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NOT ZETEKOPSIS LAUBENFELS, 1936 (PORIFERA: COELOSPHAERIDAE).
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T. MANOUSIS, M. TISELLI, S. GALINOU-MITSOUDI



Association Française de Conchyliologie

www.xenophora.org
2 square La Fontaine
75016 Paris

Président

Eric Monnier,

e-mail: ericm2007@hotmail.fr

194 Rue du Chateau des Rentiers - 75013 PARIS

Vice-Président

Fabrice Prugnaud

e-mail: fprugnaud@gmail.com

23 Rue des Bons Raisins - 92150 Suresnes



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Betty Reese

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DIDIER MERLE

Email: didier.merle@mnhn.fr

Département Origines et Evolution, Muséum national d'Histoire naturelle, Sorbonne Université (CR2P, UMR 7207 CNRS, MNHN, UPMC), 8, rue Buffon, 75005 Paris, France

BERNARD GARRIGUES

Email: bernardgarrigues@yahoo.fr

67 Route de Saint Paul, Lalande 82400, Goudourville, France

JEAN-PIERRE POINTIER

Email: pointier@univ-perp.fr

PSL Research University, CRILOBE, UAR 3278 CNRS-EPHE-Université, 58 Avenue Paul Alduy, 66860 Perpignan CEDEX, France

Abstract: A new name *Zetecopsis* is proposed for *Zetekopsis* Merle, Garrigues & Pointier, 2022 (Gastropoda: Muricidae), not *Zetekopsis* Laubenfels, 1936 (Porifera: Coelosphaeridae).

Key words: Taxonomy, Muricidae, new name.

Résumé : Un nouveau nom *Zetecopsis* est proposé pour *Zetekopsis* Merle, Garrigues & Pointier, 2022 (Gastropoda: Muricidae), non *Zetekopsis* Laubenfels, 1936 (Porifera : Coelosphaeridae).

Mots-clé : Taxonomie, Muricidae, nouveau nom.

***Zetecopsis* new name.** In the book *Fossil and Recent Muricidae of the world*, Part Muricopsinae, MERLE *et al.* (2022: 72) erected a new genus *Zetekopsis* for one Pliocene species from Western Atlantic (Costa Rica) and several extant species from Eastern Pacific (Northern Gulf of California to Guayaquil, Ecuador) previously attributed to *Muricopsis* Bucquoy & Dautzenberg, 1882 (e.g., RADWIN & D'ATTILIO, 1976; VOKES 1994). MERLE & HOUART (2003: 551) identified shell differences with typical *Muricopsis* and delineated the *Muricopsis zeteki* group. The main difference is observed on P2, which becomes strongly atrophied during the growth. Other differences concern the surface of the shell covered by numerous threads and crenulations on the outer lip. These characters do not occur in *Muricopsis* and justify a generic separation. Unfortunately, *Zetekopsis* is preoccupied by a genus of Porifera erected by LAUBENFELS (1936: 85). This second use is invalid (as are all subsequent uses) and the name must be replaced. Thus, we propose the new name *Zetecopsis* (etymology: as *Zetekopsis*, but differing by a c (as -copsis) instead of one k). The type species is *Murex zeteki* Hertlein & Strong, 1951. The species included into the genus are: *Zetecopsis galbensis* (Jung, 1969)[†] and *Z. pauxilla* (A. Adams, 1854), *Z. taupini* (Garrigues, 2016), *Z. vassarti* (Houart, 2019), *Z. westonensis* (Myers & D'Attilio, 1990), *Z. zeteki* (Hertlein & Strong, 1951) with two species in Incertae sedis ?*Z. mcleani* (Wiedrick, 2009) and ?*Z. tulensis* (Radwin & D'Attilio, 1976).

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THE CORALLIOPHILINAE FROM THE ANTILLES AND FRENCH GUIANA WITH THE DESCRIPTION OF SIX NEW SPECIES.

