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Taxonomical study on a sample of land and freshwater snails from caves in central Brazil, with description of a new species

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Abstract

A sample of land and freshwater snails, mainly pulmonates, was recently collected in caves in Goiás and Bahia states, Brazil. Twenty-one species were found in the material. The following species are reported for the first time for Goiás state: *Cecilioides consobrina* (Ferussaciidae), *Dysopeas muibum* and *Stenogyra octogyra* (Subulinidae), *Entodina jekylli* and *Prohappia besckei* (Scolodontidae; also reported for the first time for Bahia state), *Pupisoma dioscoricola* (Valloniidae). A new species from Goiás is described herein: *Gastrocopta sharae* **sp. n.** (Gastrocoptidae). The new records and species addressed here constitute important findings, helping to fill distributional gaps and improving the knowledge of the local molluscan fauna, an essential step for future conservation efforts.

Introduction

The Brazilian continental molluscan fauna is still poorly known and is deemed to have so many undescribed species as to triple the presently known number (Simone 1999, 2006). Since cave-dwelling invertebrates, in general, have received scarce attention from researchers in Brazil (Trajano and Bichuette 2010), it should be no surprise that cave-dwelling land and freshwater snails are even less known (a few exceptions are: Bichuette and Trajano 1999, 2003, Simone 2013, Salvador et al. 2016). This lack of study is alarming, especially from a conservationist point of view, since caves usually have very fragile ecosystems with a high degree of endemic species (Trajano 2000, Gallão and Bichuette 2012, Silva and Ferreira 2015).

Some recent expeditions (April/2012–January/2013) by Dr. M. E. Bichuette (Universidade Federal de São Carlos; São Carlos, Brazil) and her team to cave systems in Goiás and Bahia states, central Brazil, recovered many land and freshwater snails. This whole material was deposited in the malacological collection of the Museu de Zoologia da Universidade de São Paulo (MZSP, São Paulo, Brazil) and is studied here. The sample studied herein includes the description of a new species and occurrence of another twenty species, some of which are new records for Bahia and/or Goiás states.

Material and methods

All the material studied here was collected by M. E. Bichuette and her team and deposited in the MZSP. All the specimens were collected in caves (see Table 1 for all the localities) and comprise both empty shells and living an-

Table 1. List of all localities, i.e., the caves (or "grutas" in Portuguese), where the present material was collected, alongside their city/municipality, state, coordinates (see also Fig. 1), date of collection, the biome of the surrounding area, the microhabitat where the snails were collected and if there is a water body inside each cave.

Locality	City	State	Coordinates	Collection date	Biome	Substrate	Water body
Gruta Cantinho	Igatu/Andaraí	BA	12°51'49.9''S 41°19'26.9''W	01/Apr/2013	Campos Rupestres	wet sand	yes
Gruta do Catão	São Desidério	BA	12°22'07.0''S 44°52'03.2''W	03/Nov/2012	Cerrado/ Caatinga	wet sand, clay	yes
Gruta do Renatão	São Desidério	BA	12°26'35.6''S 44°56'26.7''W	03/Nov/2012	Cerrado/ Caatinga	clay	no
Gruta das Dores	Mambaí	GO	14°24'38.0''S 46°11'35.5''W	30/Apr/2013	Cerrado	clay	yes
Gruta Fundo de Quintal	Mambaí	GO	14°29'16.0''S 46°07'08.4''W	29/Oct/2012	Cerrado	clay	yes
Gruta Judite	Mambaí	GO	14°24'26.5''S 46°11'43.7''W	01/May/2013	Cerrado	clay	yes
Gruta da Tarimba	Mambaí	GO	14°24'43.0''S 46°10'29.6''W	28/Oct/2012, 29/Apr/2013	Cerrado	clay	yes
Gruta Pasto de Vacas I	Mambaí	GO	14°26'19.4''S 46°10'40.9''W	02/May/2013	Cerrado	clay	yes
Gruta Revolucionários	Posse	GO	14°14'03.0''S 46°20'41.8''W	30/Apr/2013, 03/May/2013	Cerrado	clay	yes

