulo, Brazil), comprising circa 10,000 lots from all regions of the globe. As this collection belonged to the commercial company Femorale, the specimens are usually in very good state of preservation and include detailed data on the collection localities (albeit not precise coordinates) and sometimes habitat. Despite most of the collection being of marine mollusks, a good portion is devoted to land snails. Among these, the sample of the family Streptaxidae from Brazil deserves further attention due to the diversity of species present and relative abundance of specimens (when compared to other families in the acquired collection). This sample counts with 37 specimens from 11 unique localities in Brazil, mostly belonging to the Atlantic forest biome, which is in particularly urgent need of better documentation of its invertebrate biodiversity.

Streptaxids are carnivorous pulmonate land snails belonging to the Stylommatophora, distributed mainly in South America, Africa and tropical Asia (ROWSON et al., 2010). The family's fossil record goes back to the Late Cretaceous of Europe and a Mesozoic Gondwanan origin has been proposed, with later radiation events (ZILCH, 1960; ROWSON et al., 2010). The most thorough works dealing with the taxonomy of South American streptaxids at the species level are TRYON (1885) and GUDE (1902), while for Brazil there are a handful of species lists, such as MORRETES (1949), SALGADO & COELHO (2003) and SIMONE (2006), the latter being the most complete and the only one illustrated. The 52 streptaxid species known in Brazil are presently distributed into six genera (SIMONE, 2006; BIRCKOLZ et al., 2016): *Hypselartemon* Wenz, 1947, *Martinella* Jousseaume, 1887, *Rectartemon* Baker, 1925, *Sairostoma* Haas, 1938, *Streptartemon* Kobelt, 1905, and *Streptaxis* Gray, 1837.

In the present work, new occurrences of streptaxids are reported, significantly extending the known geograph-

ical ranges of these species within Brazil. In addition, two new species of *Streptaxis* are described.

Abbreviations

H shell length
D shell greatest width.

Acronyms of depositories

ANSP Academy of Natural Sciences of Drexel University (Philadelphia, USA)
FMNH Field Museum of Natural History (Chicago, USA)
MZSP Museu de Zoologia da Universidade de São Paulo (São Paulo, Brazil)
ZMB Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung (formerly “Zoologisches Museum Berlin”; Berlin, Germany).

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2 Material and Methods

The lots acquired from Femorale represent haphazard collections with a clear commercial intent. Nevertheless, data on Brazilian terrestrial gastropods is so scarce that even such collections can greatly improve current knowledge. The material, comprising only empty shells, is deposited in the malacological

collection of MZSP. The streptaxid specimens (n = 37) were collected from 2007 to 2015 in 11 different localities, most of them belonging to eastern Brazilian states (Table 1) and representing the Atlantic Forest biome.

All streptaxid taxa found in the present collection and their primary data are listed in Table 1, and those species for which geographical ranges are extended are figured and further discussed in the Systematic section below. Likewise, the new species descriptions can be found below.

Identification of the material was conducted based on the original descriptions and further taxonomic literature, especially the catalogue of SIMONE (2006). Additional comparisons were made with material, including types, housed in MZSP and other collections (indicated below as necessary). Imaging and measurements were made with the aid of the Zeiss Axiovision SE64 Rel 4.8 software.

3 Systematics

Superfamily Streptaxoidea

Family Streptaxidae

Rectartemon Baker, 1925

Rectartemon depressus (Heynemann, 1868) (Figs. 1–3)

Streptaxis depressus Heynemann, 1868: 101, pl. 4, fig. 2 [August; name and description of radula].

Streptaxis apertus Martens 1868: 180 [October; description of shell]; PFEIFFER, 1876: 491; PFEIFFER, 1878: 69, figs. 9–10; SCHADE, 1965: 218.

Streptaxis apertus subglobosus Martens 1868: 180; PFEIFFER, 1876: 491.

Streptaxis apertus depressus Martens 1868: 180; PFEIFFER, 1876: 491; PARODIZ, 1957: 64; FIGUEIRAS, 1963: 92; FERNANDEZ & CASTELLANOS, 1973: 272; QUINTANA, 1982: 103.

Streptaxis (Artemon) apertus: TRYON, 1885: 63; GUDE, 1902: 229.

