

The continental malacofauna of Arabia and adjacent areas.

I. Terrestrial molluscs of Samha and Darsa Islands (Al-Ikhwan), Socotra Archipelago, Yemen

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Abstract: The previously unknown terrestrial malacofauna of the islands Samha and Darsa of the Socotra Archipelago is presented. The malacofauna consists of nine species, eight of which are new to science. Eight of these species are recorded from Samha, and two from Darsa. The islands have one species in common. The following new genus- and species-level taxa are described: *Microscintilla* n. gen., *Lithidion giganteum* n. sp., *Lithidion suturalis* n. sp., *Lithidion zajonzi* n. sp., *Cyclotopsis mirandae* n. sp., *Riebeckia sordida* n. sp., *Microscintilla mamillata* n. sp., *Microscintilla duodentata* n. sp., *Achatinelloides samhaensis* n. sp.

مجموعة الرخويات القارية في شبه الجزيرة العربية والمناطق المجاورة
١. الرخويات البرية في جزيرتي سمحة ودرسة (الأقحوان)، أرخبيل سوقطرة، اليمن

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خلاصة: تم وصف مجموعة الرخويات البرية غير المعروفة حتى الآن من جزيرتي سمحة ودرسة في أرخبيل سوقطرة. تتألف هذه المجموعة من تسعة أنواع، ثمانية منها جديدة للعلم. تم تسجيل ثمانية أنواع منها من جزيرة سمحة ونوعين من جزيرة درسة، وهناك نوع واحد مشترك بين الجزيرتين. كذلك تم وصف جنس جديد وثمانية أنواع جديدة.

INTRODUCTION

This paper describes the hitherto unknown malacofauna of the islands Samha and Darsa (The Brothers) of the Socotra Archipelago. Astonishingly, the terrestrial molluscs of these islands were never collected, although the archipelago has been visited by several expeditions throughout the last 150 years. For reasons unknown, these early naturalists only visited Socotra and Abd al-Kuri, and so one of the purposes of our expeditions was to fill this gap in the knowledge of the biota of the archipelago as a whole.

This paper marks the start of a series of publications that will report on the malacofauna not only of the Arabian Peninsula but also of neighbouring areas. The main interest is focused on the biogeographical significance of the Arabian malacofauna. Composed of elements from three

continents, the molluscs inhabiting the peninsula offer a rich source of information (NEUBERT 1998). The Gondwana connection between the malacofauna of South Africa and the East African Islands is well known. The significance of this connection to the respective faunas of north-east Africa, Arabia and the areas of the Middle East to north-west India is often underestimated. Here, geological conditions changed quite rapidly in the last 20 million years, if we consider the large areas that were open for settlement after the regression of the Tethys. Massive orogenesis and plate tectonics deeply changed the whole area and forced slow-moving animals, like molluscs, to tolerate the environment or to perish.

The fragmentation of the Afro-Arabian plate, which finally gave birth to the little archipelago of Socotra, is mirrored by the rich and highly endemic malacofauna, not only of the archipelago as a whole, but also within the islands themselves. Trapped many million years ago on this microplate, the isolated continental Tertiary malacofauna was forced to adapt to island conditions. This created a situation that makes a comparison with other islands of continental origin necessary. In this context, Madagascar and the Seychelles are of crucial interest because they started with a similar "taxonomic substratum" and have been isolated for even longer.

MATERIALS AND METHODS

The specimens were collected during an expedition to Socotra in 1999. These studies were conducted within the framework of the project "Conservation and Sustainable Use of Biodiversity of Socotra Archipelago". Specimens examined are kept in the Natural History Collection Yemen (NHCY) and in the Forschungsinstitut Senckenberg (SMF). The voucher specimens for NHCY are provisionally deposited in the malacological department of SMF. The numbers given in parentheses, or those following the SMF catalogue number, refer to the total number of specimens collected. Unless stated otherwise, all collections were of dead shells.

All measurements are in millimetres. To provide an easily accessible measurement of the relationship of shell height to diameter, a body index (B_I) is used, which is calculated as height / diameter \times 100. Turreted shells thus have values higher than 100, sphaeroidal shells around 100, and flat shells have values considerably lower than 100.

Abbreviations:

B_I	shell body index
D	shell diameter
D_{max}	maximum shell diameter
D_{min}	minimum shell diameter
$D_{operculum}$	maximum diameter of the operculum
H	shell height
H_{max}	maximum shell height
H_{min}	minimum shell height
W	number of whorls
HLMD	Hessisches Landesmuseum Darmstadt, Germany
NHCY	Natural History Collection Yemen
SMF	Senckenberg Research Institute and Natural History Museum, Frankfurt a.M., Germany

SYSTEMATIC ACCOUNT

Family Pomatiidae

A comprehensive and standardised treatment of the tropical pomatiid genera is lacking. Assigning a species to a generic name often uses traditional characters that in several cases have turned out to be unsuitable or worse – misleading. For this reason, the generic limits used herein are provisional. An additional investigation concerning the nominal genus-level taxa of the area is in preparation.

Genus *Revoilia* (*Socotora*) Pallary, 1925

1925 *Socotora* Pallary. — Geol. Survey Egypt 1925: 231.

1925 *Arabia* Pallary. — Geol. Survey Egypt 1925: 232.

Type species: *Cyclostoma albicans* Gray & Sowerby, 1839. For remarks see NEUBERT (1998).

Revoilia (*Socotora*) cf. *albicans* (Gray & Sowerby, 1839)

1839 *Cyclostoma albicans* Gray & Sowerby. — The zoology of Capt. Beechey's voyage [...]: 146, pl. 38, fig. 30.

1881 *Otopoma complanatum* Godwin-Austen. — Proc. Zool. Soc. Lond. 1881: 254, pl. 27, figs 3, 3 a.

1882 *Otopoma socotranum* Bourguignat. — Mission de G. Révoil au pays Çomalis. Faune et Flore des Pays Çomalis: 64.

Specimens examined: Yemen, Socotra Archipelago: Samha Island, south-western slope, 12°10.00'N 53°01.50'E, 240-450 m, 16.II.1999, NHCY (2), SMF 322959/2; Samha Island, Dinatuf, western coastal plain, at the small well opposite Darsa, 12°09.21'N 53°05.26'E, 15.II.1999, NHCY (2), SMF 322960/2; Darsa Island, north coast, at the central coastal plain, 10-200 m, c. 12°07.500'N 53°17.500'E, 19.IV.1999, U. Zajonz et al., NHCY (4), SMF 322961/4; Darsa Island, semi-arid plain, 5-20 m, c. 12°07'60"N 53°17'30"E, 08.IV.2000, T. Wehe, NHCY (2), SMF 322962/2.

