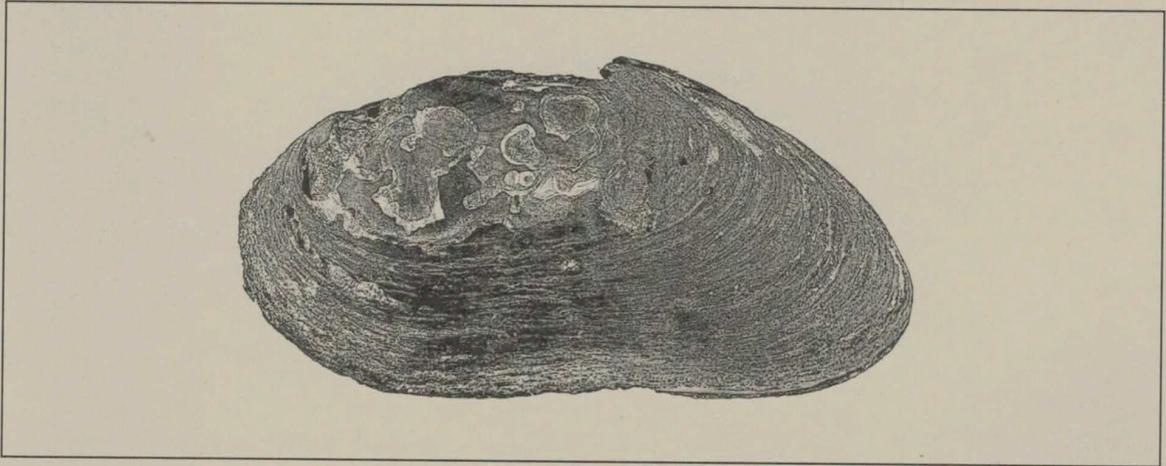


Schriften zur Malakozoologie

aus dem Haus der Natur - Cismar

Heft 27



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A new species of *Bistolida* (Gastropoda: Cypraeidae).

By FELIX LORENZ and MARCO CHIAPPONI,
Buseck-Beuern and Lecco

Abstract: *Bistolida nanostraca* n. sp. from the Cargados Carajos Shoal, Northern Mauritius differs from *B. piae* LORENZ & CHIAPPONI 2005 in that it is a smaller, and less callused shell, with a less flattened dorsal profile, reduced transverse banding, and less developed teeth. The animals differ in coloration. Radula differences are slight. The Cypraeid fauna of the atoll is discussed.

Keywords: *Cypraeidae*, *Bistolida nanostraca*, *Bistolida piae*, Mauritius.

Zusammenfassung: *Bistolida nanostraca* n. sp. von Cargados Carajos, Nord-Mauritius unterscheidet sich von *B. piae* LORENZ & CHIAPPONI 2005 durch ein kleineres, weniger kallöses Gehäuse mit weniger abgeflachtem Dorsalprofil, reduzierten transversalen Bändern und weniger ausgeprägten Zähnen. Die Tierkörper unterscheiden sich in der Färbung, Unterschiede in der Radula sind recht gering. Die Fauna der Cypraeidae auf dem Cargados Carajos-Atoll wird diskutiert.

Introduction: Recently, we had the rare opportunity to visit the Cargados Carajos Shoal, which is 400 km north of Mauritius. We observed the elusive and insufficiently characterized *Bistolida piae* LORENZ & CHIAPPONI, 2005 in its habitat. We noticed a diversity in shape, size, and coloration that is unique among the Cypraeidae and suggested that the species radiated to form two distinct, and partly sympatric populations. On reviewing the type material of *B. piae*, we noticed that four of the paratypes belong to the new species described in the following report.

Abbreviations:

CLSF: CHIAPPONI-LORENZ Seashell Foundation, Lecco, Italy

HNC: Haus der Natur - Cismar, Germany

MAM: Collection Dr. Michael A. Mont, Owings Mills, Maryland, USA

MNHN: Museum National d'Histoire Naturelle, Paris, France

SMF: Senckenberg Naturkundemuseum, Frankfurt/M., Germany

Material and methods: For the statistical comparison, we were able to measure 35 live-taken or fresh-dead specimens of *B. piae* and 40 live-taken or fresh-dead, as well as 200 beached *B. nanostraca* n. sp.

Measurements are listed as length x width x height in millimeters, with the labral and columellar teeth counted. The shell formula was derived from the measurements as described by LORENZ (2002). The percent relative mass (mR) of a shell is the relationship between the measured weight (mD) of a shell (in grams) and the hypothetical weight of a solid block of aragonite ($\rho = 0,00293 \text{ g/mm}^3$) of the shell's dimensions (length, width and height). Radulae were extracted from three individuals of each species. The animals had been dried after being kept in 60% ethanol for 24 hours. For extraction of the soft parts, the specimens were softened in water overnight. The radulae were cleaned by washing them in a 50% solution of DAN Klorix™ (bleach) for 5 minutes and then photographed. Drawings depicting the respective radula teeth at the same angle were made from these photographs.