Table 1. List of all Streptaxidae species found in the new collection acquired by the MZSP, with the studied material and the localities of their occurrence. Abbreviations: s = shell(s); HOL, holotype; PAR, paratype(s). Brazilian states: BA = Bahia, ES = Espírito Santo, MG = Minas Gerais, RJ = Rio de Janeiro, RN = Rio Grande do Norte.

Species	Material studied	Locality
<i>Hypselartemon paivanus</i> (Pfeiffer, 1867)	MZSP 123898 (1s, v/2009)	Cabo Frio Island (RJ)
<i>Rectartemon depressus</i> (Heynemann, 1868)	MZSP 129176 (2s, xi/2007); MZSP 125447 (1s, iv/2012); MZSP 127576 (3s, vii/2013)	border between BA and ES; Nanuque (MG); Serra de Macaé (RJ)
<i>Rectartemon iguapensis</i> (Pilsbry, 1930)	MZSP 129176 (1s, xi/2007); MZSP 133139 (1s, v/2015)	Serra de Macaé (RJ)
<i>Rectartemon piquetensis</i> (Pilsbry, 1930)	MZSP 123942 (7s, v/2009); MZSP 130461 (1s, v/2012); MZSP 133139 (2s, v/2015)	Nanuque (MG); Serra de Macaé (RJ)
<i>Rectartemon regius</i> (Löbbecke, 1881)	MZSP 123553 (2s, xii/2008)	border between MG and RJ
<i>Rectartemon wagneri</i> (Pfeiffer, 1841)	MZSP 123947 (4s, xii/2008)	Una (BA)
<i>Streptartemon extraneus</i> (Haas, 1955)	MZSP 123558 (6s, xii/2008)	Natal (RN)
<i>Streptaxis contusus</i> (Férussac, 1821)	MZSP 133140 (1s, vi/2015)	Arraial do Cabo (RJ)
<i>Streptaxis leirae</i> sp. nov.	MZSP 129247 (HOL, i/2013)	Brumado (BA)
<i>Streptaxis megahelix</i> sp. nov.	MZSP 124024 (HOL + PAR [2s], vii/2009)	São Fidélis (RJ)
<i>Streptaxis politus</i> (Fulton, 1899)	MZSP 133138 (1s, col. v/2015)	Itaparica Island (BA)

Streptaxis (Artemon) apertus var. *depressus*: TRYON, 1885: 63.
Streptaxis (Artemon) apertus var. *depressa*: CLESSIN, 1888: 165;
 GUDE, 1902: 229.

Alcidia aperta: BOURGUIGNAT, 1889: 47.

Rectartemon apertus: GUDE, 1903: 229; ZILCH, 1961: 80; SALGADO & COELHO, 2003: 170.

Artemon apertus: KOBELT, 1906: 43, pl. 48, figs. 10–12; JAECKEL, 1927: 137; SOLEM, 1956: 10, pl. 1, figs. 8–10.

Rectartemon (Rectartemon) depressus: PICORAL & THOMÉ, 1993: 5; PICORAL & LOPES-PITONI, 1998: 117, figs. 1–8; PICORAL & THOMÉ, 1998: 101.

Rectartemon depressus: SIMONE, 2006: 198, fig. 743; LEMOS et al., 2012: 128, figs. 1–2.

Type locality: Unknown. The locality of MARTENS (1868) has been interpreted by GUDE (1902) as “South Brazil”, while PEREIRA & THOMÉ (1999) indicates Morro Reuter municipality in Rio Grande do Sul state as a possible candidate.

Previously known distribution: Known from Brazil (Espírito Santo, Rio Grande do Sul, Santa Catarina and São Paulo states), Paraguay (Alto Paraná, Caaguazú, Concepción, Guairá, Itapúa, Paraguari and San Pedro departments), Argentina (Buenos Aires [Martín García Island], Corrientes, Entre Ríos, and Misiones provinces) and Uruguay (Paysandú department) (PARODIZ, 1957; FIGUEIRAS, 1963; QUINTANA, 1982; SIMONE, 2006).

New occurrence: Brazil: Minas Gerais state, Nanuque. Rio de Janeiro state, Serra de Macaé.

Remarks: This species is characterized by the comparatively deeper suture and by the presence of axial ribs on the abapical portion of the whorls (PICORAL & LOPES-PITONI, 1998). The present material closely resembles the types (ZMB/MOLL. 13729, 11 syntypes of *S. depressus*; ZMB/MOLL. 57163, holotype of *S. apertus*). The present record slightly extends the species’ distribution to the north; the records are from the border of Espírito Santo state with the states of Minas Gerais (Nanuque municipality) and Bahia.

