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First records of *Habeastrum* species from Ecuador (Gastropoda, Diplommatinidae)

Bernhard Hausdorf[1,2], Marijn T. Roosen[3,4,5,6], Elicio Tapia[1]

1 *Leibniz Institute for the Analysis of Biodiversity Change, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany*
2 *Universität Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany*
3 *Museo Ecuatoriano de Ciencias Naturales, Instituto Nacional de Biodiversidad, Quito, Ecuador*
4 *Natural History Museum of Rotterdam. Rotterdam, The Netherlands*
5 *Naturalis Biodiversity Centre. Leiden, The Netherlands*
6 *Taxon Expeditions. Leiden, The Netherlands*

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Corresponding author: Bernhard Hausdorf (B.Hausdorf@leibniz-lib.de)

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Abstract

Three new species of the genus *Habeastrum* (Gastropoda, Diplommatinidae), which was known only from Brazil until now, are described from the eastern slope of the Andes in Ecuador. *Habeastrum striolatum* Hausdorf & Tapia, **sp. nov.** from Pastaza province is characterised by a minute, elongated conical shell with dense riblets. *Habeastrum tayos* Hausdorf, Roosen & Tapia, **sp. nov.** from Pastaza, Morona-Santiago, and Napo provinces is characterised by an elongated conical, coarsely ribbed shell. *Habeastrum decussatum* Hausdorf & Tapia, **sp. nov.** from Sucumbios province is characterised by a wide, elongated conical shell with fine ribs crossed by spiral lines.

Key Words

Biogeography, caves, distribution, South America, taxonomy

Introduction

Simone (2019) established a new genus *Habeastrum* for two minute microsnail species, which were discovered in caves in Mato Grosso do Sul, Brazil. He tentatively classified *Habeastrum* in the caenogastropod family Diplommatinidae based on shell characters. Simone et al. (2020) described a third *Habeastrum* species from caves in Minas Gerais, Brazil, and confirmed its classification in Diplommatinidae based on anatomical characters. Diplommatinidae Pfeiffer, 1857 (Caenogastropoda: Cyclophoroidea) is a species-rich family of terrestrial microsnails (Kobelt 1902; Thiele 1929; Wenz 1938–1939). The Diplommatinidae is represented by several genera and more than 500 species in eastern and southern continental Asia, Sri Lanka, Japan, Taiwan, Indonesia, the Philippines, Northern Australia, Melanesia, Micronesia and Samoa (Kobelt 1902; Thiele 1929; Wenz 1938–1939). Some groups from Madagascar that were included in Diplommatinidae by some authors (e. g. Emberton 1994) were transferred to Boucardicinae (Hainesiidae) by Páll-Gergely et al. (2024). In South America, Diplommatinidae is represented by *Adelopoma* Döring, 1885, which is closely related to the mainly Southeast Asian genus *Diplommatina* Benson, 1849, which may even be paraphyletic with regard to *Adelopoma* (Webster et al. 2012; Köhler 2023; Páll-Gergely et al. 2024), and the genus *Habeastrum* Simone, 2019, which was only recently discovered in Brazil.

Records of Diplommatinidae are scarce within Ecuador. Breure et al. (2022) did not report any diplommatinid species from this country based on the literature available at that time. Later, Greķe et al. (2023) described a single species of *Adelopoma* from Ecuador, proving that Diplommatinidae do occur there.

We discovered three new *Habeastrum* species at the eastern slope of the Andes in Ecuador, more than 3000 km northwest of the so far known distribution of the genus in Brazil. In the following, these new *Habeastrum* species are described.

Materials and methods

The examined material is deposited in the Invertebrate collection of the Zoological Museum of the Pontificia Universidad Católica, Quito, Ecuador (QCAZI), the Instituto Nacional de Biodiversidad in Quito, Ecuador (INABIO), and the Zoological Museum of the Leibniz Institute for the Analysis of Biodiversity Change, Hamburg, Germany (ZMH). The number behind the slash after the collection number in the material lists denotes the number of individuals. SEM images of the shells were taken using a Hitachi TM4000Plus. Measurements (in mm) were taken in the images using Adobe Photoshop. Height was measured parallel to the coiling axis and diameter perpendicular to the coiling axis. The number of shell whorls was counted with an accuracy of 0.25 whorls using the method described by Kerney and Cameron (1979). The classification of the ecosystems is according to Ministerio del Ambiente del Ecuador (2013).