Bistolida nanostraca n. sp.

Bistolida owenii owenii, LORENZ & HUBERT 1993: pl. 380 fig. 19, 22, 25, 28

Bistolida owenii piae, Paratypes 3, 5, 7, 8. LORENZ & CHIAPPONI 2005: Visaya Vol. 1 No. 5 p. 22, pl. 7 fig. 29, 31, 32

Holotype 12,6 x 7,5 x 5,6 (15 : 13) coll. MNHN24515

Paratype 1 13,8 x 7,7 x 5,8 (16 : 14) coll. CLSF

Paratype 2 13,5 x 7,4 x 5,6 (15 : 11)

Paratype 3 11,8 x 6,1 x 4,6 (13 : 10)

Paratype 4 14,0 x 7,8 x 5,8 (16 : 11)

Paratype 5 12,3 x 6,6 x 5,1 (14 : 11)

Paratype 6	13,9 x 7,6 x 5,8 (15 : 11) coll. CLSF
Paratype 7	13,6 x 7,4 x 5,7 (14 : 12) coll. MAM3050
Paratype 8	14,9 x 8,2 x 6,2 (16 : 11)
Paratype 9	11,8 x 6,7 x 5,2 (13 : 11) coll. CLSF
Paratype 10	15,4 x 8,4 x 6,4 (15 : 12)
Paratype 11	16,9 x 9,7 x 7,2 (16 : 12)
Paratype 12	15,4 x 8,3 x 6,3 (15 : 12)
Paratype 13	13,4 x 7,0 x 5,3 (15 : 12)
Paratype 14	14,8 x 8,0 x 6,0 (14 : 11)
Paratype 15	12,8 x 7,1 x 5,3 (14 : 11)
Paratype 16	16,2 x 8,7 x 6,7 (15 : 12) coll. MAM3049
Paratype 17	15,5 x 9,2 x 6,7 (15 : 11) coll. MAM3051
Paratype 18	16,2 x 9,5 x 7,1 (14 : 11) coll. MAM3048
Paratype 19	15,8 x 8,5 x 6,3 (17 : 13) coll. MAM3053
Paratype 20	12,5 x 6,9 x 5,1 (13 : 11)
Paratype 21	17,3 x 9,7 x 7,6 (16 : 13)
Paratype 22	18,0 x 10,2 x 7,6 (15 : 15) coll. CLSF
Paratype 23	12,6 x 7,4 x 5,4 (15 : 11) coll. CLSF
Paratype 24	14,3 x 8,1 x 6,1 (14 : 11)
Paratype 25	12,2 x 7,1 x 5,4 (14 : 10)
Paratype 26	13,0 x 7,4 x 5,6 (13 : 11) coll. MAM3052
Paratype 27	16,8 x 9,2 x 7,0 (15 : 13) coll. SMF
Paratype 28	13,4 x 7,4 x 5,8 (15 : 11) coll. HNC
Paratype 29	14,6 x 8,5 x 6,4 (13 : 10)

Five further paratypes in the MNHN24516

All from Cargados Carajos Shoal, north of Mauritius

The paratypes are deposited in the author's collections unless otherwise stated. Five specimens of *B. piaie* are deposited in the MNHN IM-2012-5 and the HNC respectively.

Further paratype specimens will be distributed among institutions and collectors in due course.

Description: The shell is small (10 to 17 mm), elongate to cylindrical in shape (the 12,6 mm holotype is slightly elongated oval), with an equally wide, straight aperture. The shell's general appearance is semi-transparent dorsally. The spire is umbilicate, and partly exposed. The protoconch consists of only two whorls. It is brown, with a fine, cancellate sculpture below a thin layer of enamel, and it measures 1,0 mm in diameter. The sides of the shell are rounded, without callus, but merely forming narrow flanges bordering the slightly rostrate extremities. The dorsal profile, when viewed from the side, is nearly rounded, with a somewhat flattened area in the midsection. The teeth are moderately strong, with wide interstices. They extend onto the flattened base midway on the columellar side and become shorter towards the extremities. In the first quarter of the anterior columellar side, the teeth are notably thinner when compared to those in the midsection of the base. The columellar teeth are restricted to the edge of the aperture and do not extend into the shell. The fossula region is flat and smooth. The shell formula derived from measuring 50 shells is: [14(56–42)17:13] rM= 18,9.