This is a medium-sized *Revoilia* (*Socotora*) species with a fine spiral sculpture on the teleoconch whorls and a malleate subsurface. The shell sizes vary considerably, the large shells have a height of 25 mm and a diameter of up to 35 mm. In the lots from Darsa, normal-sized shells occur along with small shells of 14 × 19.5 mm, both shell types with 5.5 whorls. This enormous difference seems not to be caused by sexual dimorphism, as a few shells show intermediate sizes.

Distribution: This species is known to inhabit large areas on Socotra Island and is recorded here for the first time from Samha and Darsa.

Remarks: The species of *Revoilia* (*Socotora*) are currently under revision, and the identification of the specimens from Samha and Darsa with *R. (S.) albicans* remains provisional. The synonymy given here describes the current state of knowledge for this species and follows CROWLEY & PAIN (1978).

Genus *Lithidion* Gray, 1850

1850 *Lithidion* Gray in Baird. — Nomen. Moll. Coll. Brit. Mus. I: 35.

Type species: *Cyclostoma lithidion* Sowerby, 1847.

Diagnosis: Flat discoidal to subspherical shell with a wide umbilicus. Shell surface smooth to ribbed, outer and inner surfaces of the operculum smooth. Two characteristic lobes on the columellar side of the outer surface.

Lithidion giganteum n. sp.

Figs 1-5

Holotype: SMF 322963, Yemen, Socotra Archipelago, Samha Island, south-western slope, 12°10.00'N 53°01.50'E, 0-240 m, 16.II.1999. — Paratypes: same data as holotype, NHCY (10), SMF 322964/9, HLMD-MOL-321-PT. — Non-type specimens: Yemen, Socotra Archipelago: Samha Island, Dinatuf, western coastal plain, at the small well opposite Darsa, 12°09.21'N 53°05.26'E, 15.II.1999, NHCY (8), SMF 322965/8; Samha Island, south-western slope, 12°10.00'N 53°01.50'E, 240-450 m, 16.II.1999, NHCY (3), SMF 322966/3.

Diagnosis: Shell almost flat, unusually large when compared to other species of the genus. Only a few ridges on the shining upper shell surface. Umbilicus wide open.

Description: The shell is almost completely flat, only the protoconch is slightly elevated. The protoconch is sculptured with extremely fine granules. The surface of the teleoconch is covered with low spiral cords; their interspace is filled by fine axial streaks. The suture is appressed to the preceding whorl. The periphery may be dominated by a single spiral which is somewhat stronger. The subsurface of the shell is almost smooth and shining, the spirals are weak. The umbilicus is wide, dish-like, and the umbilical suture is shallow. The basic colour varies from completely white to yellowish cream. Often, the shell is ornamented by a pattern of dark brown axial stripes. Additionally, many shells show a reddish brown spiral band running on the surface of the shell, and a second spiral band sometimes occurs below the periphery. Colourful specimens also show a strong circular reddish band inside the aperture.

The aperture is almost circular and somewhat oblique. The upper rim is considerably protruded, covering the aperture like a triangular roof. The peristome is evenly strengthened by a white lip. The parietal callus is weak to almost missing.

The operculum displays a bilobed subquadrate shape. The outer surface is slightly convex and covered by a thickened shining calcareous layer disguising its spiral structure. The lower lobe shows a small oblique ridge; the ridge of the upper lobe is not fully developed. The inner surface is covered by a thin spiral membrane.

Measurements: Holotype: H = 5.25; D = 16.45; W = 5.00; $D_{\text{operculum}} = 4.60$. — Paratypes (n = 21): H = 5.31 ± 0.37 ; D = 16.32 ± 0.91 ; $D_{\text{min}} = 14.20$, $D_{\text{max}} = 17.84$; $H_{\text{min}} = 4.55$, $H_{\text{max}} = 6.01$; $B_I = 308 \pm 17$.

Distribution: This species is known to inhabit the eastern and southern slopes of the limestone outcrop of Samha Island. Interestingly, it could not be found on the northern coast. It occurs from the coastal plain up to an elevation of 450 m. There was no sympatric occurrence with the second *Lithidion* species, as this species starts at an altitude of about 600 m. *Lithidion giganteum* n. sp. lives in crevices of crystalline rocks and limestone boulders which form part of the erosion slopes.

Etymology: This new species is called *giganteum*, because it is the biggest *Lithidion* species known.

Remarks: *Lithidion giganteum* n. sp. differs from the other *Lithidion* species in the rest of the archipelago by its extraordinarily large size. It can easily be distinguished from *L. suturalis* n. sp. and *L. zajonzi* n. sp. by its flat shell and surface sculpture, as the two other species have an elevated spire, their spirals are stronger and extend to the subsurface of the shell. The opercula of the other two *Lithidion* species described herein have a low spiral ridge on the outer surface. The umbilicus of *L. giganteum* is much wider than in the other species and the internal suture is always shallow.