Rectartemon iguapensis (Pilsbry, 1930)
 (Figs. 4–6)

Artemon iguapensis Pilsbry, 1930: 363, pl. 32, figs. 4, 4a, 4b; MORRETES, 1949: 166; SOLEM, 1956: 10, pl. 1, figs. 14–16.

Streptaxis iguapensis: SALGADO & COELHO, 2003: 171.

Rectartemon iguapensis: SIMONE, 2006: 198, fig. 744; SALVADOR et al., 2016: table 1.

Type locality: Brazil: São Paulo state, Iguape.

Previously known distribution: Known from Bahia and São Paulo states (SIMONE, 2006).

New occurrence: Brazil: Rio de Janeiro state, Serra de Macaé.

Remarks: Even with a juvenile specimen, the number of whorls, relatively narrow umbilicus, conical spire and the telltale keel on the mid portion of the whorl (PILSBRY, 1930; SOLEM, 1956) allow the identification as *R. iguapensis*.

Rectartemon piquetensis (Pilsbry, 1930)
 (Figs. 7–9)

Artemon intermedius piquetensis Pilsbry, 1930: 365, pl. 32, figs. 5a–b; MORRETES 1949: 166.

Artemon piquetensis: SOLEM, 1956: 10.

Streptaxis piquetensis: SALGADO & COELHO 2003: 171.

Rectartemon piquetensis: SIMONE, 2006: 199, fig. 746; BIRCKOLZ et al., 2016: table 1; SIMONE & SALVADOR, 2016: table 1, figs. 93–95.

Type locality: Brazil: São Paulo state, Piquete.

Previously known distribution: Known from Bahia, Minas Gerais and São Paulo states (BIRCKOLZ et al., 2016).

New occurrence: Brazil: Rio de Janeiro state, Serra de Macaé.

Remarks: In spite of the present specimens being juveniles or sub-adults, some features allow the identification as *R. piquetensis*, such as the relatively large size when compared to most congeners, the raised spire, and the rounded profile of the body whorl (“indistinctly subangular” *sensu* PILSBRY, 1930). These features compare well with the type material (holotype ANSP 47581 and paratype ANSP 71248; SIMONE, 2006: figs. 746A and 746B, respectively), especially to the paratype.

Streptartemon Kobelt, 1905
Streptartemon extraneus (Haas, 1955)
 (Figs. 10–13)

Streptaxis (Streptartemon) extraneus Haas, 1955: 102, figs. 1–3.