Results

Diplommatinidae Pfeiffer, 1856

Habeastrum Simone, 2019

Habeastrum Simone, 2019: 287. Type species (by original designation): *Habeastrum parafusum* Simone, 2019.

Diagnosis. *Habeastrum* is characterised by minute dextral, elongated conical to cylindrical shells with regularly increasing whorls, an open umbilicus, and a non-expanded peristome.

Habeastrum striolatum Hausdorf & Tapia, sp. nov.

https://zoobank.org/D06ADC2F-1D1A-401B-AB22-FE1022DE56F7

Fig. 1A–F, Tables 1, 2

Type material. ***Holotype*:** Ecuador, Pastaza province: • Puyo, Chuwitayo, Cueva de los Tayos, inside the cave on the bottom of a 100 m vertical sinkhole, 1.9511°S, 77.7884°W, 740 m a.s.l., 24.11.2025, E. Tapia leg., QCAZI 282654. ***Paratypes*:** • same data as holotype: QCAZI 282655/1; ZMH-MOL-165097/2.

Diagnosis. Shell minute (1.3 mm high), white, elongated conical, with 5.25–5.5 strongly convex whorls, protoconch with indistinct, radial wrinkles, teleoconch with dense riblets (26–38 ribs/0.5 mm), and a narrow umbilicus taking 9–11% of the shell diameter.

Description. Shell elongated conical; 5.25–5.5 strongly convex whorls; protoconch (c. 2 whorls) with indistinct, radial wrinkles; teleoconch with dense riblets (26–38 riblets/0.5 mm on ventral side of body whorl); white; aperture almost circular, prosocline; peristome continuous, attached to body whorl, not expanded, not reflexed and hardly thickened on the inside; umbilicus open, narrow, taking 9–11% of shell diameter. Measurements see Table 2.

Etymology. Named after the striolate sculpture with fine linear ridges (Latin striolatus, striated, used as an adjective).

Distribution. *Habeastrum striolatum* sp. nov. is known only from the inside of the Cueva de los Tayos in piedmont evergreen forest on limestone outcrops of the Amazonian Cordilleras in Pastaza province in Ecuador at 740 m a.s.l.

Remarks. *Habeastrum striolatum* sp. nov. resembles the sympatric *Habeastrum tayos* sp. nov. in shell form and size, but differs from it in the finer and denser ribbing (Table 2). *Habeastrum striolatum* sp. nov. is smaller than the Brazilian *Habeastrum* species. Concerning shell form, *Habeastrum striolatum* sp. nov. is intermediate between the shorter conical *Habeastrum omphalium* Simone, 2019, and longer conical *Habeastrum strangei* Simone, Cavallari & Salvador, 2020. *Habeastrum parafusum* Simone, 2019 has a more cylindrical-conical shell. The sculpture of *Habeastrum striolatum* sp. nov. (26–38 riblets/0.5 mm on ventral side of body whorl) is most similar to that of *H. omphalium* (ca. 22 riblets/0.5 mm), but this species has faint spiral lines between the ribs, which are lacking in *H. striolatum* sp. nov. The ribbing is more dense in *H. parafusum* (ca. 40 riblets/0.5 mm), and less dense in *H. strangei* (ca. 9 riblets/0.5 mm).