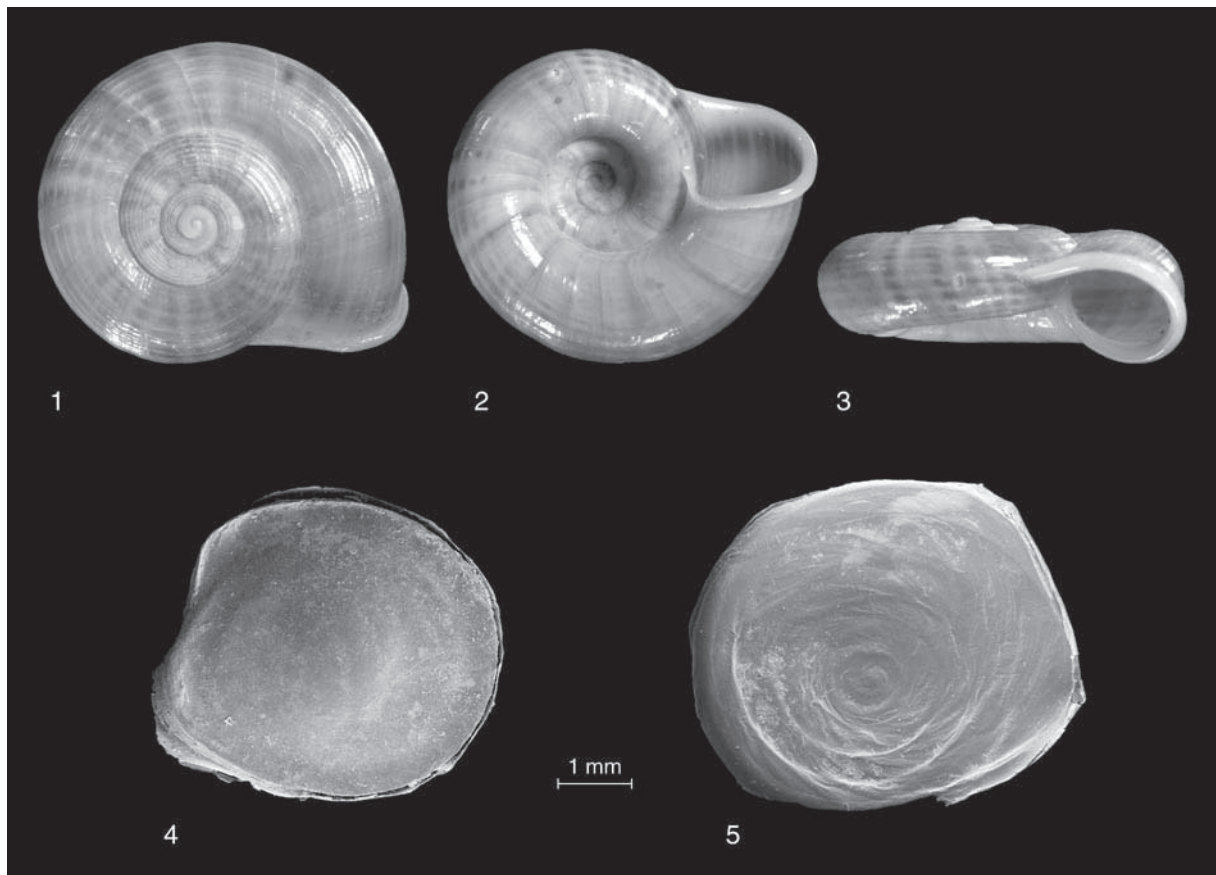
***Lithidion suturalis* n. sp.**

Figs 6-10

Holotype: SMF 322967, Yemen, Socotra Archipelago, Samha Island, on the plateau, western area, c. 800 m, 16.II.1999, A. Miller. — **Paratypes:** same data as holotype, NHCY (9), SMF 322968/9, HLMD-MOL-322-PT1, HLMD-MOL-322-PT2. — **Non-type specimens:** Yemen, Socotra Archipelago: Samha Island, below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999, U. Joger, NHCY (1), SMF 322969/1; Samha Island, ascent to the plateau, 600 m, 16.II.1999, M. Hughes, NHCY (4), SMF 322970/4.

Diagnosis: A small *Lithidion* species with a flat unsculptured subsutural ramp. Shell surface reticulate with a dominating peripheral keel. Umbilical suture deeply canaliculate.

Description: Shell with a flat conical elevated spire and a mamillate protoconch. The shell surface and subsurface are covered by fine spiral ridges which are intersected by small axial riblets. Thus, the shell surface is finely reticulated. Subsuturally, a flat ramp without any spirals is present.



Figs 1-5: *Lithidion giganteum* n. sp., holotype SMF 322963. 1: Apical view. 2: Ventral view. 3: Frontal view. 4-5: SEM of isolated opercula, type lot. 4: Outer surface. 5: Inner surface. Magnification of shells: 3 times natural size; scale bar refers to opercula only. Photos: E. Neubert, SEM: S. Hof.

In many shells, the peripheral spiral is stronger and forms a thin keel. The number of spirals between the suture and the dominating spiral is between 14 and 20. The basic colour is white to cream, but up to two red spiral bands (supra- and subperipheral) may occur. The umbilicus is wide. The umbilical suture is deeply canaliculate.

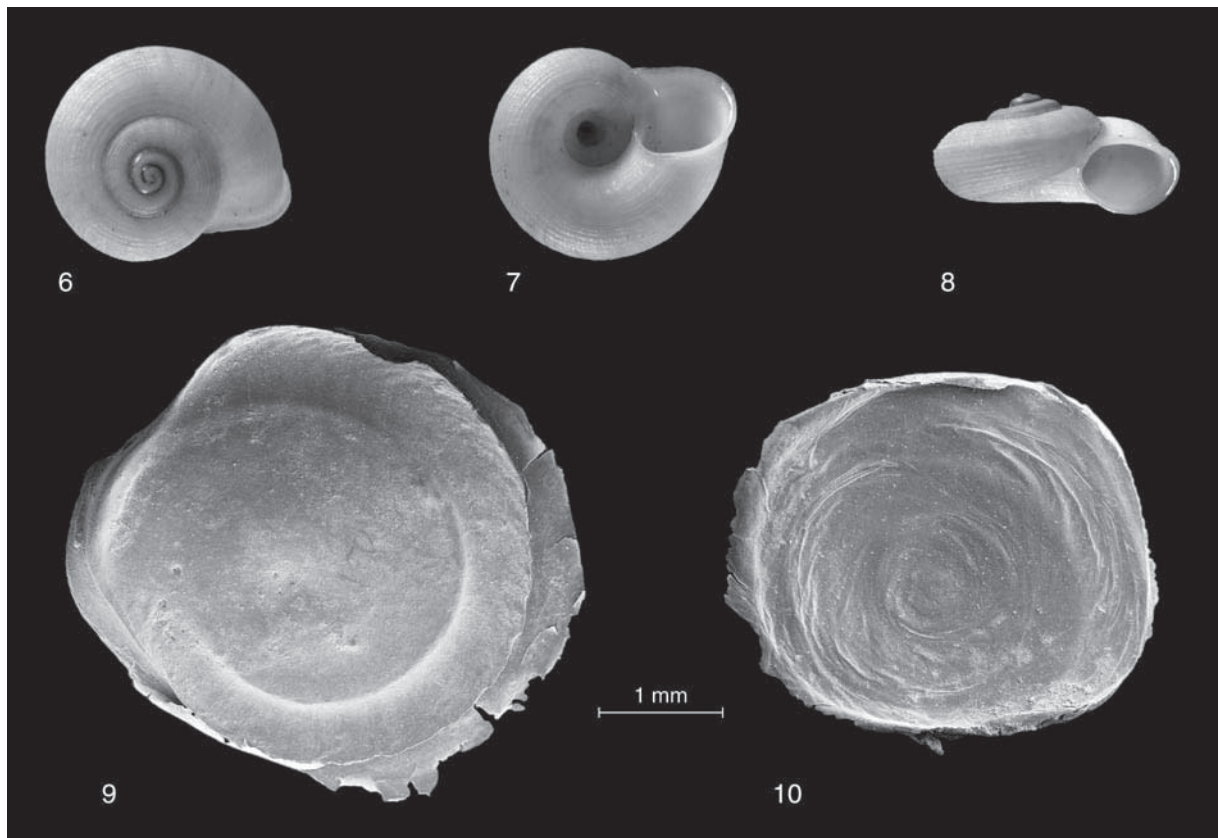
The aperture is nearly circular, the last whorl bends somewhat under the periphery of the body whorl. The apertural plain is oblique to the shell's axis. The upper apertural edge is slightly protruded, the peristomial lip weak, and the peristome curved backwards.

The operculum is bilobed and convex, the lower lobe somewhat larger than the upper lobe. The internal callus is delimited by a shallow furrow in the upper right edge, a faint spiral is visible on the outer surface.