BERNARD GARRIGUES

Email: bernardgarrigues@yahoo.fr

67 route de Saint Paul, Lalande

82400 Goudourville, France

DOMINIQUE LAMY

Email: dominique.lamy2@wanadoo.fr

As Antilles Mollusques,

6 lotissement Bel-Air, Impasse Liane de Chine,

97122, Baie-Mahault, Guadeloupe, France

DARIO ZUCCON

Email: dario.zucon@mnhn.fr

Institut de Systématique, Evolution, Biodiversité (ISYEB), MNHN, CNRS, SU, EPHE, UA

CP 26, 57 Rue Cuvier, 75005 Paris, France



Fig. 1 - *Coralliophila galea* & *salebrosa* on *Pseudodiploria clivosa* (Ellis & Solander, 1786), Guadeloupe

ABSTRACT

A total of 17 species belonging to the Coralliophilinae sub-family were presently listed in the Caribbean area, of which 14 are identified from the Lesser Antilles and French Guiana and only three are missing. Two of the identified species are only known by their holotype: *Coralliophila profundicola* Haas, 1949 and *Babelomurex spinosus* (Dall, 1889). Two other species from the Mediterranean and East Atlantic are added to that list: *Coralliophila meyendorffii* (Calcara, 1845) et *Coralliophila adansonii* (Kosuge & Fernandes, 1989). One species, *Coralliophila caribaea* Abbott, 1958 is considered as a synonym of *Coralliophila salebrosa* H & A Adams, 1863. Six new species are described (*C. cordalata* n. sp., *Babelomurex colettae* n. sp., *B. bayeri* n. sp., *B. pruvosti* n. sp., *B. stupa* n. sp. et *B. rugosus* n. sp.). Five species could not be identified. A total of 26 Coralliophilinae species are presently occurring in the study area.

INTRODUCTION

Coralliophilinae is a monophyletic group considered as a Muricidae sub-family. It includes between 200 and 250 species distributed in all the tropical and sub-tropical oceans. Coralliophilinae of the West-Atlantic are poorly studied and publications rather old. Planktotrophy of this group of Muricidae suggests large range areas, thus a revision of this group implies to include a study of the East-Atlantic and Mediterranean faunas. Several studies have been carried out on the North-East-Atlantic Coralliophilinae from the Azores, Canary Islands, Madeira and the West-African Coasts. Mediterranean species have also been widely studied.

MATERIAL AND METHODS

This study is based on material collected during several MNHN campaigns between 2011 and 2019: KARUBENTHOS 1 and 2 in Guadeloupe, MADIBENTHOS in Martinique and 'La Planète Revisitée' in French Guiana. Sampling was carried out from the shoreline to depths of 850 m during KARUBENTHOS 2. Sampling of the littoral species was carried out using scuba diving or brushing. This last technique allowed to collect very small and often juvenile specimens which are very useful for taxonomic studies. The deeper species have been sampled by dredging. Moreover, a great part of collected specimens have been sequenced. Numerous specimens have also been collected by the second author during the last decades.

This work is divided into two parts. The first part includes general comments on Coralliophilinae and especially on their mode of life and their habitat. In addition, to approach the study of planktotrophic marine species it is necessary to consider all the neighbouring species from the East-Atlantic and the Mediterranean. This list has been added to that of the West-Atlantic and the Caribbean areas. A summary table gathers all these species comparing their range. Its purpose is to highlight those that occur in several of the three regions.

The second part of this work is reserved to the systematic study, including taxonomy and phylogeny. Plates 2 to 5 show the spiral sculpture and the different sequences of spiral cords of the related species groups (see the descriptive method by Merle, 2001). Plates 6 to 21 illustrate Coralliophilinae collected in the Antilles and French Guiana and Plates 22 to 25 illustrate the species from East-Atlantic and Mediterranean absent in Antilles and French Guiana.