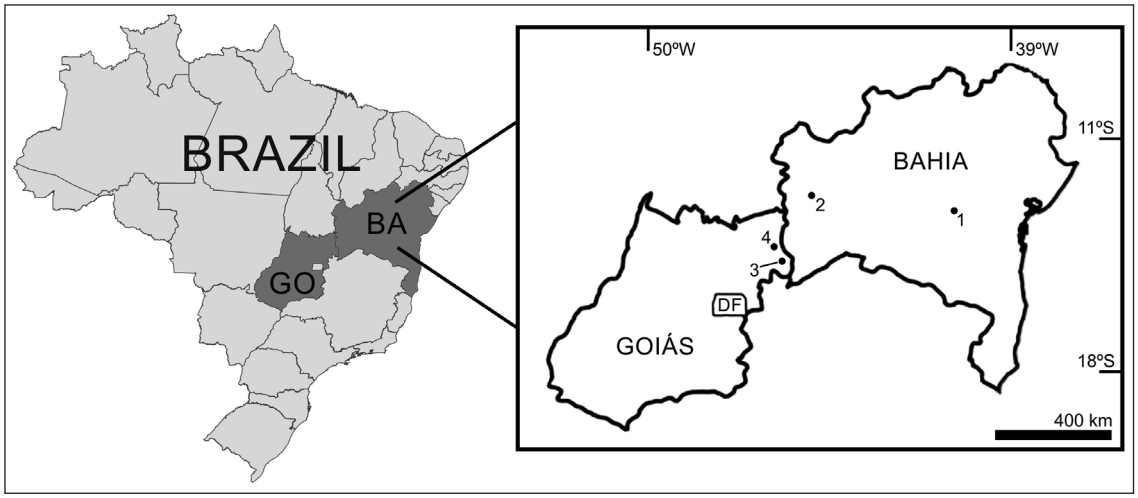

Figure 1. Map showing the Brazilian states of Bahia and Goiás, with the cities where the caves are located (see also Table 1): **1**, Igatu/Andaraí; **2**, São Desidério; **3**, Mambaí; **4**, Posse. Abbreviations: GO, Goiás state; BA, Bahia state; DF, Distrito Federal.

imals. Brief descriptions of each locality can be found in Table 1, alongside their precise coordinates (see also Fig. 1). Localities from Goiás all fit into the Cerrado Biome, while those in Bahia are either Campos Rupestres (montane subtropical savannah) or a transition between the Cerrado and the Caatinga.

Identification was conducted based on the work of Simone (2006), the original descriptions, and additional material housed in the collection of the MZSP. Unfortunately, some species could not be identified beyond genus level, either due to poor preservation of the specimens or to very young age. The complete list of species, as well as a relation of all the studied material, can be found in Table 2. Species that deserve further notice, such as those with new records, are figured and discussed in the Systematics session below. Measurements were made with a digital caliper or with the aid of the Zeiss Axiovision SE64 Rel 4.8 imaging software. The following abbreviations are used herein: shell dimensions: H = shell length, D = shell greatest width, h = aperture height, d = aperture width; institutions: NHMUK = Natural History Museum (London, UK); NMSW = National Museum Wales (Cardiff, UK).

Systematics

Pulmonata
Stylommatophora
Superfamily Pupilloidea
Family Gastrocoptidae
Genus *Gastrocopta* Wollaston, 1878

***Gastrocopta sharae* sp. n.**

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Figs 2–6

Type material. Holotype: MZSP 122725 (Figs 2–4). Paratype: MZSP 122726, from type locality (Figs 5–6).

Table 2. List of all species found on the present material, with information on locality data, whether it is a new occurrence (species with new records are analyzed more thoroughly in the text) and record number of the MZSP collection. Abbreviations: **BA,** Bahia state; **GO,** Goiás state; **Can,** Gruta Cantinho; **Cat,** Gruta do Catão; **Dor,** Gruta das Dores; **FdQ,** Gruta Fundo de Quintal; **Jud,** Gruta Judite; **PdV**, Pasto de Vacas I; **Ren,** Gruta do Renatão; **Rev,** Gruta Revolucionários; **Tar,** Gruta da Tarimba; **hol,** holotype; **par,** paratype; **sh,** shell; **spc,** specimen.