The dorsal ground color is plain white in the holotype. There are hues of pink, blue, or brown in some of the the paratypes. There may be pink to pale, greyish-blue zones concealing the paler ground color, of which only two, white, transverse, wavy bands remain visible. The terminal blotches are distinct and dark in the holotype, but in the paratypes, they vary from discrete reddish-brown to being absent. The dorsal spotting is fine, conspicuous, and sparse in the holotype, but there are albinistic specimens without any darker spotting. Brown blotches originating from darker, interrupted embryonal banding are usually absent, with remnants of them found in some paratypes, including some of those that are unspotted and nearly all-white otherwise (e.g. Paratype 9). Sparse, dark-brown, small, and distinct spots cover the margins and the outer half of the base in most shells. Some specimens are completely white, without any darker pigmentation. Others merely show vague, greyish-to-brown clouds dorsally, but lack any spotting or banding. The shape varies slightly from elongate oval to cylindrical. The degree of callosity does not vary much, shells with prominent marginal callus have not been found. The length of the teeth varies slightly, in some shells the columellar teeth only extend slightly towards the base. The dorsum shows a pale, yellow fluorescence when viewed under ultraviolet light.

The animal has a transparent-white mantle with minute, crowded papillae. Tentacles, proboscis, and eyestalks are yellow-to-orange. The foot is greyish-white and semi-transparent. A darker, grey stripe at the posterior end of the foot is barely discernible or absent. The siphon is transparent white, with numerous hairlike processes around its outer edge.

The animal is able to autotomize a small portion of its foot. There is a dense array of glands in the anterior part of the foot. These can secrete large amounts of transparent mucus. The stomach contents of three specimens examined consisted of spicules of different types, suggesting that the species feeds on a variety of sponges. The radula is large, measuring 4,5 mm in length in a shell of 13 mm length (Fig. 1, 2)

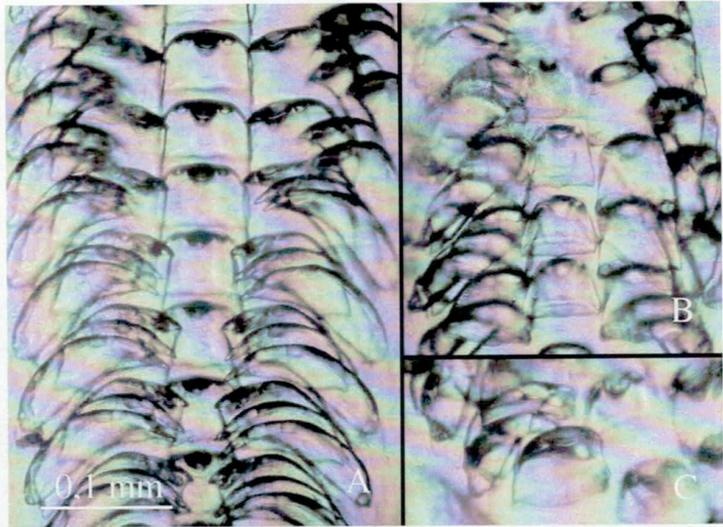


Fig. 1: Light microscopic photo of radulae.
Left: *B. piae*.
Right: *B. nanostraca* n. sp.

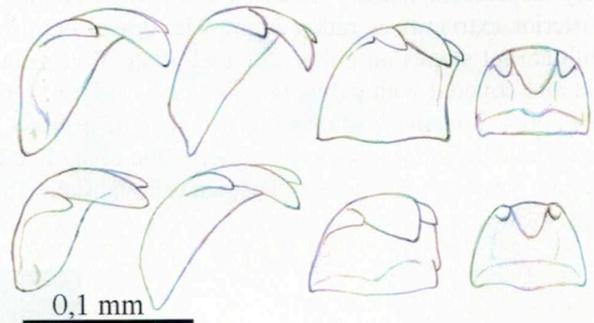


Fig. 2: Sketches of the radular teeth.
From left to right: Outer and inner lateral, marginal and rhachidian. Top: *B. piae*, bottom: *B. nanostraca* n. sp.

The spawn consists of 15 to 40 spherical transparent egg capsules of 3,1 to 3,5 mm diameter, each of which contain 50 to 70 larvae. The capsules are not placed in a compact assembly, but are spread over an area of 2 to 3 cm. The female does not cover the spawn with its foot, but remains close by, often accompanied by one or two males (Fig. 6A).

Habitat and distribution: *Bistolida nanostraca* n. sp. are found in holes and ledges of shallow reefs, usually well hidden among debris. They are found throughout the Cargados Carajos Shoal (Type locality: unnamed intertidal reef flat off South Island).

Etymology: The name *nanostraca* (gr. *nanos* = dwarf and *ostracum* = shell) refers to the dwarfed appearance of the species in comparison with its sister *B. piae*.

Discussion: Until recently, the name *menkeana* DESHAYES, 1863 was used for *Bistolida piae* (e.g. by RAYBAUDI 1992, 1997), going back to an article by CATE (1967), who apparently never saw the holotype of *menkeana* in the MNHN. That shell is a small (10 mm), badly eroded specimen, possibly coming from a population of *B. owenii* (SOWERBY I, 1837), which are commonly cast ashore in the south of Mauritius. The name is now in use for that variation. In 2005, we published a review of *Bistolida owenii* and its related taxa in *Visaya* Vol.1 No. 5 p. 22 ff, where we also described *Bistolida piae* (as a subspecies of *owenii*) to introduce a valid name for the population formerly mistaken for *menkeana*. Subsequent analysis of the mtDNA of *Bistolida owenii*, *B. vasta* SCHILDER & SCHILDER, 1938, and *B. piae* conducted by Dr. CHRISTOPHER MEYER (personal communication) revealed considerable differences between those three taxa that we interpret as supportive of their distinction on the level of a species.