ORIGINS OF CORALLIOPHILINAE

The first known appearance of the Coralliophilinae occurred in the American area with *Coralliophila (Timotia) aldrichi* (Cossmann, 1903) from Middle Eocene (Bartonian) 40 Myr, from Mississippi and Louisiana (Lozouet & Renard, 1998; Merle *et al.*, 2011). Moreover, from a paleobiogeographic point of view, the opening of the Atlantic in the Cretaceous 65 Myr looks too old to explain the range of the species on both sides of the Atlantic. In absence of exchanges they would undoubtedly have diverged. Regarding this species, it is necessary to make a clarification. Cossmann (1903) had put *Murex cancellaroides* Meyer & Aldrich, 1886 in synonymy with *Murex cancellarioides* Grateloup, 1835, forgetting the *i* after the *r*, and had renamed it *aldrichi*. So it looks like the valid name is: *Coralliophila cancellaroides* (Meyer & Aldrich, 1886) (J.F. Lesport pers. com.). At the present time Coralliophilinae are occurring in the whole tropical and subtropical belt of the globe from the intertidal area to depths of 1400m.

DISPERSION OF SPECIES

Coralliophilinae have a multispiral protoconch apart from a few rare exceptions suggesting a planktotrophic larval development. During evolution many groups of Muricidae have lost planktotrophy, but it appears that Coralliophilinae have kept this mode of development. The duration of the planktotrophic larval phase in Coralliophilinae is quite variable, hatching and metamorphosis may be separated by several weeks and even

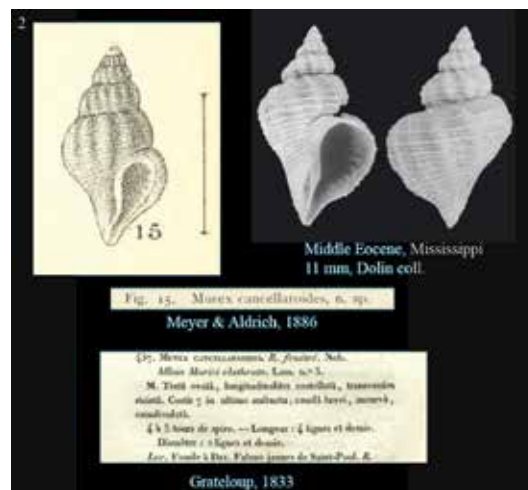


Fig.2 - *Murex cancellaroides*

several months (Bouchet, 1987). The different intercontinental ocean currents of the North-Atlantic seem the best way for the dispersion of species. The Gulf Stream begins between Florida and Bahamas and crosses the Atlantic Ocean before reaching the north of Europe. The Azores Current separates from the Gulf Stream near the Grand Bank and then continues East towards the African Coasts and the Cadix Gulf where a part of waters enters the Strait of Gibraltar (Gyory *et al.*, 2003). To the south the trade winds carry the surface waters towards the west. However, there are circulating return counter-currents under the surface waters in the Equatorial zone and also upwelling of deep cold waters. The low speed of some currents seems thus incompatible with the lifetime of some larval stage.

In the case of dispersion and settlement of migrant species numerous other ecological factors can be taken into account such as water salinity and temperature. Regarding food resources only eurytopic species which have a great adaptability are favoured. The reproduction phase during which temperature has an important role is also a critical period for survival of species (Bouchet & Taviani, 1992). Bouchet & Warén (1994) have studied the dispersion of planktotrophic larvae of deep species. These authors suggested two hypotheses (i) the larvae can survive in the benthic demersal zone feeding on bacteria or other organic material, (ii) larvae migrate towards the surface water layers rich in phytoplankton and then go back down to their favourite deep waters. Ship's ballast water may constitute another non-negligible factor of dispersion especially in the case of coastal species.