Measurements: Holotype: H = 4.26; D = 10.96; W = 4.50; D_{operculum} not available (specimen without operculum). — Paratypes (n = 21): H = 4.66 ± 0.26; D = 11.15 ± 0.48; D_{min} = 10.38, D_{max} = 12.12; H_{min} = 4.14, H_{max} = 5.20; B_l = 240 ± 14. Isolated opercula (n = 5): 3.24 ± 0.13.

Etymology: This species is named for its characteristic subsutural ramp.

Remarks: Differentiating characters are discussed under *L. giganteum* and *L. zajonzi*. *Lithidion suturalis* n. sp. seems to be restricted in its distribution to the elevated parts of the island. Sympatry could not be recorded. In the lot from an altitude of 600 m, four specimens with unusually large diameters (H = 5.81 ± 0.18; D = 14.97 ± 1.16) were found amongst specimens of



Figs 6-10: *Lithidion suturalis* n. sp., holotype SMF 322967. 6: Apical view. 7: Ventral view. 8: Frontal view. 9-10: SEM of isolated opercula, type lot; 9: Outer surface. 10: Inner surface. Magnification of shells: 3 times natural size; scale bar refers to opercula only. Photos: E. Neubert, SEM: S. Hof.

normal size. These shells share all conchological characters of *L. suturalis* although they reach the size range of *L. giganteum*. Here they are provisionally included as *L. suturalis* n. sp., because size alone is not regarded as a character to separate species. A final decision has to be postponed until the altitudes between 400 and 600 m are properly explored.

Lithidion zajonzi n. sp.

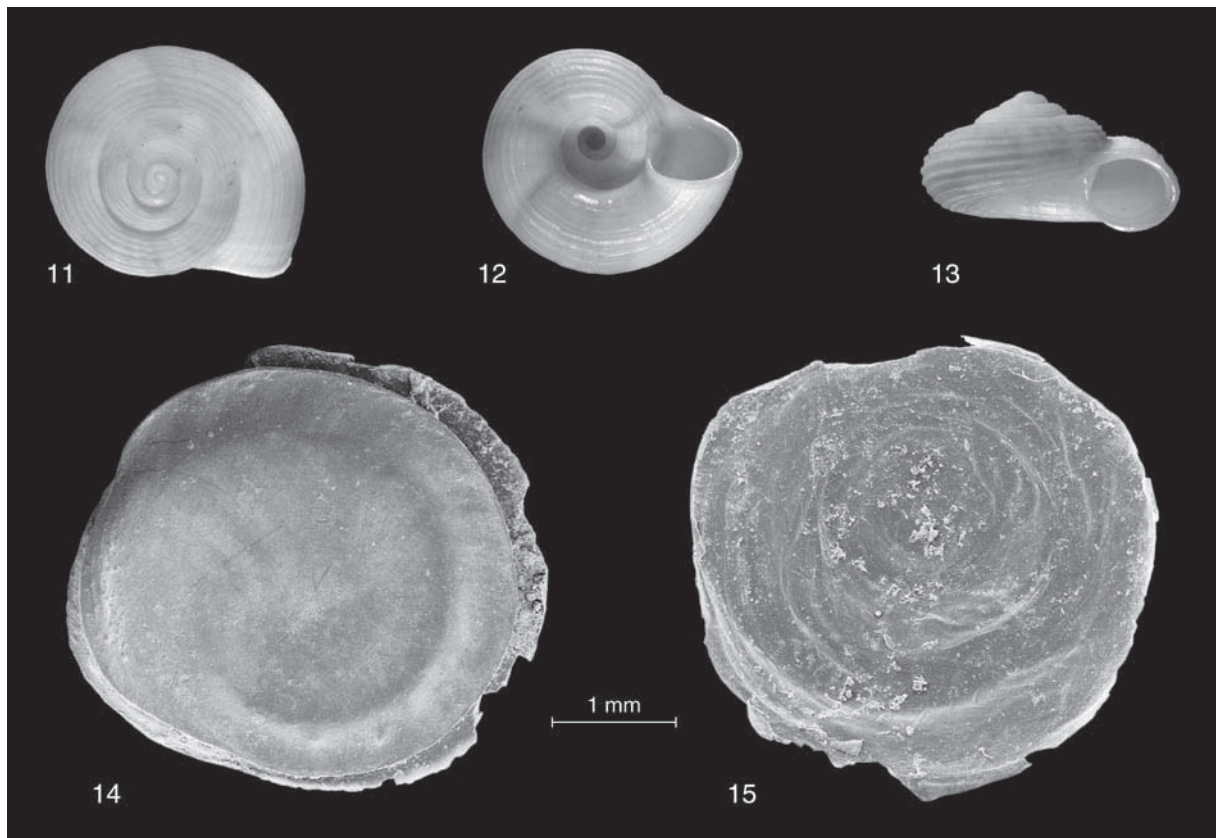
Figs 11-15

Holotype: SMF 322971, Yemen, Socotra Archipelago, Darsa Island, north coast, at the central coastal plain, 10-200 m, c. 12°07.500'N 53°17.500'E, 19.IV.1999, U. Zajonz et al. — Paratypes: same data as holotype, NHCY (11), SMF 322972/11, HLMD-MOL-323-PT1, HLMD-MOL-323-PT2.

Diagnosis: A small species of *Lithidion* with only a few, but dominating, surface spirals. Axial sculpture weak, umbilical suture canaliculate.

Description: Teleoconch with an elevated spire and mamillate protoconch, the protoconch with extremely fine granules. The shell sculpture consists of coarse spirals with the median spiral often pronounced. There are approximately ten spirals between suture and spiral keel. The axial sculpture elements are less strong, the spiral pattern dominates. The basic shell colour is white. Behind the peristome, an internal brown ring can sometimes be found. The umbilicus is wide, and the umbilical suture is canaliculate.

The circular aperture is callused by a white lip which often bends backwards. The last whorl only slightly bent below the body whorl. The upper peristomial edge is slightly protruded, the peristomial ring is almost closed.



Figs 11-15: *Lithidion zajonzi* n. sp., holotype SMF 322971. 11: Apical view. 12: Ventral view. 13: Frontal view. 14-15: SEM of isolated opercula, type lot: 14: Outer surface. 15: Inner surface. Magnification of shells: 3 times natural size; scale bar refers to opercula only. Photos: E. Neubert, SEM: S. Hof.

The operculum is bilobed, the lower lobe stronger than the upper with a faint spiral ridge on the outer surface. No major differences to the operculum of *Lithidion suturalis* n. sp.

Measurements: Holotype: H = 5.43; D = 11.48; W = 5.00; D_{operculum} not available (specimen without operculum). — Paratypes (n = 21): H = 5.25 ± 0.36; D = 11.42 ± 0.59; D_{min} = 10.25, D_{max} = 12.55; H_{min} = 4.58, H_{max} = 5.88; B_I = 218 ± 11. Isolated opercula (n = 5): 3.20 ± 0.30.