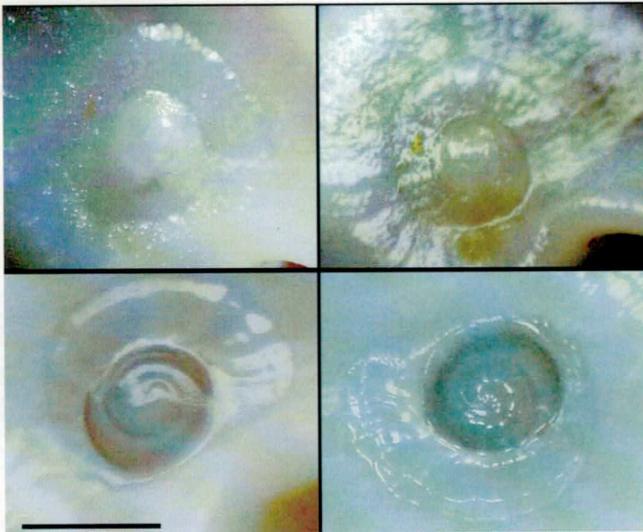


Fig. 3: Protoconchs in subadult shells.
 Top: *B. piae*. Bottom *B. nanostraca*.
 Scale: 1 mm

As four of nine specimens of the original type material (paratypes 3, 5, 7, 8) of *B. piae* belong to the new species, the concept of the true *B. piae* will be described in the following, based on the study of additional material that was not available at the time of the initial description.

B. piae ranges from 15 to 24 mm [19(61–43)16:13] rM=24,2. It is characterized by an oval to pyriform, very depressed, heavily callused shell with angular, bent-up margins surrounding the dorsum. The posterior extremity is rather blunt. The dorsal outline, when viewed from the side, forms a flat plateau with abrupt slopes on either side (see Plate 3, especially the third row on the right). The spire is mostly flat and covered with callus in adult shells (Fig. 4: top). The protoconch measures 1 mm in diameter and has approximately 2 whorls (The images of a protoconch in Fig. 3A were taken from a dead, slightly eroded shell. So far, we have not been able to study a live-taken juvenile *B. piae*). The teeth are thick and extend far across the convex base and the labrum. The aperture is narrow and straight. The fossula area may show 2 to 3 weak denticles.

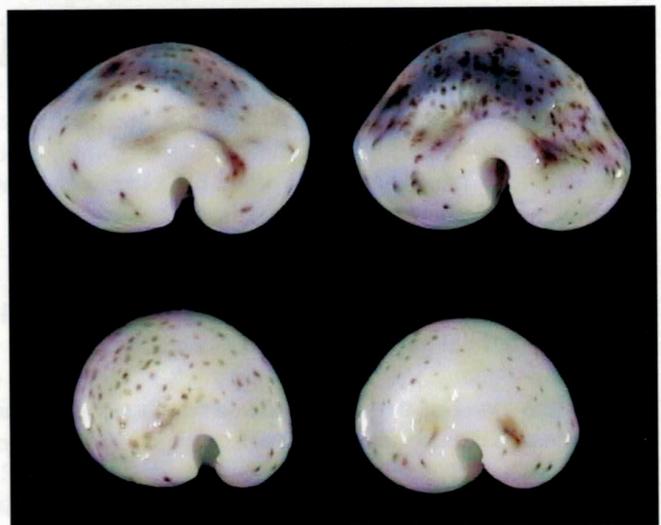


Fig. 4: Marginal callosities
 (shells not to scale).
 Top: *B. piae*. Bottom *B. nanostraca*

The dorsal ground color is pale-pink, with three broad, blue zones. There are one or two square brown patches on the right side of the dorsum, above the spire. These are part of a brown, interrupted embryonal band. The entire dorsum is densely covered with fine brown spots and sometimes one or two compact, brown blotches. The terminals show discrete red-brown blotches on either side of the dorsum. Above the angular callus ridge there is dense, mottled brown marginal spotting. Below this, towards the base, the spotting is slightly less dense.

The animal has a thin, semi-transparent, yellow mantle with crowded, minute, branching papillae giving it a "blurry" surface. The tentacles and the proboscis are bright orange, and the eyestalks are brown. The foot is white, with a black longitudinal stripe between its tip and the posterior part of the shell (Fig. 5).