Habeastrum tayos Hausdorf, Roosen & Tapia, sp. nov.

https://zoobank.org/1771F906-399A-4BAC-BE5A-474312E9547A

Fig. 1G–L, Tables 1, 2

Type material. ***Holotype*:** Ecuador, Pastaza province: • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9478°S, 77.7875°W, 740 m a.s.l., 07.11.2025, E. Tapia & A. Guasti leg., QCAZI 282656. ***Paratypes*:** Ecuador, Pastaza province: • same data as holotype. QCAZI 282657/1; ZMH-MOL-165103/5. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9477°S, 77.7877°W, 750 m a.s.l., 07.11.2025, E. Tapia & A. Guasti leg., ZMH-MOL-165577/1. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9475°S, 77.7879°W, 760 m a.s.l., 08.11.2025, E. Tapia & A. Guasti leg., ZMH-MOL-165578/2. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9473°S, 77.7875°W, 750 m a.s.l., 08.11.2025, E. Tapia & A. Guasti leg., INABIO-MCL-1255/1, ZMH-MOL-165579/1. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9479°S, 77.7873°W, 720 m a.s.l., 08.11.2025, E. Tapia & A. Guasti leg., QCAZI 282658/3, ZMH-MOL-165580/3. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9481°S, 77.7869°W, 730 m a.s.l., 09.11.2025,