Etymology: This species is dedicated to Dipl.-Biol. Uwe Zajonz, who collected the specimens.

Remarks: *Lithidion zajonzi* is reminiscent of *L. suturalis* from Samha. In particular the type of sculpture pattern, shell shape and the canaliculate umbilical suture are quite similar. The constantly different number of spiral ridges and the blunt keel of *L. suturalis* separate the two species.

Genus *Cyclotopsis* Blanford, 1864

1864 *Cyclotopsis* Blanford. — Ann. Mag. Nat. Hist. 1864: 447.

Type species: *Cyclostoma semistriatum* Sowerby, 1843 from India, Poona (original type designation).

Traditionally, the small and more turbate pomatiid species from the Socotra Archipelago are confined to *Cyclotopsis*. A clear differential diagnosis of this genus is missing, and it still has to be proven that it can be applied to any of the East-African pomatiid species. The following species are published here under *Cyclotopsis* with some hesitation.

Cyclotopsis mirandae n. sp.

Figs 16-19

Holotype: SMF 322973, Yemen, Socotra Archipelago, Samha Island, on the plateau, western area, 16.II.1999, A. Miller.
 — Paratypes: same data as holotype, NHCY (6), SMF 322974/5, HLMD-MOL-324-PT1, HLMD-MOL-324-PT2. —
 Non-type specimens: Yemen, Socotra Archipelago: Samha Island, below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999, U. Joger, NHCY (1), SMF 322975/1; Samha Island, ascent to the plateau, on limestone cliffs facing north, 600 m, 16.II.1999, M. Hughes, NHCY (1), SMF 322976/1.

Diagnosis: Turbinate shell with a granulated submamillate protoconch. Teleoconch with a colourful pattern of spirals, patches and axial flames.

Description: Shell turbinate, teleoconch high, conical. The submamillate protoconch has two whorls and is covered by small coarse granules. The teleoconch whorls are separated by a shallow suture, and the whorls are somewhat “pasted” to the preceding whorl. The shell sculpture is composed of spirals, which are intersected by small axial riblets. The upper teleoconch whorls bear about 7-9 spirals if measured above the upper edge of the aperture. Subsuturally, there is always a broad and smooth zone lacking any spirals. On the body whorl, the spirals become faint below the periphery and on the periumbilical area, but appear again in the umbilicus. The umbilicus is open reaching about 25 % of the maximum shell diameter.

The aperture is subspherical pyriform. The peristome is not connected, the parietal callus almost absent. The apertural lip is small but present, the peristomial rim somewhat curved backwards.

The basic colour of the shell is creamy white, but this coloration is often obscured by a vivid pattern of colour spirals, patches etc. The basic pattern consists of up to four dark brown spiral bands interrupted by white axial flames. Almost white specimens are common.

The paucispiral operculum with an acentric core zone. Upper edge is acutely protruded, the outer surface of the final whorl heavily callused.

Measurements: Holotype: H = 5.10; D = 5.60; W = 5.00; $D_{\text{operculum}} = 2.40$. — Paratypes (n = 13): H = 6.05 ± 0.45 ; D = 6.32 ± 0.35 ; $D_{\text{min}} = 5.60$, $D_{\text{max}} = 6.80$; $H_{\text{min}} = 5.10$, $H_{\text{max}} = 6.65$; $B_1 = 105 \pm 3$.

Etymology: This species is named in honour of Dr. Miranda Morris to acknowledge her tremendous capacity for translating and organising.

Remarks: The typical population is quite stable in its characters. Coloration is the only character that varies to some extent. Specimens from the other two lots known for this species (both collected in almost the same location) are considerably bigger. As this is the only difference to be found, these populations are considered conspecific with *Cyclotopsis mirandae* n. sp. but excluded here from the type series. Their absolute measurements differ considerably from the type lot, but the B_1 is very similar (n = 5): H = 9.4 ± 0.95 ; D = 10.1 ± 1.0 ; $D_{\text{min}} = 8.5$, $D_{\text{max}} = 11.4$; $H_{\text{min}} = 7.9$; $H_{\text{max}} = 10.3$; $B_1 = 107 \pm 3$. Specimen shown in Fig. 19: H = 10.7; D = 11.4.

The basic structure of the operculum is very similar to that of *Socotora* species. These specimens need to be compared with the Indian *C. semistriatum* and the *Cyclotopsis* species from Socotra. This is postponed to a work in preparation on the operculate land shells of the archipelago.