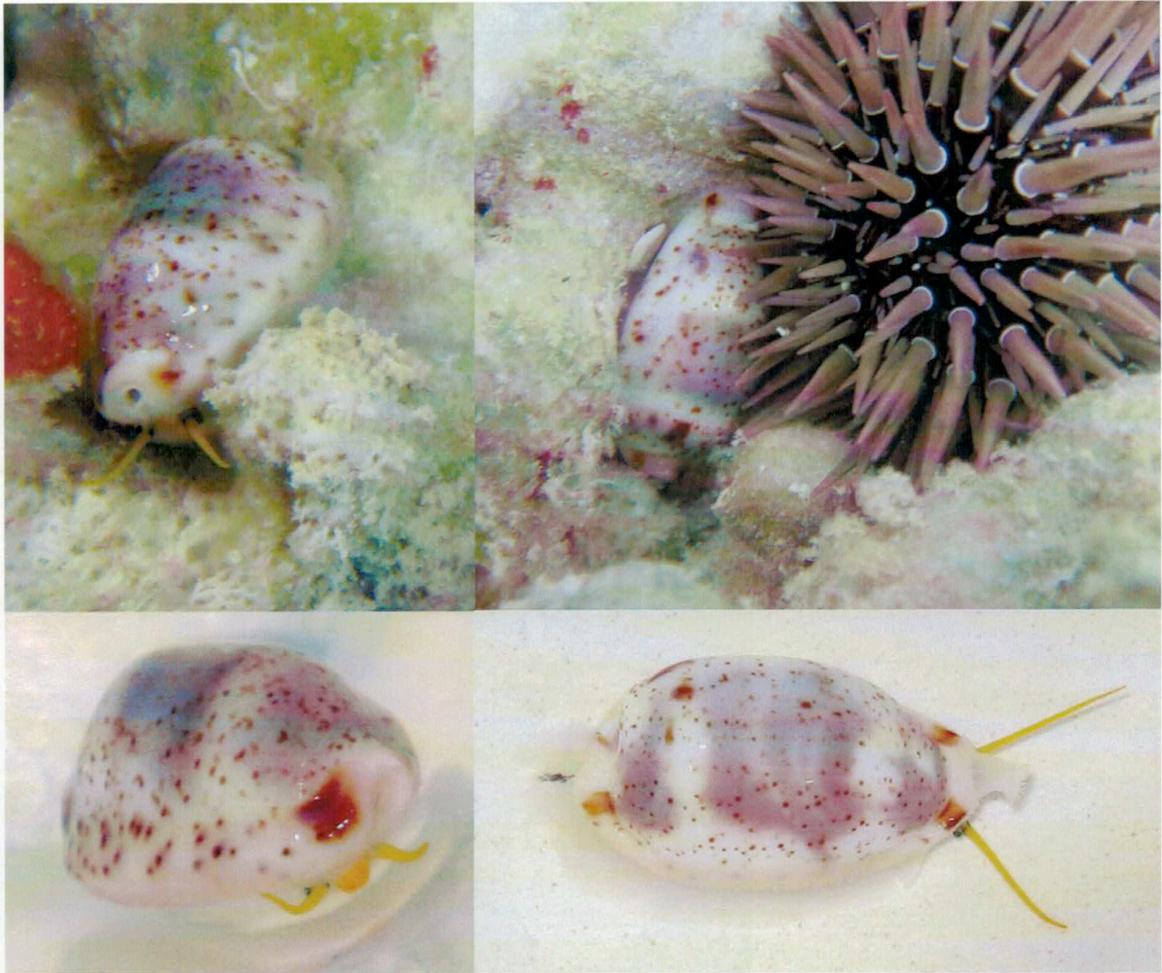


Fig. 5: *Bistolida piae*, living animals. Top row: Specimens in the habitat, photos JANA KRATZSCH. Bottom left: Specimen showing the orange proboscis. Bottom right: Crawling specimen showing the dark stripe on the posterior part of the foot. Photo by THIERRY DANDRIMONT.

The radula is illustrated in Fig 1, 2. The spawn is unknown. The species is a spongivore as the stomach contents of the specimens studied contained different types of poriferan spicules.

B. nanostraca n. sp. is mostly smaller than *B. piae*, ranging from 9 to 17 mm [14(56–42)17:13] rM= 18,9. Compared to *B. piae*, *B. nanostraca* is lighter, more elongate, oval rather than pyriform, often cylindrical, hardly callused, and with a more rounded dorsal profile. The posterior extremity is more delicate and rostrate than that of *B. piae*. The spire is slightly umbilicate, and not covered with callus, whereas in *B. piae*, it is usually flat and always covered with callus. The sides are rounded, not callused, and not forming angular margins as in *B. piae* (Fig. 4). The teeth are less thick and extend less onto the flattened base and the margins. The dorsal ground color is paler and the transverse banding that is always seen in *B. piae* is usually reduced in *B. nanostraca*, which instead has a pellucid, semi-transparent appearance. The terminal blotches are distinct and dark, and are usually more conspicuous than those of *B. piae*. The dorsal spotting, when present, is finer and more sparse than in *B. piae*. Brown blotches originating from the embryonal banding, as typically seen in *B. piae*, are often absent in *B. nanostraca*.