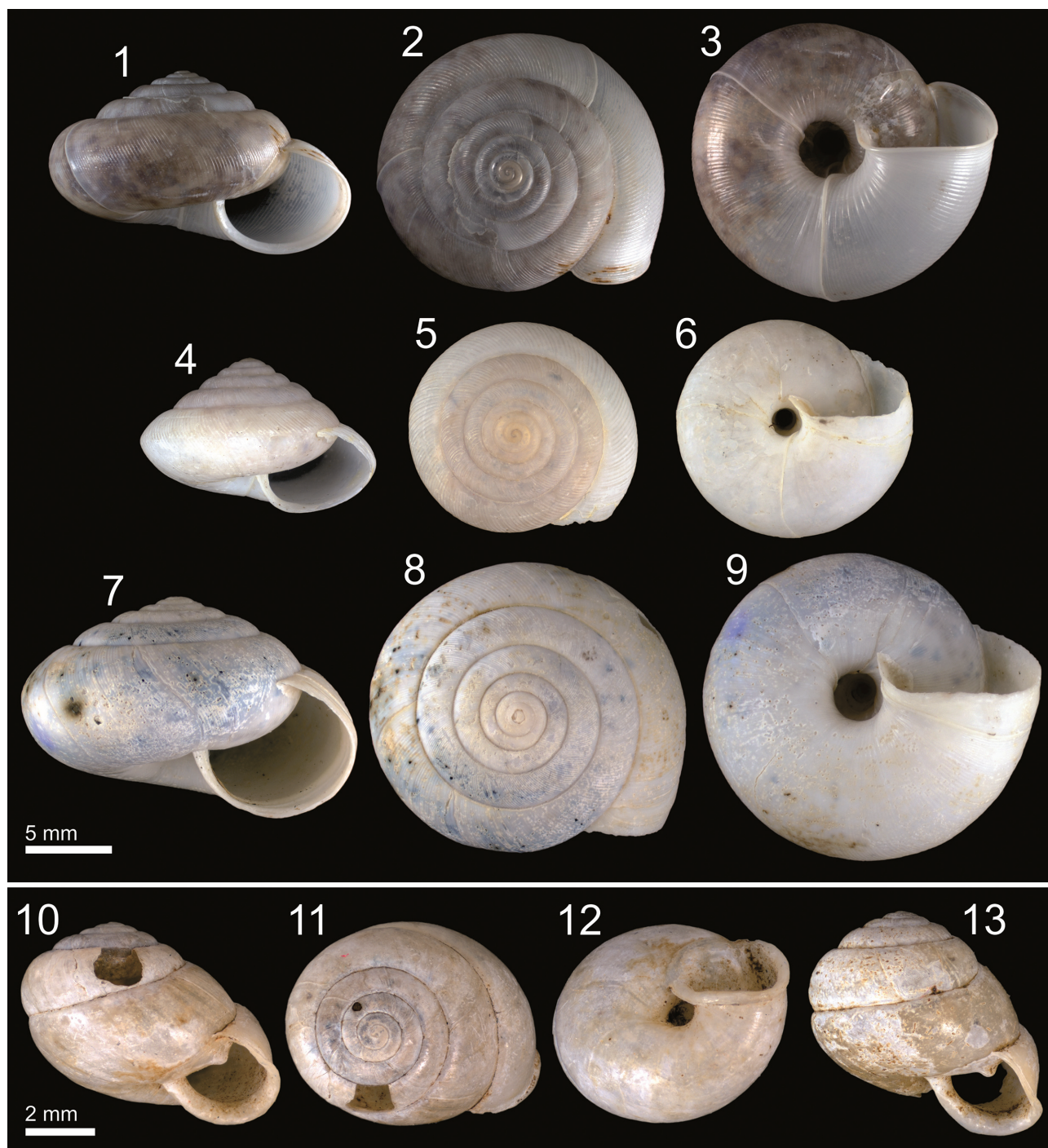
Streptartemon extraneus: SALGADO & COELHO, 2003: 171; SIMONE, 2006: 197, fig. 737.

Type locality: Brazil: Pará state, Monte Alegre, Serra Formosa (near Mulata).

Previously known distribution: Known only from type locality.

New occurrence: Brazil: Rio Grande do Norte state, Natal.

Remarks: The present specimens (Figs. 10–12) compare very well with the holotype (FMNH 52354; HAAS, 1955: figs. 1–3; SIMONE, 2006: fig. 737), especially with its diagnostic round aperture with a single parietal tooth and the nearly flat shell profile of the last and penultimate whorl above the aperture. A single specimen, however, has the last whorl positioned closer to the columellar axis, that is, less displaced laterally (Fig. 13). It is thus reminiscent in overall shell shape to some congeners, namely, *S. deformis* (Férussac, 1821) and *S. streptodon* (Moricand, 1851), while maintaining the diagnostic characters of *S. extraneus*. It is presently not possible to know if this is a common conchological variation of the species or if it is an aberrant form (e.g., since the specimen is rather poorly preserved, resulting from breakage and further deformed



Figs. 1–13. Streptaxidae species with geographical range extension. Specimens are shown at the same scale within each genus. – **1–3.** *Rectartemon depressus*, MZSP 125447 (H = 11.7 mm, D = 18.7 mm). **4–6.** *Rectartemon iguapensis*, MZSP 133139 (H = 9.8 mm, D = 14.8 mm). **7–9.** *Rectartemon piquetensis*, MZSP 133139 (H = 14.2 mm, D = 21.0 mm). **10–12.** *Streptartemon extraneus*, specimen #1, MZSP 123558 (H = 6.1 mm, D = 7.2 mm). **13.** *Streptartemon extraneus*, specimen #2, MZSP 123558 (H = 6.6 mm, D = 6.7 mm).



Figs. 14–18. *Streptaxis leirae* sp. nov. Holotype, MZSP 129247 (H = 6.8 mm, D = 13.5 mm). The scale bar (= 1 mm) refers only to the close-up image of the protoconch and first whorls.

growth). All of the present specimens were collected under bushes in a dune area, indicative of a dry sandy habitat for this species. The present record greatly extends the species' range to the east.