Species	Family	New record?	Cave(s)	Collection Nr. (MZSP)
Neritimorpha				
Helicina angulata Sowerby, 1873	Helicinidae	–	Ren (BA)	MZSP 122761 (1 spc)
Caenogastropoda				
Pomacea sp.	Ampullariidae	–	Cat (BA)	MZSP 122776 (1 sh)
Idiopyrgus souleyetianus Pilsbry, 1911	Pomatiopsidae	–	Cat (BA)	MZSP 122772 (1 sh), 122773 (5 sh), 122774 (6 sh), 122775 (3 sh)
Pulmonata - Hygrophila				
Biomphalaria sp.	Planorbidae	–	Cat (BA), PdV (GO)	MZSP 122768 (17 sh), 122769 (1 sh), 122770 (5 sh), 122771 (3 sh), 122777 (1 sh)
Aplexa marmorata (Guilding, 1828)	Physidae	–	Jud (GO)	MZSP 122730 (1 spc)
Pulmonata - Stylommatophora				
Solaropsis sp.	Camaenidae	–	Tar (GO)	MZSP 122727 (2 spc)
Radiodiscus sp.	Charopidae	–	Tar, Rev (GO)	MZSP 122816 (1 sh), 122817 (9 sh), 131089 (2 sh), 131090 (1 sh)
Zilchogyra sp.	Charopidae	–	Dor (GO)	MZSP 122734 (1 sh)
Cecilioides consobrina (d'Orbigny, 1841)	Ferussaciidae	yes	Tar, Rev (GO)	MZSP 131578 (1 sh), 131579 (1 sh), 122756 (1 sh), 122759 (1 sh)
Gastrocopta sharae sp. nov.	Gastrocoptidae	yes	Rev (GO)	MZSP 122725 (hol), MZSP 122726 (par)
Cyclodontina sexdentata (Spix, 1827)	Orthalicidae	–	Cat (BA)	MZSP 122763 (1 spc)
Ringincella luetzelburgi Weber, 1925	Orthalicidae	–	Ren (BA)	MZSP 122762 (2 sh)
Entodina jekylli Baker, 1913	Scolodontidae	yes	Tar, Rev (GO)	MZSP 122735 (10 sh + 4 spc), 122757 (1 sh), 131091 (5 sh + 1 spc), 131092 (2 sh), 131093 (3 sh)
Happia sp.	Scolodontidae	–	Cat (BA)	MZSP 122767 (1 spc)
Happia glaberrima	Scolodontidae	–	Rev (GO), Cant (BA)	MZSP 122822 (1 spc), 122824 (1 sh), 122825 (2 sh), 122826 (4 spc), 1228227 (1 spc)
Prohappia besckei (Dunker, 1847)	Scolodontidae	yes	Can, Ren (BA); Tar, Rev (GO)	MZSP 122736 (4 sh + 1 spc), 122758 (1sh), 122760 (4 sh + 1 spc), 122764 (1 sh), 131094 (4 sh), 131095 (7 sh), 131096 (3 sh), 131097 (3 sh), 131098 (1 spc), 131099 (1 sh)
Allopeas micra (d'Orbigny, 1835)	Subulinidae	–	FdQ (GO)	MZSP 122729 (1 sh) MZSP 122732 (1 sh)
Dysopeas muibum (Marcus & Marcus, 1968)	Subulinidae	yes	Tar (GO)	MZSP 131100 (1 sh)
Leptinaria sp.	Subulinidae	–	Cat, Ren (BA)	MZSP 122765 (1 sh), 122766 (1 sh)
Leptinaria concentrica (Reeve, 1849)	Subulinidae	–	Rev (GO)	MZSP 122828 (1 spc)
Stenogyra octogyra (Pfeiffer, 1856)	Subulinidae	yes	Dor, Jud, Tar (GO)	MZSP 122728 (1 sh), 122731 (1 spc), 122733 (2 sh)
Pupisoma dioscoricola (C.B. Adams, 1845)	Valloniidae	yes	Tar, Rev (GO)	MZSP 122737 (1 sh), 122738 (1 sh), 122739 (1 sh), 131101 (1 sh)