WAY OF LIFE AND PREDATION

Coralliophilinae are parasites of corals and have no radula. They feed exclusively upon Anthozoan introducing their proboscis inside the polyp. The polyp tissues are then predigested by salivary enzymes before to be ingested. Some Coralliophilinae species are permanently fixed upon their host whereas others can migrate from one host to another (Kilburn *et al.*, 2010). Anthozoa are Scleractinarians (Hexacorallia, formerly Madreporaria) or Alcyonarians (Octocorallia including Gorgonians and Soft Corals). Scleractinarians live in symbiosis with microalgae (Zooxanthellae) which need light for photosynthesis. In Guadeloupe Scleractinarians may occur to the depths of 80-90 m. Alcyonarians are less dependant on Zooxanthellae and will be present at great depths. Gorgonians have a skeleton composed of a proteic flexible substance

called gorgonin and are fixed on hard substrates from the first meters below the surface. Soft Corals have no a real skeleton but minute spinose elements called sclerites. In Antilles, Soft Corals appear from 100 m deep to more than 4000 m. The more common species in this last zone is *Stereonephthya portoricensis* (Hargitt, 1901).

Postcamp *et al* (2017) studied the coral hosts of two of the most common Coralliophilinae of the coastal zones of the Caribbean: *Coralliophila galea* (Dillwyn, 1823) and *C. caribaea*, Abbott, 1958. In their work, these authors described a new species, *C. curacaoensis*. *Coralliophila caribaea* has a broad host spectrum including Scleractinarians and Gorgonians whereas *C. galea* and *C. curacaoensis* are restricted on Scleractinarians. Twenty Scleractinian species belonging to ten genera are involved as hosts. In addition *C. caribaea* parasitizes four species of Soft Corals and *C. curacaoensis* was only found on a single Scleractinian species belonging to the *Madracis* genus. The coexistence of three juvenile species on the same host coral, *Madracis decactis* was also observed during the MADIBENTHOS expedition.



Fig. 3 - Three different species collected, on the same coral host, during the MADIBENTHOS expedition.

Regarding Scleractinarians, Coralliophilinae sedentary species such as *C. galea* may be usually found bordering living coral areas (Photo 1; Pl.1, Figs. E, F) but they can sometimes move on the coral. *Coralliophila caribaea* may be found at the base of Alcyonarians as well as on a branch of a Scleractinian. The predation on coral colonies is visible with the appearance of the skeleton alone (Photo 1; Pl 1 Fig.E). This predation looks minimal for the majority of Coralliophilinae, however, Bruckner *et al.* (2003) have shown that the mean consumption of *C. galea* upon *Acropora palmata* is 1.9 to 6.5 cm² per individual per day which is far from negligible.

Sexes are separated and generally males are smaller than females. In most of cases, fertilization is internal. Females carry the ovigerous capsules in a groove located between the foot and the operculum (Kilburn *et al.*, 2010) and incubation takes place inside the pallear cavity. Egg capsules are then released externally when larvae are ready to hatch.

LIST OF SPECIES

This list groups the listed species and their synonyms in the West-Atlantic zone and the Caribbean area (from North Carolina to South of Brazil) as well as in the North-East-Atlantic (Azores, Canary Islands, Madeira and North-East Africa until Cape Verde Islands) and in Mediterranean. Some species will be discussed later and the new species are not included in that list. The list of species from the North-East Atlantic is based on the work of Bouchet & Waren (1985) and Oliverio & Gofas (2006). Other works on the description of new species have also taken into account. Mediterranean Coralliophilinae follow the list of Russo (2020).