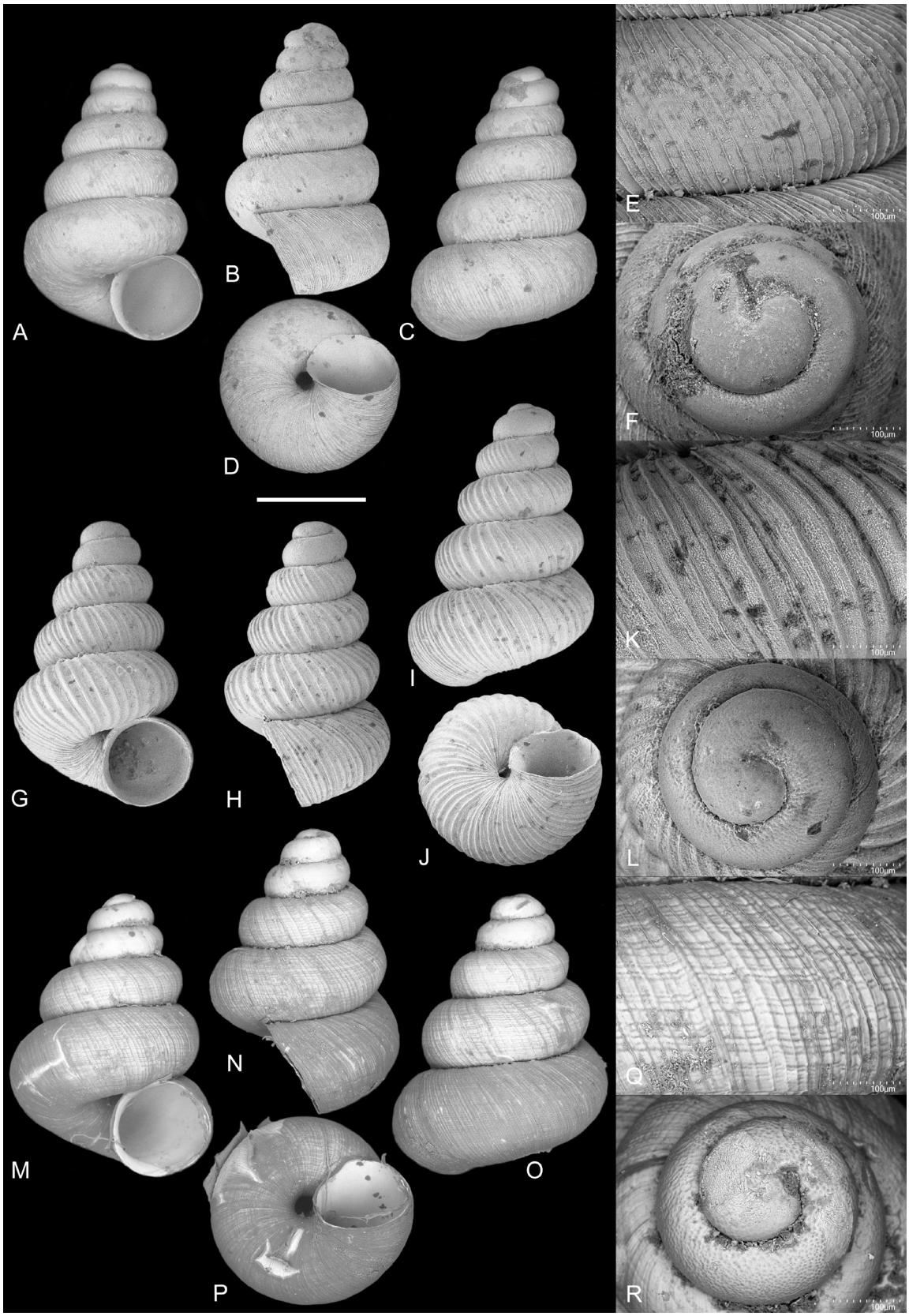

Figure 1. Shells of *Habeastrum* species. **A–F.** *Habeastrum striolatum* Hausdorf & Tapia, sp. nov., Ecuador, Pastaza province, Puyo, Chuwitayo, Cueva de los Tayos, inside cave (holotype QCAZI 282654). **G–L.** *Habeastrum tayos* Hausdorf, Roosen & Tapia, sp. nov., Ecuador, Pastaza province: Puyo, Chiwitayu, Cueva de los Tayos area (QCAZI 282656). **M–R.** *Habeastrum decussatum* Hausdorf & Tapia, sp. nov., Ecuador, Sucumbios province, Lumbaqui, via la Troncal km 12, sector Dumbique, Dashino River (QCAZI 282661). **A**, **G**, **M.** Ventral view of shell; **B**, **H**, **N.** Lateral view of shell; **C**, **I**, **O.** Dorsal view of shell; **D**, **J**, **P.** Umbilical view of shell; **E**, **K**, **Q.** Detail of sculpture of last whorl; **F**, **L**, **R.** Protoconchs. Scale bar: 0.5 mm for whole shell photos.

Table 1. Characteristics of *Habeastrum* species.

Species	D	H	D/H	Shell shape	W	U/D	Sculpture	Protoconch
Habeastrum striolatum Hausdorf & Tapia, sp. nov.	0.77–0.82; mean 0.80; std. dev. 0.03 (n = 3)	1.26–1.27; mean 1.28; std. dev. 0.03 (n = 3)	0.61–0.64; mean 0.62; std. dev. 0.02 (n = 3)	slender conical	5.25–5.5	0.09–0.11; mean 0.10; std. dev. 0.01 (n = 3)	26–38 riblets per 0.5 mm on body whorl	with indistinct, radial wrinkles
Habeastrum tayos Hausdorf, Roosen & Tapia, sp. nov.	0.75–0.91; mean 0.81; std. dev. 0.04 (n = 13)	1.19–1.53; mean 1.35; std. dev. 0.10 (n = 13)	0.56–0.76; mean 0.61; std. dev. 0.05 (n = 13)	slender conical	4.5–5.5	0.0–0.07; mean 0.05; std. dev. 0.03 (n = 13)	8–12 coarse ribs per 0.5 mm on body whorl	with a dense pattern of wavy wrinkles
Habeastrum decussatum Hausdorf & Tapia, sp. nov.	0.92–0.93; mean 0.93; std. dev. 0.01 (n = 2)	1.31–1.32; mean 1.31; std. dev. 0.01 (n = 2)	0.70–0.71; mean 0.71; std. dev. 0.01 (n = 2)	wide conical	4.5	0.08–0.10; mean 0.09; std. dev. 0.01 (n = 2)	24–25 riblets per 0.5 mm on body whorl, crossed by spiral lines	with dense, irregular indentations
Habeastrum parafusum Simone, 2019	0.7–0.9	1.1–1.7	0.47–0.64	cylindrical-conical	c. 7	0.12	22 riblets per 0.5 mm on body whorl	with minute radial wrinkles
Habeastrum omphalium Simone, 2019	0.9–1.1	1.0–1.6	0.69–0.90	wide conical	c. 5	0.25	40 riblets per 0.5 mm on body whorl	with minute radial wrinkles
Habeastrum strangei Simone, Cavallari & Salvador, 2020	ca 1	ca 2	0.50	slender conical	7–7.5	0.12	9 riblets per 0.5 mm on body whorl	smooth

D, large diameter of shell; H, height of shell; n, number of measured individuals; std. dev., standard deviation; U, width of umbilicus; W, number of whorls.