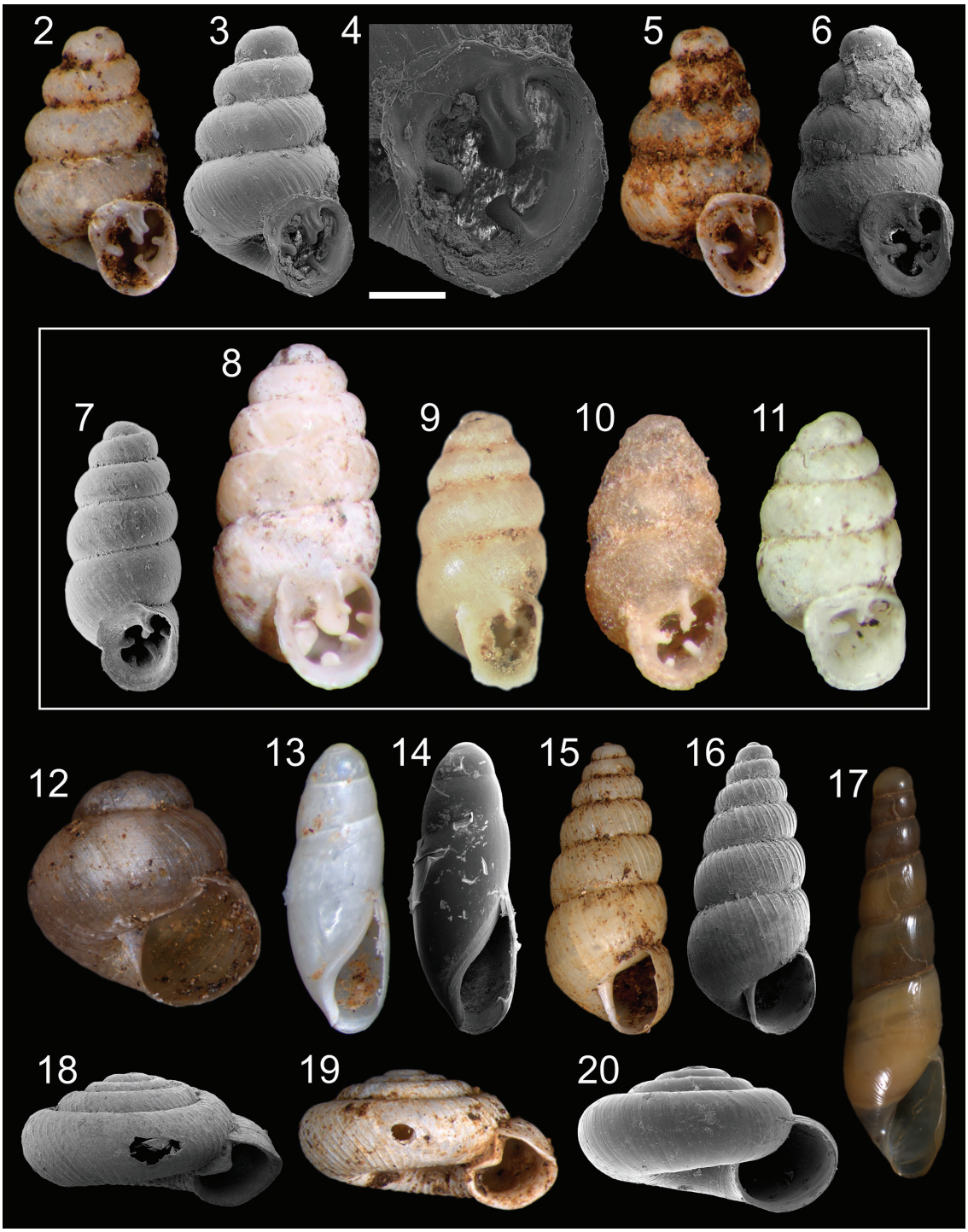
Type locality. BRAZIL, Goiás, Mambaí, Gruta Revolucionários (col. M.E. Bichuette, J.E. Gallão, D.M. Shimonsky, P.P. Rizzato, R. Borghezan; 29/iv/2013).

Distribution. Known only from the type locality (Fig. 1).

Etymology. The name refers to Shar, a fictional goddess of darkness, caverns, and secrets, from the Faerûnian pantheon of the Forgotten Realms campaign setting of the Dungeons and Dragons role-playing game.

Diagnosis. Shell pupilloid-conical. Four apertural barriers: two lamellae and two teeth). Anguloparietal lamella shaped like narrow gutter, bent towards palatal region.

Description. Shell minute (H < 2 mm), pupilloid-conical; greatest width of shell on body whorl (D/H = 0.6); body whorl ca. 1/2H; spire angle 48°. Whorl profile greatly convex; suture well-marked. Protoconch (ca. 1½ whorl) round, smooth; transition to teleoconch clearly marked by change to teleoconch sculpture. Teleoconch sculptured by strongly prosocline faint axial riblets. Aperture rounded to lightly quadrangular (d/h = 0.8; h/H = 0.4); peristome reflexed; parietal callus distinctive. Apertural barriers totaling four (Fig. 3): upper palatal tooth, lower palatal tooth, columellar lamella, anguloparietal lamella. Anguloparietal lamella shaped like narrow gutter, bent towards palatal region. After the anguloparietal lamella, the strongest barriers are the