- *Coralliophila aberrans* (C. B. Adams, 1850), syn. *Coralliophila deburghiae fusiformis* Dall, 1889.
- *Coralliophila adansoni* (Kosuge & Fernandes, 1989).
- *Coralliophila aedonia* (Watson, 1886).
- *Coralliophila africana* Smriglio & Mariottini, 2002.
- *Coralliophila ahui* Cossigniani, 2009.
- *Coralliophila basileus* (Dautzenberg and Fischer, 1896).
- *Coralliophila brevis* (Blainville, 1832), syn. *Pyrula borbonica* Maravigna, 1842; *Pyrula santangeli* Maravigna, 1840; *Pyrula squamulata* Philippi, 1836; *Coralliophila alboranensis* Smriglio & Mariottini, 2003.
- *Coralliophila caribaea* Abbott, 1958.
- *Coralliophila curacaoensis* Potkamp & Hoeksema, 2017.
- *Coralliophila fontanangioyae* Smriglio & Mariottini, 2000.
- *Coralliophila galea* (Dillwyn, 1823), syn. *Coralliophila abbreviata* Kiener, 1936 (*auct non* Lamarck, 1816); *Murex subglobosus* Wood, 1828; *Coralliophila nodulosa*, H. & A. Adams, 1863; *Coralliophila undosa*, H. & A. Adams, 1863.
- *Coralliophila guancha* Smriglio, Mariottini & Engl, 2003.
- *Coralliophila juliamoralesae* Smriglio, Mariottini & Engl, 2002.
- *Coralliophila kalafuti* (Petuch, 1987).
- *Coralliophila kaofitorum* Vega, Vega & Luque, 2002.
- *Coralliophila lintoni* (Verrill & Smith, 1882).
- *Coralliophila meyendorffii* (Calcara, 1845).
- *Coralliophila panormitana* (Monterosato, 1869).
- *Coralliophila profundicola* Haas, 1949.
- *Coralliophila richardi* (P. Fischer, 1882), syn. *Coralliophila lactuca* Dall, 1889.
- *Coralliophila ruderata* Sturany, 1896 in Monterosato.
- *Coralliophila salebrosa* H. & A. Adams, 1863.
- *Coralliophila sofiae* (Aradas & Benoit, 1876).
- *Coralliophila squamosa* (Bivona, 1838), syn. *Hirtomurex squamosus* (Bivona, 1838), syn. *Murex aluoides* Blainville, 1829; *Fusus squamulosus* Philippi, 1836; *Pseudomurex perfectus* Fischer P., 1883; *Pseudomurex monterosatoi* Locard, 1897; *Hirtomurex longicauda* Settepassi, 1971.

- *Coralliophila trigoi* Mariottini, Smriglio & Rolán, 2005.
- *Coralliophila violacea* (Kiener, 1836).
- *Babelomurex atlantidis* Oliverio & Gofas, 2006.
- *Babelomurex basilius* (Penna Neme & Leme, 1978).
- *Babelomurex benoiti* (Tiberi, 1855),
syn. *Pseudomurex amaliae* Kobelt, 1907.
- *Babelomurex cariniferus* (G.B. Sowerby II, 1834),
syn. *Coralliophila babelis* (Requien, 1848);
Coralliophila carinata Koroneos, 1979; *Coralliophila lacerata* (Deshayes, 1856); *Coralliophila lacerata*
var. *piruloides* Martens, 1876 (dubious syn.); *Fusus babelis* Requien, 1848; *Fusus babelis* var. *regalis*
Requien, 1848; *Latiaxis elegans* Angas, 1878;
Purpura gravesii Broderip, 1836.
- *Babelomurex dalli* (Emerson & D'Attilio, 1963),
syn. *Coralliophila deburghiae* (Reeve, 1857) *sensu*
Dall (1889) (misapplication).
- *Babelomurex fax* (F. M. Bayer, 1971).
- *Babelomurex juliae* (Clench & Aguayo, 1939).
- *Babelomurex mansfieldi* (McGinty, 1940).
- *Babelomurex pacei* (Petuch, 1987).
- *Babelomurex scalariformis* (Lamarck, 1822).
- *Babelomurex sentix* (F. M. Bayer, 1971),
syn. *Latiaxis sentix carcassii* Nicolay & Angioy, 1985.
- *Babelomurex spinosus* Dall, 1889.
- *Babelomurex tectumsinensis* (Deshayes, 1856),
syn. *B. gili* Kosuge, 1990; *Coralliophila priolana*
Settepassi, 1977.