Table 2. Measurements of *Habeastrum* species (in mm).

	D	H	da	ha	U	W	D/H	da/D	ha/H	da/ha	U/D	R
Habeastrum striolatum sp. nov., Cueva de los Tayos (holotype QCAZI 282654)	0.82	1.27	0.42	0.39	0.08	5.5	0.64	0.51	0.31	1.07	0.10	26
Habeastrum striolatum sp. nov., Cueva de los Tayos (paratype ZMH-MOL-165097)	0.81	1.31	0.43	0.40	0.07	5.5	0.61	0.53	0.30	1.08	0.09	31
Habeastrum striolatum sp. nov., Cueva de los Tayos (paratype ZMH-MOL-165097)	0.77	1.26	0.41	0.37	0.08	5.25	0.61	0.53	0.29	1.10	0.11	38
Habeastrum tayos sp. nov., Cueva de los Tayos area (holotype QCAZI 282656)	0.82	1.31	0.42	0.40	0.06	5	0.62	0.51	0.31	1.04	0.07	9
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype QCAZI 282657)	0.88	1.48	0.44	0.41	0.07	5.5	0.59	0.50	0.28	1.05	0.08	9
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype ZMH-MOL-165103)	0.79	1.26	0.40	0.38	0.07	5	0.63	0.51	0.30	1.07	0.09	10
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype ZMH-MOL-165103)	0.76	1.19	0.36	0.37	0.06	4.75	0.76	0.76	0.76	0.76	0.08	9
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype INABIO-MCL-1255)	0.80	1.36	0.41	0.32	0.00	5	0.59	0.51	0.24	1.26	0.00	8
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype ZMH-MOL-165579)	0.80	1.42	0.42	0.35	0.00	5.5	0.56	0.52	0.25	1.20	0.00	11
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype QCAZI 282657)	0.80	1.26	0.40	0.35	0.00	4.5	0.63	0.51	0.27	1.16	0.00	10
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype QCAZI 282657)	0.80	1.32	0.41	0.39	0.05	5	0.61	0.51	0.29	1.05	0.06	9
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype ZMH-MOL-165580)	0.86	1.53	0.45	0.43	0.00	5.5	0.56	0.53	0.28	1.05	0.00	10
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype QCAZI 282659)	0.91	1.43	0.46	0.39	0.05	4.5	0.63	0.51	0.27	1.19	0.06	12
Habeastrum tayos sp. nov., Cueva de los Tayos area (paratype ZMH-MOL-165581)	0.81	1.31	0.42	0.41	0.04	5	0.62	0.51	0.31	1.01	0.05	11
Habeastrum tayos sp. nov., Sunka Biological Station (paratype INABIO-MCL-1253)	0.96	1.60	0.51	0.51	0.01	6	0.6	0.53	0.31	1.00	0.02	11
Habeastrum tayos sp. nov., Sunka Biological Station (paratype INABIO-MCL-1254)	0.98	1.60	0.44	0.48	0.01	6	0.61	0.45	0.30	0.91	0.01	12
Habeastrum tayos sp. nov., Tena, Cotundo, Santa Helena de los Guacamayos towards Cosanga (ZMH-MOL-165576)	0.81	1.31	0.43	0.38	0.05	5.25	0.62	0.53	0.29	1.12	0.06	10
Habeastrum tayos sp. nov., Chaco, Oyacachi (ZMH-MOL-165583)	0.75	1.32	0.39	0.34	0.03	5	0.57	0.52	0.25	1.15	0.04	10
Habeastrum decussatum sp. nov., Lumbaqui, via la Troncal km 12 (holotype QCAZI 282661)	0.93	1.31	0.46	0.44	0.09	4.5	0.71	0.49	0.33	1.04	0.10	25
Habeastrum decussatum sp. nov., Lumbaqui, via la Troncal km 12 (paratype ZMH-MOL-165491)	0.92	1.32	0.46	0.44	0.08	4.5	0.70	0.50	0.33	1.06	0.08	24