Figures 2–20. *Gastrocopta sharae* sp. n., holotype (MZSP 122725, H = 1.9 mm, D = 1.1 mm). **2.** Apertural view; **3.** Apertural view, SEM image; **4.** Close-up of the aperture, showing dentition; scale bar = 200 µm. **5–6.** *Gastrocopta sharae* sp. n., paratype (MZSP 122726, H = 1.9 mm, D = 1.1 mm). **5.** Apertural view; **6.** Apertural view, SEM image. **7–11.** Other *Gastrocopta* spp. from Brazil, shown in apertural view. All images in scale to one another and to *G. sharae* (Figs 2, 3, 5, 6). **7.** *G. barbadensis*, from Trindade Island, SEM image (MZSP 104736, H = 1.9 mm); **8.** *G. iheringi*, probable syntype, from Bolacha, Rio Grande do Sul state (MZSP 7519, H = 2.5 mm); **9.** *G. oblonga*, from Brazil, precise provenance unknown (NMSW unnumbered, H = 2 mm); **10.** *Gastrocopta servilis*, from Fortaleza, Ceará state (MZSP 7520, H = 2 mm); **11.** *Gastrocopta solitaria*, possible holotype, from Fernando de Noronha Archipelago (NHMUK unnumbered, H = 2 mm). **12.** *Pupisoma dioscoricola*, apertural view (MZSP 131101, H = 1.6 mm, D = 1.6 mm). **13–14.** *Cecilioides consobrina* (MZSP 131579, H = 1.9 mm, D = 0.6 mm). **13.** Apertural view; **14.** Apertural view, SEM image. **15–16.** *Dysopeas muibum* (MZSP 131100, H = 5.4 mm, D = 2.3 mm). **15.** Apertural view; **16.** Apertural view, SEM image. **17.** *Stenogyra octogyra*, apertural view (MZSP 122731, H = 14.3 mm, D = 3.7 mm). **18–19.** *Entodina jekylli* (MZSP 131092, H = 1.6 mm, D = 3.1 mm). **18.** Apertural view, SEM image; **19.** Apertural view. **20.** *Prohappia besckei*, apertural view, SEM image (MZSP 131096, H = 1.0 mm, D = 1.8 mm).

lower palatal tooth and columellar lamella. Umbilicus narrow, deep.

Dimensions (in mm). Holotype: 4¼ whorls; H = 1.9; D = 1.1; h = 0.7; d = 0.6. **Paratype:** 4¼ whorls; H = 1.9; D = 1.1; h = 0.7; d = 0.6.

Discussion. The minute pupilloid shell and the pattern of apertural barriers, especially the presence of an anguloparietal lamella (formed by the fusion of the angular and parietal lamellae), place the present specimens in *Gastrocopta*. They are sufficiently different and easily diagnosable from all known *Gastrocopta* species in Brazil, which warrants the description of a new species: *Gastrocopta sharae* sp. n. Although each of the diagnostic features of *G. sharae* can be found separately in congeners (e.g., Pilsbry 1916–1918), their occurrence together is unique for this species.

Gastrocopta sharae can be easily distinguished by its strongly conical shell (Figs 2, 3, 5, 6). Nearly all Brazilian species have more pupiform/cylindrical shells: *G. barbadensis* (Pfeiffer, 1853) (Fig. 7), known from the Caribbean Islands, Venezuela, Fernando de Noronha Archipelago and Trindade Island (Cunha et al. 2015); *G. iheringi* (Suter, 1900) (Fig. 8), known only from Rio Grande do Sul state (Simone 2006); *G. oblonga* (Pfeiffer, 1852) (Fig. 9), known from Suriname to Argentina (Simone 2006); and *G. servilis* (Gould, 1843) (Fig. 10), known from Ceará and Rio de Janeiro states (Simone 2006). *Gastrocopta solitaria* (Smith, 1890) (Fig. 11), from Fernando de Noronha Archipelago, is somewhat conical, but not nearly as much as *G. sharae*.

Likewise, *G. sharae* is easily diagnosable by its narrow gutter-like anguloparietal lamella (Fig. 4), slightly bent towards the palatal region of the aperture. All the Brazilian species present a bifid weak anguloparietal lamella, with the single exception of *G. iheringi* (Fig. 8). The latter also has a gutter-like lamella, but it is much broader and straight (i.e., not bent towards the palatal region). Moreover, *G. iheringi* is much taller than *G. sharae*, reaching a shell length of 2.5 mm; this might not seem a large difference at first sight, but differences of this magnitude are usually considered to be interspecific in the family.

Family Valloniidae
Genus *Pupisoma* Stoliczka, 1873

Pupisoma dioscoricola (C.B. Adams, 1845)

Fig. 12

Synonymy see Hausdorf (2007). Complement:
Pupisoma dioscoricola: Salgado and Coelho 2003: 153.
Pupisoma discoricola [sic]: Simone 2006: 308 (fig. 9).
Pupisoma (*Ptychopatula*) *dioscoricola*: Hausdorf 2007: 1483 (Figs 1–2, 6).

Type locality. USA, Texas, Brownsville. Paralectotypes are from Mexico, San Luis Potosí, Valles Falls and Choy Cave.

Previously known distribution. From Florida, USA, to southern Brazil and northern Argentina, including the Caribbean islands (Hausdorf 2007).

New occurrence. Goiás. Mambaí: Gruta da Tarimba. Posse: Gruta Revolucionários.