Table 1.- Species listed in their respective range [Species present in all ranges are in blue]

Species	Caribbean and West-Atlantic	East-Atlantic	Mediterranean
<i>Coralliophila abnormis</i>	present		
<i>Coralliophila adansonii</i>	present	present	
<i>Coralliophila aedonae</i>		present	
<i>Coralliophila aghionae</i>		present	present
<i>Coralliophila aghionii</i>		present	present
<i>Coralliophila acaules</i>		present	
<i>Coralliophila brevis</i>		present	present
<i>Coralliophila caribaea</i>	present		
<i>Coralliophila caracensis</i>	present		
<i>Coralliophila formanagleyae</i>		present	
<i>Coralliophila galea</i>	present		
<i>Coralliophila guacuba</i>		present	
<i>Coralliophila guianensisae</i>		present	
<i>Coralliophila kalarum</i> *	present		
<i>Coralliophila kargitorum</i>		present	
<i>Coralliophila karami</i>	present		
<i>Coralliophila meyerduffy</i>	present	present	present
<i>Coralliophila panamensis</i>		present	present
<i>Coralliophila profundicola</i>	present		
<i>Coralliophila rostralis</i> *	present	present	present
<i>Coralliophila ruficincta</i>			present
<i>Coralliophila sublimosa</i>	present		
<i>Coralliophila setacea</i>		present	present
<i>Coralliophila squarrosus</i>		present	present
<i>Coralliophila ulgosa</i>		present	present
<i>Coralliophila violacea</i>			present
<i>Babelomurex atlantidis</i>		present	
<i>Babelomurex basilius</i> *	present		
<i>Babelomurex benoiti</i>			present
<i>Babelomurex caribbaeus</i>		present	present
<i>Babelomurex dalli</i>	present	present	
<i>Babelomurex fax</i>	present		
<i>Babelomurex galea</i> *	present		
<i>Babelomurex mansfieldi</i>	present		
<i>Babelomurex pacei</i>	present		
<i>Babelomurex sentix</i>	present	present	present
<i>Babelomurex sinclairianus</i>	present		
<i>Babelomurex sublimus</i>	present		
<i>Babelomurex tectumsinensis</i>		present	present

* Among the currently known species from the West-Atlantic area, including Brazil, only four of them were not collected in the zones studied in this paper: *Coralliophila archana*, *C. kargitorum*, *Babelomurex basilius* & *B. galea* [Pl. 21].

TERMINOLOGY

P: primary cord

SP: subsutural primary cord

IP: infrasutural primary cord

P1: shoulder cord

P2-P6: primary cords of the convex part of the

teleoconch whorl

ADP: adapertural primary cord on the siphonal canal

MP: median primary cord on the siphonal canal

ABP: abapertural primary cord on the siphonal canal

s: secondary cord

adis: adapical infrasutural secondary cord

abis: abapical infrasutural secondary cord

s1-s6: secondary cords of the convex part of the

teleoconch whorl

ID, D1-D6: internal denticles

H: shell height

Other abbreviations and conservation of specimens:

AMNH: American Museum of Natural History, New York, USA

ANSP: Academy of Natural Sciences of Philadelphia, Pennsylvania, USA.

FMNH: Field Museum of Natural History, Chicago, Illinois, USA.

MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA.

MHNG: Muséum d'Histoire Naturelle, Genève, Suisse.

MNHN: Muséum national d'Histoire naturelle (secteur mollusques récents), Paris, France.

MOM: Musée Océanographique de Monaco.

NHMUK: Natural History Museum of United Kingdom, London, United Kingdom.

RMNH: Rijksmuseum van Natuurlijke History, Leiden, The Netherlands.

USNM: National Museum of Natural History, Smithsonian Institution. Washington, USA.