D, large diameter of shell; H, height of shell; da, diameter of aperture; ha, height of aperture; R, ribs/0.5 mm on body whorl; U, width of umbilicus; W, number of whorls.

E. Tapia leg., QCAZI 282659/2, ZMH-MOL-165581/2. • Puyo, Chiwitayu, Cueva de los Tayos area, 1.9482°S, 77.7867°W, 730 m a.s.l., 09.11.2025, E. Tapia leg., QCAZI 282660/1, ZMH-MOL-165582/2. – Ecuador, Morona-Santiago province: • Sunka Biological Station, sampling station SU7, 2.0667°S, 77.7500°W, 1032 m a.s.l., 01.03.2026, M.T. Roosen & L. Tucupi Catan leg., INABIO-MCL-1253/1, INABIO-MCL-1254/1.

Other material. Ecuador, Napo province: •Tena, Cotundo, Santa Helena de los Guacamayos towards Cosanga, 0.6609°S, 77.7930°W, 1700 m a.s.l., 07.11.2025, D. Kammin, K. Kopp & E. Tapia leg., ZMH-MOL-165576/1. Chaco, Oyacachi, 0.22109°S, 78.04959°W, 3090 m a.s.l., 16.11.2025, D. Kammin, K. Kopp & E. Tapia leg., ZMH-MOL-165583/1.

Diagnosis. Shell minute (1.2–1.6 mm high), white, elongated conical, with 4.5–6 strongly convex whorls, coarse ribs (8–12 ribs/0.5 mm), and a narrow umbilicus taking 7% of the shell diameter.

Description. Shell elongated conical; 4.5–6 strongly convex whorls; protoconch (c. 2 whorls) with a dense pattern of wavy wrinkles; teleoconch coarsely ribbed (8–12