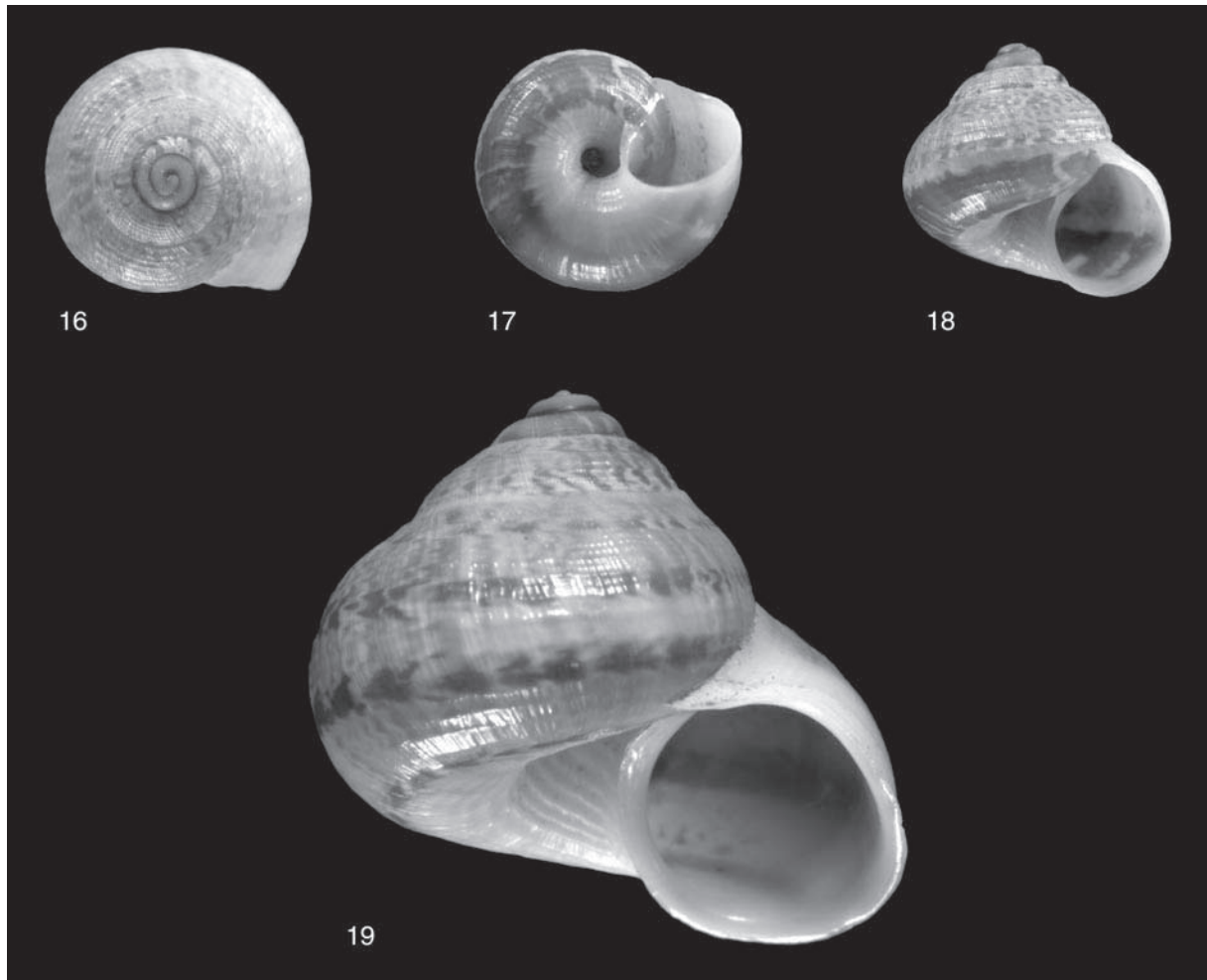
Family Subulinidae

Genus *Riebeckia* Martens 1883

1883 *Riebeckia* v. Martens. — Conchologische Mitteilungen II: 148.

Type species: *Achatina sokotorana* von Martens, 1881, from Socotra.

Diagnosis: Elongated turreted shells, decollating in some species. Shell sculpture smooth or with a characteristic reticulate microsculpture on the surface of the teleoconch. The columella is truncate, the median tooth of the radula is of medium size and weakly tricuspidate.



Figs 16-19: *Cyclotopsis mirandae* n. sp. 16-18: Holotype SMF 322973. 16: Apical view. 17: Ventral view. 18: Frontal view. 19: Specimen from Samha Island, “on limestone cliffs facing north, 600 m, 16.II.1999, M. Hughes”, SMF 322976, frontal view. Magnification of shells: 7 times natural size. Photos: E. Neubert.

Remarks: In 1884, CROSSE founded the genus *Balfouria* based on *Stenogyra* (*Opeas*?) *hirsuta* Godwin-Austen, 1881 (= ? *Stenogyra arguta* Martens, 1881). This genus was defined by the presence of a microsculpture and bristles on the teleoconch whorls. The value of this sculpture as a generic character has not been properly assessed until now. The morphology of the genital organs of the new (and microsculptured) species described herein shows no structural difference from that of *Riebeckia sokotorana*. For this reason, the new species is here described under *Riebeckia*. A formal revision of the Subulinidae of the archipelago is in preparation and will resolve the proper use of generic names. Data on the genital anatomy of *R. sordida* n. sp. will be discussed in this context.

Riebeckia sordida n. sp.

Fig. 20

Holotype: SMF 322977, Yemen, Socotra Archipelago, Samha Island, north-western slope of the escarpment below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999. — Paratypes: same data as holotype, NHCY (4), SMF 322978/3, HLMD-MOL-325-PT. — Non-type specimens: Yemen, Socotra Archipelago: Samha Island, south-western slope, 12°10.00'N 53°01.50'E, 240-450 m, 16.II.1999, NHCY (2), SMF 322979/2.

Diagnosis: A slender *Riebeckia* species with flattened teleoconch sutures, a sculpture of undulating axial ribs and a characteristically hairy periostracum.

Description: The shell is slender, conical, and opaque brown in fresh specimens. The protoconch consists of four whorls, the upper two are white and almost smooth, the lower two are brown and display a faint wavy axial sculpture. The suture of the protoconch is very deep, and the upper two whorls are flattened to almost angled.

The teleoconch whorls are flat with a shallow suture. The sculpture consists of axial ribs crossed by sharp and low spirals. Thus, a wavy or undulating pattern is produced. The ribs are covered by a hairy periostracum with erected bristles in the place where axials meet spirals. The last whorl is bluntly keeled.

The aperture is small, subrectangular with the columella slightly truncate and somewhat callused. The columella reflects over the slit-like umbilicus.

The living animal is bright yellow in colour.

Measurements: Holotype: H = 25.00; D = 5.30; W = 13.00. — Paratypes (n = 9): H = 22.84 ± 1.54; D = 5.40 ± 0.21; H_{min} = 20.30, H_{max} = 26.00; D_{min} = 5.10, D_{max} = 5.80; B₁ = 423 ± 22.5.

Etymology: The species name is derived from the Latin 'sordidus', meaning 'dirty'.

Remarks: *Riebeckia sordida* n. sp. is the only representative of the family Subulinidae so far recorded from Samha Island. It has only been found in the more humid and sheltered areas below the plateau and was not recorded from the plateau itself. It differs from all other microsculptured *Riebeckia* species by its peculiar undulating ribs. In the other species (all from Socotra), the ribs are always straight.

It has to be noted that in the specimens available to the author, there are a few eroded shells with wavy axial ribs from two localities on Socotra. The specimens are very similar to *R. sordida* n. sp. but a decision on their status is postponed until fresh shells are available. These localities, on the southern escarpment of Socotra and the western Haggier, are characterised by small waterfalls or at least humid surroundings and thus probably offer similar environmental conditions to the ones in the cave area on Samha.

In the field it could be observed that *R. sordida* n. sp. used the bristles as an anchoring structure for clay. When found alive, the shells were completely camouflaged by the earth and looked like small moving clumps of loam.

Family Cerastidae

Genus *Microscintilla* n. gen.

Type species: *Microscintilla mamillata* n. sp.

Diagnosis: This new genus is characterised by its shining shell devoid of any sculptural detail. The protoconch is mamillate and not dome-shaped or elevated and ridged as can be seen in many other cerastid genera. Within the family, *Microscintilla* n. gen. belongs to the group with the short coniform penial caecum (MORDAN 1992: 6). It differs from *Achatinelloides* (which is here considered as relatively closely related) by its short and non-septate epiphallus, the caecum without internal pilasters and a much shorter free oviduct (if compared to the pedunculus). Within the previously known species of *Achatinelloides*, no species with a shell as shining as in *Microscintilla* n. gen. is known.

Etymology: This genus is called *Microscintilla* (= little spark) for its shining and shimmering surface.

Remarks: The use of the terms penial flagellum and penial caecum by MORDAN (1992) implies that we have to deal with two different organs. It should be stressed that these are only two

different character states of the same organ, which should preferably be called the penial caecum to avoid any confusion with the (epiphallial!) flagellum.

Microscintilla mamillata n. sp.