Streptaxis Gray, 1837
Streptaxis leirae sp. nov.
 (Figs. 14–18)

Type material: Holotype: MZSP 129247 (A. BIANCHI col., i/2013; Figs. 14–18).

Type locality: Brazil: Bahia state, Brumado municipality, forested area near the city.

Etymology: The name refers to Leira, a fictional goddess of illusion and mist, from the Faerûnian pantheon of the Forgotten Realms campaign setting of the Dungeons & Dragons role-playing game. This epithet, thus, also alludes to the type locality, the city of Brumado, which means “misty” in Portuguese.

Distribution: Known only from the type locality.

Habitat: The specimen was collected on the forest floor, in the leaf litter, but the type of forest was not specified. This region of Bahia state represents an area of tran-



Figs. 19–24. *Streptaxis megahelix* sp. nov. – 19–23. Holotype, MZSP 124024 (H = 13.5 mm, D = 18.1 mm). The scale bar (= 1 mm) refers only to the close-up image of the protoconch and first whorls. 24. Paratype (fragmentary), MZSP 124024 (H = 16.0 mm, D = 15.8 mm).

sition between biomes, where three of the Brazilian great biomes can be found: the Atlantic Forest, the Cerrado and the Caatinga.

Material analyzed: Known only from the holotype, a complete but somewhat bleached and worn empty shell.

Diagnosis: Shell discoid to lenticular; body whorl with faint angulation, with lower (abapical) portion of the whorl strongly angulated towards the umbilicus; aperture laterally elongated; “displaced” body whorl that gives the umbilicus a somewhat “bent” appearance.

Description: Shell small ($D \sim 13$ mm), discoid to lenticular, with whorls slowly increasing in width. Spire low, with step-like whorls. Whorl profile strongly convex; suture well-marked. Body whorl with faint angulation, with lower (abapical) portion of the whorl strongly angulated towards the umbilicus. Protoconch (ca. $2\frac{1}{4}$ whorls) flattened, apparently smooth (although this could be due to the shell being somewhat worn); transition to teleoconch clearly marked by an axial growth mark and start of teleoconch sculpture. Teleoconch sculptured by prosocline well-marked axial ribs on upper (adapical) portion of whorls; lower (abapical) portion smooth; sculpture apparently starts to gradually fade from the beginning of the body whorl onwards, but never completely disappears; axial growth marks present in seemingly irregular intervals. Body whorl markedly bent downwards (abapically) close to aperture. Aperture D-shaped, laterally (away from columellar axis) elongated; peristome strongly reflexed; parietal callus noticeable, but thin and incompletely defined. Umbilicus narrow, deep; body whorl seems “displaced”, giving the umbilicus a somewhat bent appearance.

Dimensions: Holotype: $6\frac{3}{4}$ whorls; $H = 6.8$ mm; $D = 13.5$ mm.

Remarks: The following features allow the classification of this new species in the genus *Streptaxis*: (1) the overall discoid shell shape, with the whorls of the spire well delimited by a deep suture; (2) the teleoconch sculpture present only on the upper (adapical) region of the whorls; (3) the aperture shape and the aperture region being slightly bent downwards (abapically), seen in some species like *S. crossei* (Pfeiffer, 1867), *S. dunkeri* (Pfeiffer, 1845), *S. lutzburgi* Weber, 1925 and *S. saopaulensis* Pilsbry, 1930; (4) the somewhat “displaced” body whorl, which gives the umbilicus a rather bent appearance, as seen in some species like *S. dunkeri* and *S. lutzburgi*. Some of these features are also known from other streptaxid genera, like *Sairostoma* and *Streptartemon*, but the whole set of features is seen only in *Streptaxis*. Of course, the state of the knowledge of Brazilian streptaxids is still incipient, and no major revisions have been undertaken. Nevertheless, the present species is so distinct and easily diagnosable from the presently known fauna, that

it warrants description as a new taxon, namely *Streptaxis leirae* **sp. nov.**

Streptaxis leirae **sp. nov.** can be clearly distinguished from its congeners by its discoid shell and its strongly bent umbilicus. The only vaguely similar congeners are *S. discus* Pfeiffer, 1851 and *S. lutzburgi*; however, the former is almost perfectly planispiral (and its occurrence in Brazil remains unconfirmed; SIMONE, 2006), while the latter has an overall taller spire (but also displays a bent umbilicus, although to a lesser degree than in *S. leirae* **sp. nov.**). The overall shell shape of *S. leirae* **sp. nov.** is reminiscent of *Sairostoma perplexum* Haas, 1938, but the aperture is completely distinct: the monospecific genus *Sairostoma* is diagnosable by its extremely narrow sickle-shaped aperture.