The animal of *B. nanostraca* has a transparent instead of a yellow-orange mantle as in *B. piae*. The black stripe at the posterior end of the foot typically found in *B. piae* is barely discernible or absent in *B. nanostraca* (Fig. 6).

Unspotted, nearly all-white shells (Paratypes 21-27), range from 11 to 18 mm. They are similar to the typical variation in lacking strong callosities, but the teeth are usually shorter. The ground color is pellucid white and there may be three pale-tan zones, but there are no darker spots or blotches either dorsally or along the margins. Even though the shell appears to be an albino, the animal has bright yellow-orange tentacles. Approximately 10% of the specimens found in the south of the Atoll are of this variation. Comparable off-color shells have not been found among *B. piae* or any other relative in the genus.



Fig. 6: *Bistolida nanostraca*, living animals.

A: Specimens with spawn (paratypes 3 to 5). B: Pale and dark pigmented forms from the same area.

C: The dark stripe at the posterior of the foot is barely discernible. D: Unspotted "albinistic" specimen with yellow-orange tentacles. E: The holotype *in situ*.

The ground color of *Bistolida stolidia clavicola* LORENZ, 1998 and *B. diauges* (MELVILL, 1888) may switch from the typical saturated green or blue to paler reddish-brown or lemon-yellow. However, also in off-color shells, there are always darker spots and blotches. The frequent occurrence of an albinistic phenotype within the same habitat is otherwise only known from a few species of Cypraeidae: *Cribrarula melwardi* (IREDALE, 1930), *Notocypraea comptonii* (GRAY, 1847), and species of the genus *Zoila*. With the exception of the first one, all of these species are intracapsular developers.

The radulae of *B. piae* and *B. nanostraca* show a number of slight differences: the rachidian tooth in *B. piae* has straight sides and in *B. nanostraca* it is distinctly wider at its base, which is not indented above its middle part as in *B. piae*. The marginal teeth are shorter in *B. nanostraca*, and their median denticle is somewhat longer than in *B. piae* (Figs. 1, 2). In relation to the variability of radulae observed within other species of the family, the differences between the two species discussed here are noteworthy, but too slight to contribute as a diagnostic feature. Both species seem to feed on the same types of encrusting sponges.

The lack of a prominent, denticulate fossula safely separates shells of *B. piae* and *B. nanostraca* from their closest relatives, *B. owenii* (Mauritius and La Reunion) and *B. vasta* (East Africa and Madagascar). The animal of *B. owenii* has a grey-brown mantle with small, branched, white papillae and a grey siphon with coarser papillae along its edge and darker grey blotches on either side (Fig. 7).



Fig 7: *Bistolida owenii*, Tamarin Bay, Southwest Mauritius (11 mm)

The Cargados Carajos Shoal, also known as St. Brandon, is a 50 km long chain of small, sandy islands and a compact fringing reef to the east, located 400 km north of Mauritius Island. It is exposed to heavy storms and cyclones. Its shallow islands are remnants of a volcanic crater, but now largely consist of dead coral, shell rubble, and sand, with little vegetation. During the year, floods move large amounts of sand in the lagoon, passes break through the dunes of the islands, reefs get covered in sand and rubble, and the direction of prevailing currents constantly changes. Coral growth is limited to solid, robust species. The coral bolders in the shallows usually have living polyps and specimens of *Tridacna* on both sides, indicating that everything gets rolled around on a regular basis by extreme currents.

The fauna is famous for a number of molluscs that are not typically found elsewhere: *Lambis violacea* SWAINSON, 1821, *Lyria anna* LESSON, 1835, and *Conus (Textilia) timorensis* HWASS, 1792, but none of these is endemic to Cargados Carajos. Recently, *Morum (Oniscida) lorenzi* MONSECOUR, 2012, and *Conus (Rolaniconus) lecourtorum* LORENZ, 2012 were discovered and these are endemic, as are *Ficus dandrimonti* n. sp. and *Conus (Cylindrus) textile vaulberti* n. ssp., which are described in this issue, and a number of undescribed species that are currently under study. Our rough estimate is that less than 5% of the molluscan fauna is really endemic to the atoll. Many species of gastropods that one would expect to find in this part of the Indian Ocean are rare or absent, indicating a high degree of isolation. The local Cypraeid fauna has some species that are typical for the Seychelles and Madagascar, but are not found in Mauritius (e.g. *Cribrarula abaliena* LORENZ, 1989). Interestingly, none of the species considered endemic to Mauritius and La Reunion are found in Cargados Carajos.

Certain Cypraeidae that are common in Mauritius or the Seychelles are absent in Cargados Carajos: *Erronea caurica elongata* (PERRY, 1811), *Melicerona listeri* (GRAY, 1824), *Palmadusta asellus* (LINNAEUS, 1758), *P. clandestina passerina* (PEASE, 1865), and *Purpuradusta microdon chrysalis* (KIENER, 1843).