Remarks. Despite the species being known throughout the Americas, the present record fills a gap in the species distribution (see the revision of Hausdorf 2007: fig. 6).

Superfamily Achatinoidea
Family Ferussaciidae
Genus *Cecilioides* Férussac, 1814

Cecilioides consobrina (d'Orbigny, 1837)

Figs 13–14

Achatina consobrina d'Orbigny 1837: 89 (pl. 11 bis, Figs 10–12); d'Orbigny 1841: 170.
Caecilioides (*Caecilianopsis*) *consobrina*: Hylton Scott 1948: 254; Morretes 1949: 131.
Cecilioides (*Karolus*) *consobrina*: Figueiras 1963: 87; Quintana 1983: 80.
Cecilioides consobrina: Parodiz 1957: 131; Salgado and Coelho 2003: 154; Simone 2006: 182 (fig. 666); Aguirre et al. 2007: 10 (fig. 4.5); Miquel et al. 2007: 114; Miquel and Aguirre 2011: 109 (fig. 8).

Type locality. Near Matanzas, Cuba.

Previously known distribution. From the Caribbean Islands to central-northern Argentina (Miquel and Aguirre 2011) and Uruguay (Figueiras 1963).

New occurrence. Goiás. Mambaí: Gruta da Tarimba. Posse: Gruta Revolucionários.

Remarks. The present record is the first occurrence for Goiás and fills a gap in the species distribution in Central Brazil.

Family Subulinidae
Genus *Dysopeas* Baker, 1927

Dysopeas muibum Marcus & Marcus, 1968

Figs 15–16

Pseudopeas (*Dysopeas*) *muibum* Marcus and Marcus 1968: 199 (Figs 11-19)
Dysopeas muibum: Simone 2006: 185 (fig. 673); Simone and Salvador 2016: 29, fig. 97, table 1.

Type locality. São Paulo, São Paulo state, Brazil.

Previously known distribution. Known only from its type locality (Marcus and Marcus 1968; Simone 2006) and Nanuque, Minas Gerais state (Simone and Salvador 2016).

New occurrence. Goiás. Mambaí: Gruta da Tarimba.

Remarks. The present record greatly expands this species distribution: ca. 720 km to the northwest.

Genus *Stenogyra* Shuttleworth, 1854

***Stenogyra octogyra* (Pfeiffer, 1856)**

Fig. 17

Bulimus octogyrus Pfeiffer 1856: 45.
Opeas octogyrum: Pilsbry 1906: 206 (pl. 29, Figs 75–79); Baker 1913: 644; Salgado and Coelho 2003: 155.
Stenogyra octogyra: Simone 2006: 188 (fig. 695).

Type locality. Caracas, Venezuela.

Previously known distribution. Venezuela and Brazil (Pará, Ceará, Rio Grande do Norte and Mato Grosso states) (Simone 2006).

New occurrence. Goiás. Mambaí: Gruta das Dores, Gruta Judite, Gruta da Tarimba.

Remarks. The present record fills a gap in the species' previously known distribution in Brazil.

Superfamily Rhytidoidea
Family Scolodontidae
Genus *Entodina* Ancey, 1887

***Entodina jekylli* Baker, 1913**

Figs 18–19

Entodina jekylli Baker 1913: 630 (pl. 22, Figs 11–13); Morretes 1949: 137; Baker 1963: 239; Salgado and Coelho 2003: 169; Simone 2006: 224 (fig. 851).

Type locality. Camp 39 of Stanford expedition, Madeira-Mamoré railway ca. 284 km above Porto Velho, Rondônia, Brazil.

Previously known distribution. Known only from type locality.

New occurrence. Goiás. Mambaí: Gruta da Tarimba. Posse: Gruta Revolucionários.

Remarks. There are two further possible records of this species from Peru and Bolívia (Ituarte et al. 2008; Ramírez et al. 2012), but the specimen figure by Ituarte et al. (2008: 83, text fig.), referred to as *Systrophia* (*Entodina*) aff. *jekylli*, is quite different from the type specimen figured by Simone (2006: 244, fig. 851B). The present specimens do compare well with the types; however, they lack the palatal tooth typical of the species (Baker 1913). This could be simple morphological variation (intraspecific differences in dentition are common in pulmonate snails), represent juvenile or sub-adult specimens or, less likely, even be an indicative that the present material represents a new species. The present record greatly extends the species distribution, ca. 2000 km southeast.

Genus *Prohappia* Thiele, 1927

***Prohappia besckei* (Dunker in Pfeiffer, 1847)**

Fig. 20

Helix Besckei Dunker *in* Pfeiffer 1847: 81; Hidalgo 1870: 37.
Happia (*Prohappia*) *besckei*: Morretes 1949: 139.
Happia besckei: Salgado and Coelho 2006: 169.
Prohappia besckei: Simone 2006: 228 (fig. 873); Simone and Salvador 2016: 29 (Figs 98–100, table 1).