Streptaxis megahelix **sp. nov.**
(Figs. 19–24)

Type material: MZSP 124024 (P. CONÇALVES col., vii/2009); holotype (Figs. 19–23) and 2 paratypes (Fig. 24).

Type locality: Brazil: Rio de Janeiro state, São Fidélis municipality, Serra do Sapateiro.

Etymology: The composite noun in apposition refers to the many-whorled shell spire of the species.

Distribution: Known only from type locality.

Habitat: The specimens were collected from the leaf litter in an area of Atlantic Forest.

Material analyzed: Types: somewhat bleached and worn empty shells, holotype complete, but paratypes fragmentary.

Diagnosis: Shell conical, with high multi-whorled spire (ca. 10 whorls); aperture narrow, sickle-shaped.

Description: Shell small ($D \sim 18$ mm), conical, multi-whorled (~ 10 whorls), with whorls very slowly increasing in width. Spire high, with weakly step-like whorls. Whorl profile strongly convex; suture well-marked. Body whorl rounded. Protoconch (~ 2 whorls) flattened, with first $\sim \frac{1}{2}$ whorl smooth (although this could be due to the shell being somewhat worn), then sculptured by prosocline axial ribs that gradually increase in strength; transition to teleoconch unclear. Teleoconch sculptured by prosocline well-marked axial ribs on upper (adapical) portion of whorls; lower (abapical) portion smooth; axial growth marks present in seemingly irregular intervals. Aperture narrow, sickle-shaped; peristome markedly reflexed (except on the palatal region closest to the suture, where it is only weakly reflexed); parietal callus distinct. Umbilicus wide, deep.

Dimensions: Holotype: $10\frac{1}{4}$ whorls; $H = 13.4$ mm; $D = 18.1$ mm. Paratype #1: $9\frac{1}{2}$ whorls; $H = 16.0$ mm; $D = 15.8$ mm.

Remarks: Like *Streptaxis leirae* **sp. nov.** above, the present species can be classified in the genus *Streptaxis* due to its conical, many-whorled shell, with the whorls

strongly delimited by a deep suture, and to its teleoconch sculpture present only on the upper (adapical) region of the whorls. Moreover, the present specimens are remarkably distinct from the presently known streptaxids and thus, are described here as a new species: *Streptaxis megahelix* **sp. nov.**

Streptaxis megahelix **sp. nov.** is easily distinguished from most of its congeners by its conical shell and high multi-whorled spire. There is only a handful of similar species: *S. cypsele* (Pfeiffer, 1849), *S. iheringi* (Pilsbry, 1930) and *S. luetzelburgi*, but none achieve the same number of whorls. *Streptaxis megahelix* is more similar in shape to the first two of the above-mentioned species, but it has a greater number of whorls, a much broader shell, and a much narrower (and more sickle-shaped) aperture. Moreover, *S. megahelix* displays neither the slightly “displaced” body whorl of *S. luetzelburgi* nor its abapically bent apertural region.

Even in the restricted sample, it can be seen that the species show some morphological variation, with the most complete paratype (Fig. 24) displaying a higher spire, resulting in an overall narrower shell than the holotype. Nevertheless, the range of conchological variation can only be fully assessed when more specimens become available.

4 Discussion

Although a small and haphazard collection, it is surprising how much information it adds to the knowledge of Brazilian streptaxids, from several new occurrences and geographical range extensions to the description of two new species. This reinforces the message recently argued by BIRCKOLZ et al. (2016) that knowledge of Brazilian land snails remains incipient and there is still much work to be done regarding the basics of alpha taxonomy and snail biology. As terrestrial mollusks are arguably among the most endangered animals (LYDEARD et al. 2004; RÉGNIER et al. 2008), with many species becoming extinct before being described (e.g., RICHLING & BOUCHET 2013; SALVADOR & SIMONE 2015), this knowledge cannot come too soon and any relevant piece of information is worthwhile of study and publication.

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