Three cowry-species that have been found at Cargados Carajos are not found in Mauritius or La Reunion: *Bistolida piae* LORENZ & CHIAPPONI, 2005, *Cribrarula abaliena* LORENZ, 1989, and *Erronea adusta* (LAMARCK, 1810).

The following cowries are found in Mauritius and the Seychelles: *Bistolida diauges* (MELVILL, 1888), *Cypraea tigris* (LINNAEUS, 1758), *E. helvola argella* (MELVILL, 1888), *Lyncina carneola* (LINNAEUS, 1758), *L. leviathan titan* SCHILDER & SCHILDER, 1962, *L. vitellus* (LINNAEUS, 1758), *L. lynx* (LINNAEUS, 1758), *Mauritia arabica immanis* SCHILDER & SCHILDER, 1939, *M. histrio* (GMELIN, 1791), *Nucleolaria nucleus* (LINNAEUS, 1758), *Ovatipsa chinensis violacea* (Rous, 1905), *Pustularia cicercula* (LINNAEUS, 1758), *P. globulus brevirostris* SCHILDER & SCHILDER, 1938, *Staphylaea limacina interstincta* (WOOD

1828), *S. staphylaea laevigata* (DAUTZENBERG, 1932), and *Talostolida pellucens* (MELVILL, 1888) are moderately regular finds on the beaches.

Monetaria annulus (LINNAEUS, 1758), *M. caputserpentis* (LINNAEUS, 1758), and *M. moneta* (LINNAEUS, 1758) are fairly abundant along the shores in shallow water. Inside the lagoon, *Bistolida kieneri* (HIDALGO, 1906), *Erosaria erosa* (LINNAEUS, 1758), *Palmadusta diluculum* (REEVE, 1845), and *Purpuradusta fimbriata durbanensis* (SCHILDER & SCHILDER, 1938) are locally common.

Some species that are living in the turbid, inaccessible waters of lagoon edges, or the sublitoral zone below (*Arestorides argus contracasta* Lorenz, 2012, *Leporicypraea mappa rosea* (GRAY, 1924), *Mauritia depressa dispersa* SCHILDER & SCHILDER, 1939, *M. mauritiana* (LINNAEUS, 1758), *M. scurra scurra* (GMELIN, 1791), and *Talparia talpa* (LINNAEUS, 1758), seem to successfully maintain indigenous populations as their empty shells wash up frequently along beaches that are exposed to the outer reef.

B. piae is rather widespread along the Mascarene ridge, from Rodrigues Island northwards to Cargados Carajos and the Seychelles, where it lives only at greater depths (JARRETT, 2000). It is not found on La Reunion and the island of Mauritius.

On the contrary, *B. nanostraca* is definitely endemic to Cargados Carajos Shoal. It is by far the most abundant species in the lagoon, judging from the amount of eroded shells on the beaches. However, finding a fresh dead or a living animal is difficult and a matter of good luck, as there seems to be no particular habitat for larger numbers of them. Living *B. nanostraca* were mainly found in deep crevices among rubble and sand, and *B. piae* only in areas exposed to strong current and wave action. Both can be found less than ten meters apart from each other. At Cargados Carajos, it seems that *B. piae* and *B. nanostraca* adapted to several ecological niches that are occupied by other species of cowries elsewhere.

Explanations of Plate 1:

Bistolida nanostraca

1st row: Holotype (16 mm)

2nd row: Paratype 6 (14 mm)

3rd row left: Paratype 28 (13 mm). Right: Paratype 3 (12 mm)

4th row: Paratype 14 (15 mm)