Figs 21-23

Holotype: SMF 322980, Yemen, Socotra Archipelago, Samha Island, NW slope beside the trail to the plateau, 600 m, 16.II.1999, M. Hughes. — Paratypes: same data as holotype, NHCY (4), SMF 322981/3, HLMD-MOL-326-PT1, HLMD-MOL-326-PT2. — Non-type specimens: Yemen, Socotra Archipelago: Samha Island, on the plateau, western area, 16.II.1999, A. Miller, NHCY (8), SMF 322982/7; Samha Island, below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999, U. Joger, NHCY (1), SMF 322983/1.

Diagnosis: A species of *Microscintilla* with an ovate shell and a thick parietal callosity. Aperture only with a columellaris.

Description: The protoconch is smooth, consists of almost two whorls and is characterised by its mamillate form. The shell colour is uniform brown; the shell is translucent in fresh specimens. The upper teleoconch whorls rapidly increase in width. The form of the teleoconch is ovate; its surface is shiningly smooth with faint and irregularly spaced axial riblets which may develop to wrinkles. Specimens with a hammered surface are also present. The suture is shallow but marked by a fine thread-like callused line. The body whorl measures almost half of the complete shell size.

The umbilicus is open, but constricted like a funnel. The aperture is spherical with a finely callused reddish lip in fresh specimens. The peristome is flared with a white recurved rim. The parietum displays a thick barren callus spreading into the angularis. On the columellar side, a triangular shield partly covers the periomphalum. Internally, a faint to strong columellaris can be found, usually in a high position in the aperture.

Measurements: Holotype: H = 13.10; D = 6.70; W = 6.00. — Paratypes (n = 10): H = 10.30 ± 2.50; D = 6.30 ± 0.50; H_{min} = 7.40, H_{max} = 13.10; D_{min} = 4.90, D_{max} = 7.25; B_I = 163 ± 28.

Genital morphology (Fig. 21): The penis is cylindrical and subdivided into two parts of equal length by the insertion of the penial appendix. Proximally, a big coniform penial caecum originates. Internally, penis and epiphallus are separated by a strong blunt papilla. The epiphallial lumen is smooth. The musculus retractor penis inserts in a median position on the epiphallus, its second branch attaches at the appendix. Their common stem connects to the diaphragm. The appendix can be separated in three to four parts, the terminal part of flagellate structure.

Vagina and free oviduct have a similar length, the pedunculus is much longer than the free oviduct.

Etymology: This species is named after the mamillate form of its protoconch.

Remarks: For a differential diagnosis, see under *M. duodentata* n. sp.

Microscintilla duodentata n. sp.

Figs 24-25

Holotype: SMF 322984, Yemen, Socotra Archipelago, Samha Island, south-western slope, 12°10.00'N 53°01.50'E, 240-450 m, 16.II.1999, E. Neubert. — Paratypes: same data as holotype, NHCY (3), SMF 322985/2, HLMD-MOL-327-PT. — Non-type specimens: Yemen, Socotra Archipelago: Samha Island, below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999, U. Joger, SMF 322986/1.

Diagnosis: A species of *Microscintilla* with an elongated teleoconch. Aperture with a columellaris and a palatal denticle in a median position on the peristome.

Description: The protoconch of two whorls is smooth and broadly mamillate. The teleoconch shell is glossy, only faint growth lines can be seen under the lens. The suture is shallow and appressed to the whorls. Fresh specimens have a fine light-brown coloration.

The subrectangular aperture is characterised by a labial tooth in a median position on the lip. The columellaris is very high, the columella straight and perpendicular. It reflects over the umbilicus with a callus often obscuring the umbilicus. The parietal area is demarcated by a thin thread which ends up in the aperture with a wart-like angularis. The angularis is always separated from the palatal peristome.

Measurements: Holotype: H = 13.00; D = 6.00; W = 5.50. — Paratypes (n = 5): H = 14.10 ± 1.43; D = 6.19 ± 0.34; D_{min} = 5.60, D_{max} = 6.85; H_{min} = 12.20, H_{max} = 16.80; B_I = 227 ± 18.

Etymology: This species is called *duodentata* for the presence of two teeth in the aperture.

Remarks: The two species of *Microscintilla* can be differentiated by their protoconch (more pointed in *M. mamillata*), the form of their apertures and the presence of a labial tooth in *M. duodentata*. Eroded specimens of both species lose their glossy shine and turn greyish white.

Genus *Achatinelloides* G. Nevill, 1878

1878 *Achatinelloides* G. Nevill. — Hand List Moll. Indian Mus. I: 131.

Type species: *Bulimus socotorensis* L. Pfeiffer, 1845.

Diagnosis: Conical to elongate oviform shells, often with a characteristic zig-zag colour pattern. Shell surface smooth to sharply ribbed. Epiphallus elongate and partly septate, penial caecum conical with internal pilasters, free oviduct very long (cf. MORDAN 1992).

Achatinelloides samhaensis n. sp.

Figs 26-27

Holotype: SMF 322987, Yemen, Socotra Archipelago, Samha Island, on the plateau, western area, 16.II.1999, A. Miller. — Paratypes: same data as holotype, NHCY (5), SMF 322988/4, HLMD-MOL-328-PT1, HLMD-MOL-328-PT2. — Non-type specimens: Yemen, Socotra Archipelago: Samha Island, ascent to the plateau, 600 m, 16.II.1999, M. Hughes, NHCY (2), SMF 322989/2; Samha Island, below the plateau, vicinity of the cave, 12°09.61'N 53°02.47'E, 600 m, 16.II.1999, U. Joger, NHCY (1), SMF 322990/1.

Diagnosis: A small species of *Achatinelloides* with a typical colour pattern, a ribbed shell and a closed umbilicus.

Description: The protoconch consists of almost two whorls, is evenly rounded, smooth and white. The shell is acutely conical, the body whorl reaching almost half of the total shell length. The basic colour of the shell is glossy white. The upper teleoconch whorls are ornamented by broad, brown axial stripes. On the body whorl, these stripes may be straight above the periphery or follow an oblique zig-zag pattern. The shell is covered by broad and low ribs.