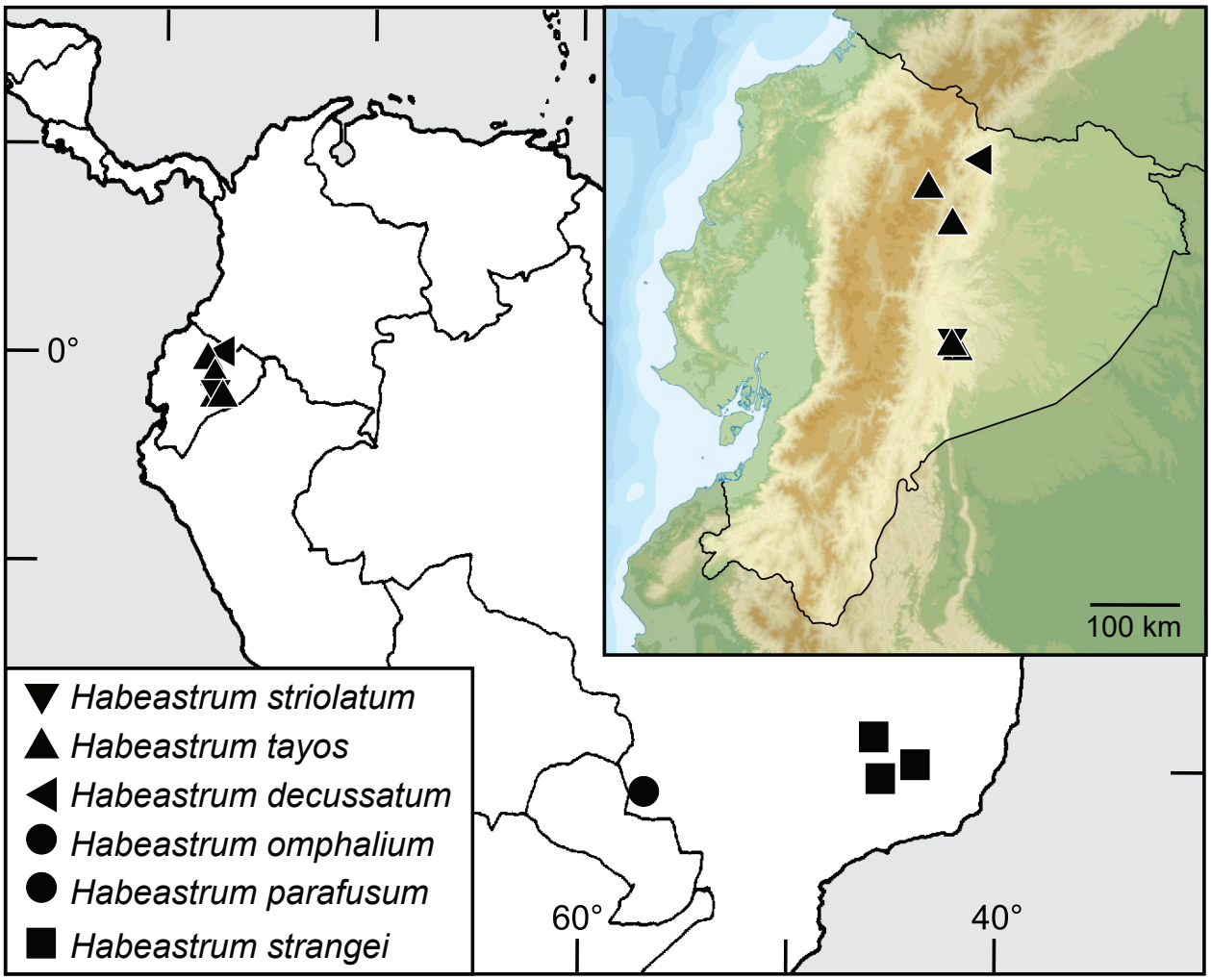

Figure 2. Distribution of *Habeastrum* species in South America. Insert: distribution of *Habeastrum* species in Ecuador enlarged.

ribs/0.5 mm on ventral side of body whorl); white; aperture circular, prosocline; peristome continuous, attached to body whorl, not expanded, not reflexed and hardly thickened on the inside; umbilicus open, narrow, taking up to 7% of shell diameter. Measurements see Table 2.

Etymology. The specific epithet refers to the oilbird (*Steatornis caripensis* Humboldt, 1817), also known as the 'tayo' in Spanish (used as a noun in apposition). This species breeds in caves, many of which are named after it, including caves at the type locality and around Sunka.

Distribution. *Habeastrum tayos* sp. nov. is known from piedmont evergreen forest on limestone outcrops in the Amazonian Cordilleras in Pastaza and Morona-Santiago provinces at 720–1032 m a.s.l. It was found in litter between calcareous rocks. Similar shells were found at higher altitudes in low montane evergreen forest of the northern Eastern Andes (1700 m a.s.l.) and in high montane evergreen forest of the northern Eastern Andes (3090 m a.s.l.) in Napo province. There they occurred in a very acidic habitat without calcareous rocks. Their specific identity has to be proven, given the different habitats. There were no statistical differences between the eleven measured specimens from Pastaza and the two specimens from the Eastern Andes in the shell dimensions (Student's t-tests, two-tailed: diameter of shell, $p = 0.37$; height of shell, $p = 0.27$).

Remarks. *Habeastrum tayos* sp. nov. differs from all the other known *Habeastrum* species in the much coarser ribbing (Table 2).