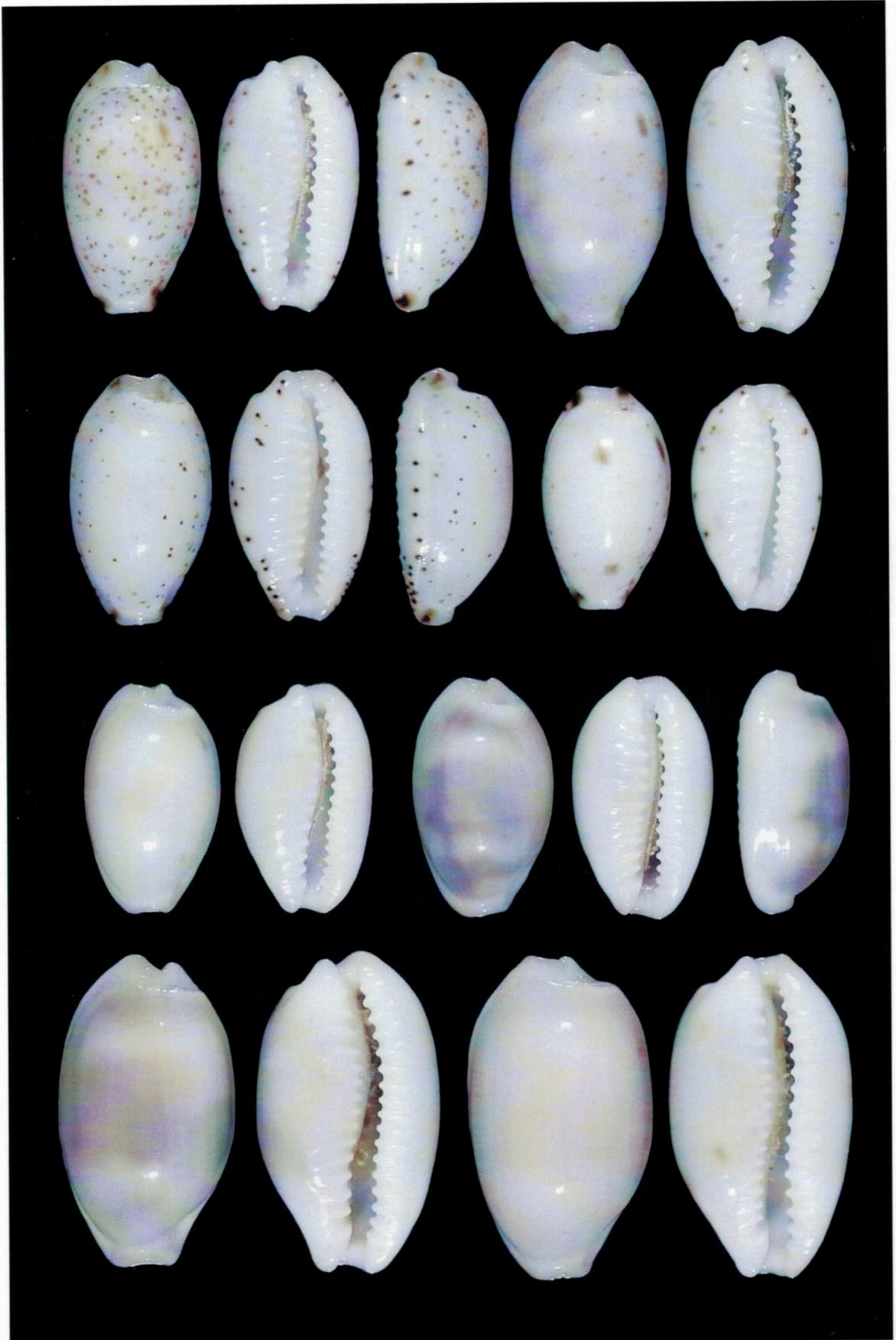


LORENZ, F. & CHIAPPONI, M.: A new species of *Bistolida* (Gastropoda: Cypraeidae).

Explanations of Plate 2:

Bistolida nanostraca

- 1st row left: Paratype 7 (14 mm). Right: Paratype 19 (16 mm)
2nd row left: Paratype 2 (14 mm). Right: Paratype 9 (12 mm)
3rd row left: Paratype 25, (12 mm). Right: Paratype 23 (13 mm)
4th row left: Paratype 21 (17 mm). Right: Paratype 22 (18 mm)



LORENZ, F. & CHIAPPONI, M.: A new species of *Bistolida* (Gastropoda: Cypraeidae).

Explanations of Plate 3:

Bistolida piae

1st row: 19,7 mm

2nd row: 19,7 mm

3rd row: 22,2 mm

4th row left: 18,7 mm. Right: 17,1 mm



LORENZ, F. & CHIAPPONI, M.: A new species of *Bistolida* (Gastropoda: Cypraeidae).

The differences between the two concern all of the features that are understood as being most subject to natural selection pressures: shape, thickness, and size, as well as the coloration of the shell, which is constant in *B. piae*, but varies considerably in *B. nanostraca*. The number of teeth and the structure of the radula show less obvious differences. We suspect that the thick, callused shell of *B. piae* is a defense against fish attacks. Many specimens show traces of healed fish-bites. The smaller and narrower *B. nanostraca* appears better adapted to hiding deeper in the narrow crevices of a coral conglomerate.

The species of *Bistolida* have a planktotrophic development, and their spawns are similar to those of most cowries in consisting of one hundred or more egg capsules, each containing several hundred larvae. The spawn of *B. nanostraca* consists of remarkably few egg capsules with exceptionally large and few larvae. Nurse eggs, characteristic of intracapsular larval development in other genera (*Cypraeovula*, *Notocypraea*, *Zoila*), were not observed. The size and small amount of whorls of the protoconchs of *B. nanostraca* and *B. piae* suggest that their free-swimming veliger phase is either short or absent (See also RANSON, 1967, LILTVED, 1989, FOIN, 1981, 1982, and MEYER, 2003). This mechanism may aid in maintaining populations in an isolated atoll that is hit heavily by cyclones and under the permanent influence of strong currents.

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