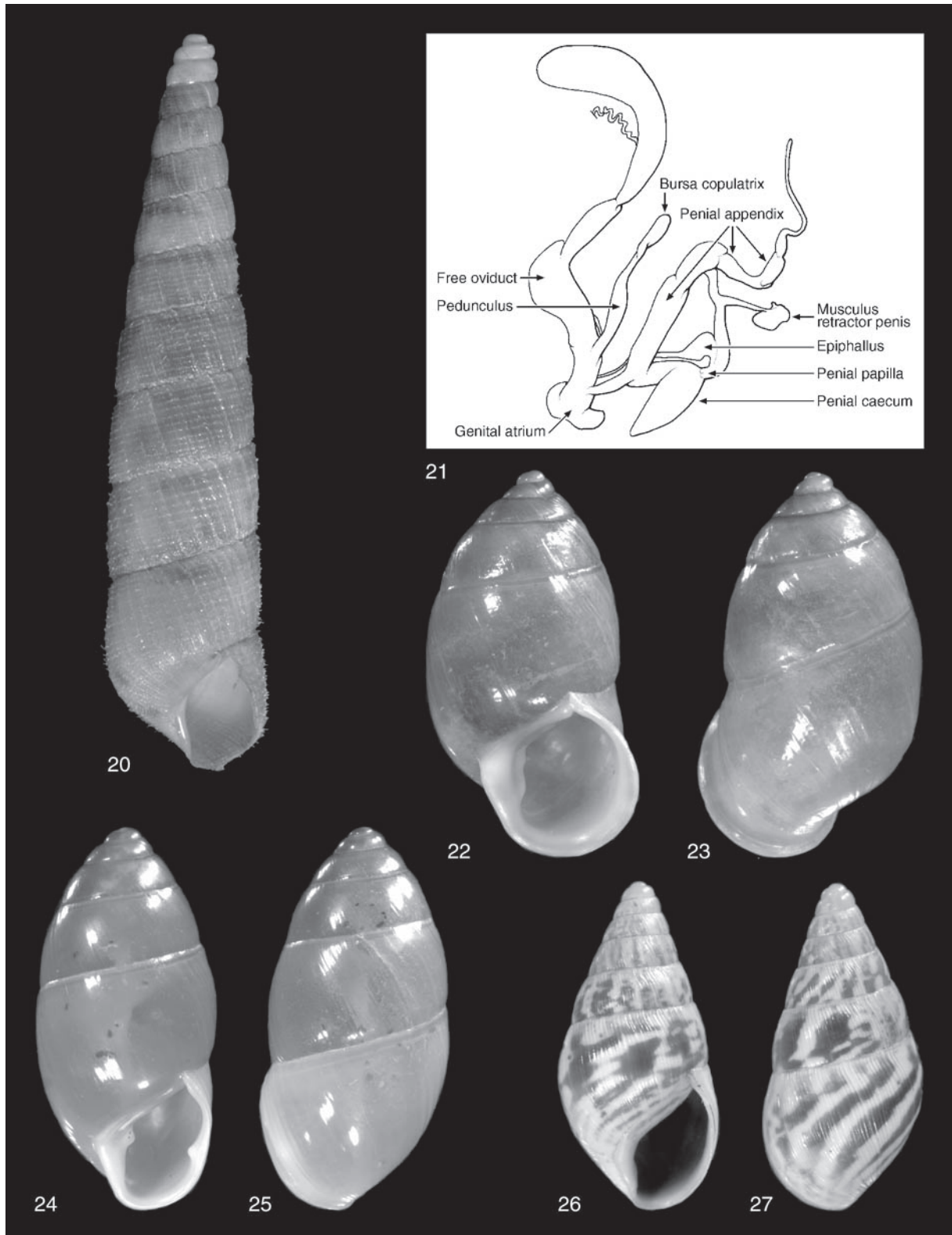
The aperture is oblique with a high and acute sinulus. The columella is straight, the columellaris is low, ends basally on the columella, but does not reach the peristome. The umbilicus is completely closed by a small columellar callus. Basally, the aperture is bluntly angled. The parietum is often covered by a thin glazing callus, and the angularis often connects to the peristome. The labial callus is white and thin but clearly discernible. On the inside, the aperture exhibits a deep brown colour.

Measurements: Holotype: H = 11.15; D = 5.58; W = 7.00. — Paratypes (n = 10): H = 11.36 ± 0.64; D = 5.48 ± 0.33; D_{min} = 4.85, D_{max} = 6.15; H_{min} = 9.95, H_{max} = 12.15; B_I = 207.5 ± 10.5.

Distribution: *Achatinelloides samhaensis* n. sp. is endemic to Samha Island.

Etymology: This species is called *samhaensis*, as it is endemic to the island of Samha.

Remarks: This species shows some similarities to the *A. tigris*-group from Socotra. It differs from these species by its ribbed shell (the Socotran species are almost smooth) and the formation of the umbilicus. In the Socotran species, the umbilicus is shaped like a half-moon and the periomphalum is deeply excavated.



Figs 20-27: 20: *Riebeckia sordida* n. sp., holotype SMF 322977, frontal view. 21-23: *Microscintilla mamillata* n. gen. n. sp., paratype SMF 322981. 21: Anatomy of genital organs. 22: Frontal view. 23: Dorsal view. 24-25: *Microscintilla duodentata* n. gen. n. sp., holotype SMF 322984. 24: Frontal view. 25: Dorsal view. 26-27: *Achatinelloides sambaensis* n. sp., holotype SMF 322987. 26: Frontal view. 27: Dorsal view. Magnification of shells: 5 times natural size. Photos: E. Neubert.

DISCUSSION

The malacofauna of the two islands still has to be regarded as insufficiently well known. On Samha Island, the expedition was only able to collect from the north-western slope, a few spots on the plateau and in one locality on the south-eastern coast. Considering the limited habitat size of many pulmonate snails on Socotra, and judging from similar cases on other small islands, still more species can be expected. Darsa Island is a remote rock in the sea with only a small lowland area. The slopes of the huge limestone rock are very steep. The slopes, as well as the plateau, have never previously been investigated by a mollusc collector. Until now, only two operculate land shells are known from Darsa, but new species or even genera of pulmonates can be expected from the more sheltered and humid areas on the slope and the plateau.

The distribution pattern of the snails on Samha seems to be similar to that on Socotra, Abd al-Kuri and Darsa. Repeatedly one finds that the hot lowland is inhabited by a combination of the local *Lithidion* sp. with a *Revoilia* sp. In Socotra, this combination shows some more variation as the island is much bigger. On Samha, the distribution pattern seems to follow a strict altitudinal regime: *Revoilia* (*S.*) cf. *albicans* was found together with *Lithidion giganteum* at altitudes up to 450 m. The higher regions of the island are inhabited by *L. suturalis* and *C. mirandae*. On the three small islands, pulmonates seem to be restricted to higher altitudes, while on Socotra, the microclimatic conditions obviously support *Achatinelloides* species even in the hot *Croton* shrublands. The habit of *Achatinelloides* to aestivate on stems of bushes and trees probably helps the animals to survive arid periods. The lowlands of the small islands have no bushes at all (except a few *Tamarix* plants around the well in Samha) and thus offer no suitable habitats.

All species encountered seem to suffer from predatory pressures. This was particularly noticeable on Darsa Island, where nearly all shells were cracked. Possible predators are introduced rats, and birds like the Socotran or Somalian starling.

It is worth noting that *Revoilia* (*S.*) cf. *albicans* (but probably *R. sordida* n. sp. as well) is the only species so far known to live on the three islands of the archipelago (*R. sordida* n. sp. on two). All other species (more than 100) are not only endemic to the archipelago but also endemic to their particular island.

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