Type locality. Brazil (restricted to Rio de Janeiro by Hidalgo 1870).

Previously known distribution. Brazil: Minas Gerais, Rio de Janeiro and Santa Catarina states (Simone 2006; Simone and Salvador 2016). Paraguay (Morretes 1949; Simone 2006).

New occurrence. Bahia. Igatu/Andaraí: Gruta Cantinho. São Desidério: Gruta do Renatão. **Goiás.** Mambaí: Gruta da Tarimba. Posse: Gruta Revolucionários.

Remarks. The shell morphology of the present specimens compare very well to *P. besckei*; the size of the specimens from Goiás, however, is much smaller (D ~ 2 mm), slightly larger than half the normal size. This could represent a variation of the species in a cave environment, but the sample is too small to be of any significance. The present record extends the species distribution ca. 600 km to the north.

Discussion

Many records reported here are the first for either Goiás or Bahia states (Table 2). These findings are especially important as they not only extend the geographical distribution of some species but also fill "distribution gaps" of some others; for instance, one species, *Entodina jekylli*, was previously known only from its type locality. The present records are among the few concerning molluscan cave fauna. Most caves in Brazil have no legal protection and are threatened by mining activities, but still harbor new discoveries (e.g., Simone 2013). Better known geographical distributions, as well as the presence of endemic taxa, can improve arguments for conservation. It is our hope that the present work is a step towards proper legal protection of such fragile ecosystems.

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References

Aguirre ML, Miquel SE, González CA, Kröhling D, Zucol AF, Brea M, Eastoe C (2007) Malacofauna continental holocena y paleoambientes em Villa Valle María (Diamante, Entre Ríos, Argentina). Geobios 44(1): 1–17. https://doi.org/10.1016/j.geobios.2010.06.003

Baker F (1913) The land and freshwater mollusks of Stanford Expedition to Brazil. Proceedings of the Academy of Natural Sciences of Philadelphia, 65(1914): 618–672.

Baker HB (1963) Type land shells in the Academy of Natural Sciences of Philadelphia II. Land Pulmonata, exclusive of North America, North of Mexico. Proceedings of the Academy of Natural Sciences of Philadelphia 115(8): 191–259.

Bichuette ME, Trajano E (1999) Light reaction, spontaneous and feeding behaviour in epigean and cave gastropods, *Potamolithus* spp., from Upper Ribeira karst area, southeastern Brazil (Mollusca: Gastropoda: Hydrobiidae). Mémoires de Biospéologie 26: 1–6.

Bichuette ME, Trajano E (2003) Population study of epigean and subterranean *Potamolithus* snails from southeast Brazil (Mollusca: Gastropoda: Hydrobiidae). Hydrobiologia 505: 107–117. https://doi.org/10.1023/B:HYDR.0000007299.26220.b8

Cunha CM, Salvador RB, Simone LRL (2015) The terrestrial microgastropods of Trindade Island, Brazil (Gastropoda: Pulmonata). Spixiana 38(1): 139–143.

Figueiras A (1963) Enumeración sistemática de los moluscos terrestres del Uruguay. Comunicaciones de la Sociedad Malacológica del Uruguay 1(4): 79–96.

Gallão JE, Bichuette ME (2012) A lista de fauna ameaçada de extinção e os entraves para a inclusão de espécies – o exemplo dos peixes troglóbios brasileiros. Natureza and Conservação 10(1): 83–87. https://doi.org/10.4322/natcon.2012.014

Hausdorf B (2007) Revision of the American *Pupisoma* species (Gastropoda: Pupilloidea). Journal of Natural History 41(21–24): 1481–1511. https://doi.org/10.1080/00222930701401069

Hidalgo JG (1870) Catalogue des coquilles terrestres recueiliis par les naluralistes de la commission scientifique espagnole sur divers points de l'Amerique meridionale. Journal de Conchyliologie 18: 27–70.

Hylton Scott MI (1948) Moluscos del noroeste argentino. Acta Zoológica Lilloana 6: 241–274.

Ituarte C, Cuezzo G, Ramírez R (2008) Inventario preliminar de los moluscos terrestres y de agua dulce del área de la Reserva Los Amigos. http://www.amazonconservation.org [accessed on 15/iv/2014]

Marcus E, Marcus EBR (1968) Über einige Subulinidae (Pulmonata von São Paulo). Beiträge zur Neotropischen Fauna 5(3): 186–208. https://doi.org/10.1080/01650526809360407

Miquel SE, Aguirre ML (2011) Taxonomía de los gasterópodos terrestres del Cuaternario de Argentina. Revista Española de Paleontología 26(2): 101–133.