Habeastrum decussatum Hausdorf & Tapia, sp. nov.

https://zoobank.org/103D1404-AA22-4422-A9FC-57EEC865672A

Fig. 1M–R, Tables 1, 2

Type material. ***Holotype*:** Ecuador, Sucumbios province: • Lumbaqui, via la Troncal km 12, sector Dumbique, Dashino River, in leaf litter at base of non-calcareous rocky wall in a small river cliff, 0.0364°S, 77.2997°W, 500 m a.s.l., 22.07.2025, E. Tapia & A. Guasti leg., QCAZI 282661. ***Paratypes*:** • same data as holotype: QCAZI 282662/1; ZMH-MOL-165491/2.

Diagnosis. Shell minute (1.3 mm high), corneous-brown, wide, elongated conical, with 4.5 strongly convex whorls, protoconch (2 whorls) with dense, irregular indentations, teleoconch with fine ribs (24–25 ribs/0.5 mm) crossed by spiral lines, and a narrow umbilicus taking 8–10% of the shell diameter.

Description. Shell elongated conical; 4.5 strongly convex whorls; protoconch (c. 2 whorls) with dense, irregular indentations; teleoconch finely ribbed (24–25 ribs/0.5 mm on ventral side of body whorl) crossed by distinct spiral lines; corneous-brown; aperture circular, prosocline; peristome continuous, attached to body whorl, not expanded, not reflexed and hardly thickened on the inside; umbilicus open, narrow, taking 8–10% of shell diameter. Measurements see Table 2.

Etymology. Named after the decussate sculpture consisting of fine radial ribs crossed by spiral lines (Latin decussatus, marked with lines intersecting cross-wise, used as an adjective).

Distribution. *Habeastrum decussatum* sp. nov. is only known from piedmont evergreen forest in the north of the Eastern Cordillera in Sucumbios province in Ecuador at 500 m a.s.l.

Remarks. *Habeastrum decussatum* sp. nov. differs from all other *Habeastrum* species in the wide conical shell with fine radial ribs crossed by distinct spiral lines on the teleoconch, and distinct irregular indentations on the protoconch (Table 2).

Discussion

Not much is known about the ecology of the *Habeastrum* species. All Brazilian *Habeastrum* species are known only from caves in karst areas. Of the species in Ecuador, only *Habeastrum striolatum* sp. nov. was collected inside a cave in a karst area. *Habeastrum tayos* sp. nov. was collected exclusively outside caves. Nevertheless, *Habeastrum tayos* sp. nov. may also be a subterranean species that lives in rock crevices, and its empty shells are occasionally washed out. *Habeastrum decussatum* sp. nov. has even been found on non-calcareous bedrocks. In contrast to the other two species, which are whitish, *Habeastrum decussatum* sp. nov. is corneous-brown, indicating that it may live on the soil surface rather than subterranean.

The *Habeastrum* species resemble the Southeast Asian *Acmella* Blanford, 1869 (Assimineidae) species (Das et al. 2021), which also often inhabit caves. However, the duplication of the eyes, the eponymous autapomorphy of the Diplommatinidae or of a subgroup of this family, apparently confirms the classification of *Habeastrum* in the Diplommatinidae (Simone et al. 2020). In line with this classification, *Habeastrum* has a plesiomorphic hypoathroid central nervous system (Simone et al. 2020), in contrast to the apomorphic epiathroid nervous system of Sorbeoconcha, to which the Assimineidae belong, and lacks a seminal vesicle, another autapomorphy of Sorbeoconcha (Ponder et al. 2008). However, *Habeastrum* has a coiled radular sac (Simone et al. 2020), which is also considered an autapomorphy of Sorbeoconcha (Ponder et al. 2008). Obviously, further investigations of its phylogenetic relationships are required.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Artificial Intelligence (AI) use

The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI.

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Author contributions

All authors have contributed equally.

Author ORCIDs

B. Hausdorf https://orcid.org/0000-0002-1604-1689

M.T. Roosen https://orcid.org/0000-0001-7651-6685

E. Tapia https://orcid.org/0000-0001-9005-5328

Data availability

All of the data that support the findings of this study are available in the main text.