Miquel SE, Tablado A, Sodor A (2007) Curaduría en la Colección Nacional de Invertebrados de Argentina: aportes a la biodiversidad y biogeografía de gasterópodos terrestres argentinos. Comunicaciones de la Sociedad Malacológica del Uruguay 9(90): 113–115.

Morretes FL (1949) Ensaio de catálogo dos moluscos do Brasil. Arquivos do Museu Paranaense 7: 1–216.

d'Orbigny A (1834–1847) Voyage dans l'Amérique méridionale: (le Brésil, la république orientale de l'Uruguay, la République argentine, la Patagonie, la république du Chili, la république de Bolivia, la république du Pérou), exécuté pendant les années 1826, 1827, 1828, 1829, 1830, 1831, 1832, et 1833. Tome Quatrième. P. Bertrand, Paris, 395 + 392 pp.

d'Orbigny A (1841–1845) Mollusques. In: de la Sagra R (Ed.) Histoire Physique, Politique et Naturelle de l'Ile de Cuba. A. Bertrand, Paris, 1–264 [1], 1–380 [2].

Parodiz JJ (1957) Catalogue of the land Mollusca of Argentina. The Nautilus 70: 127–135.

Pfeiffer L (1847) Diagnosen neuer Heliceen. Zeitschrift für Malakozoologie 4: 31–32, 81–84.

Pfeiffer L (1856) Diagnosen neuer Landschnecken. Malakozoologische Blätter 3: 43–52.

Pilsbry HA (1906) Manual of Conchology, Second Series. Pulmonata. Vol. 18. Achatinidae: Stenogyrinae and Coeliaxinae. Academy of Natural Sciences of Philadelphia, Philadelphia, 357 pp.

Pilsbry HA (1916–1918) Manual of Conchology, Second Series. Pulmonata. Vol. 24. Pupillidae (Gastrocoptinae). Academy of Natural Sciences of Philadelphia, Philadelphia, 380 pp.

Quintana MG (1983) Catalogo preliminar de la malacofauna del Paraguay. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Zoologia) 1(3): 61–158.

Ramírez R, Borda V, Romero P, Ramirez J, Congrains C (2012) Biodiversidad y endemismo de los caracoles terrestres *Megalobulimus* y *Systrophia* en la Amazonia occidental. Revista Peruana de Biología 19(1): 59–74. https://doi.org/10.15381/rpb.v19i1.798

Salgado NC, Coelho ACS (2003) Moluscos terrestres do Brasil (gastrópodes operculados ou não, exclusive Veronicellidae, Milacidae e Limacidae). Revista de Biología Tropical 51 (suppl. 3): 149–189.

Salvador RB, Cavallari DC, Simone LRL (2016) Taxonomical study on a sample of land snails from Alto Ribeira State Park (São Paulo, Brazil), with description of a new species. Archiv für Molluskenkunde 145(1): 59–68. https://doi.org/10.1127/arch.moll/1869-0963/145/059-068

Simone LRL (1999) Mollusca Terrestres. In Brandão CR, Cancello EM (Eds). Invertebrados Terrestres, Vol. 5. Biodiversidade do Estado de São Paulo, Brasil: síntese do conhecimento ao final do século XX. FAPESP, São Paulo, 3–8.

Simone LRL (2006) Land and freshwater mollusks of Brazil. EGB/FAPESP, São Paulo, 390 pp.

Simone LRL (2013) *Habeas*, a new genus of Diplommatinidae from Central Bahia, Brazil (Caenogastropoda), with description of three new species. Journal of Conchology 41(4): 519–525.

Simone LRL, Salvador RB (2016) Taxonomical study on a sample of land snails from Nanuque (Minas Gerais, Brazil), with description of three new species. Stuttgarter Beiträge zur Naturkunde A, Neue Serie 9: 9–30. https://doi.org/10.18476/sbna.v9.a2

Souza-Silva M, Ferreira RL (2015) Cave invertebrates in Espírito Santo state, Brazil: a primary analysis of endemism, threats and conservation priorities. Subterranean Biology 16: 79–102. https://doi.org/10.3897/subtbiol.16.5227

Trajano E (2000) Cave faunas in the Atlantic tropical rain forest: composition, ecology, and conservation. Biotropica 32(4b): 882–893.

Trajano E, Bichuette ME (2010) Diversity of Brazilian subterranean invertebrates, with a list of troglomorphic taxa. Subterranean Biology 7: 1–16. https://doi.org/10.1111/j.1744-7429.2000.tb00626.x