BG: Bernard Garrigues collection (Lalande, France).

DL: Dominique Lamy collection (Baie-Mahault, Guadeloupe).

PR: Paolo Russo collection (Venice, Italia).

For a better understanding, references to figures in the reference papers appear in regular fonts while references to pictures and plates are in capital letters (ex.pl.x, fig.x or Pl.x, Fig.x).

SYSTEMATICS

Superfamily Muricoidea Rafinesque, 1815

Family Muricidae Rafinesque, 1815

Subfamily Coralliophilinae Chenu, 1859

THE LIMIT OF GENERA

Steenstrup (1850, p.75) describes the genus *Rhizochilus* together with its type species *R. antipathum*. Three years later Adams & Adams (1853) described *Coralliophila* as a subgenus of *Rhizochilus* and proposed a list of species. The description of the subgenus *Coralliophila* is rather succinct and Iredale (1912) raised this taxon to the rank of genus and choosed in the list of Adams as type species, *neritoidens* Chemnitz (= *Murex*

neritoideus Gmelin, 1791, p. 3559, n°169, syn. *Coralliophila violacea* (Kiener, 1836).

The genus *Hirtomurex* has been described by Coen (1922) with *Fusus lamellosus* Philippi, 1836 (= *Hirtomurex squamosus* Bivona & Bernardi, 1838) as type species. It is characterized by very squamous spiral cords. This species occurs in Mediterranean and in the East-Atlantic. Regarding the shell morphology, the Indo-Pacific species belonging to the *Hirtomurex* genus are an homogeneous group. However, *H. squamosus* is not clearly distinguishable from the East-Atlantic or Mediterranean Coralliophilinae (Oliverio & Gofas, 2006) and consequently following these authors, *squamosus* will be placed in the *Coralliophila* genus. It must be remembered that *squamosa* is the type species of the *Hirtomurex* genus. The problem of its validity is thus open.

Coen (1922) described the *Babelomurex* genus on the type species *Fusus babelis* Requier, 1822 (= *Babelomurex cariniferus* (G.B. Sowerby II, 1834) whose the main distinctive characters are a biconic shell with a high carenated spire ornamented with large triangular spines arranged in a crown at the shoulder and grooves on the internal part of the external lip.

Since Thiele (1929) who created the Magilidae Family characterized by the absence of radula, the Coralliophilinae sub-family is considered as a monophyletic group. Oliverio *et al.* (2009) presented a molecular phylogeny using sequences of the mitochondrial marker 12rDNA which confirmed the monophyly of Coralliophilinae. In this study 42 coralliophilin species from various sources were used. The results clearly showed the presence of two major clades within the Coralliophilinae. Clade A gathers the East-Atlantic species closed to *Coralliophila meyendorffii* usually included in the genus *Coralliophila* to which are added *Quoyula monodonta* (= *Coralliophila monodonta*), *Babelomurex lischkeanus*, *Rapa rapa* and *Leptoconchus* sp. Clade B gathers the type species of *Babelomurex* (*B. cariniferus*) most of the other *Babelomurex* but also *Coralliophila caribaea* and the type species of Coralliophilinae, *C. violacea*. The genus *Hirtomurex* Coen, 1922 (type species *Fusus lamellosus* Philippi, 1836) is also represented in the clade B by an Indo-Pacific species *H. filiaregis* (Kurohara, 1959) together with another Indo-Pacific species *C. erosa* (Röding, 1798).

Regarding the species studied in the present paper, *C. meyendorffii* and the closed species from East-Atlantic or Mediterranean usually included in the Coralliophilinae, are in clade A whereas *C. caribaea* is included in clade B. Then, as currently established and as reported by Oliverio & Gofas (2006) the genera *Coralliophila* and *Babelomurex* are polyphyletic and need a redefinition.

In this paper we tried to compare the molecular results of Oliverio *et al.* (2009) with the conchological characters. The study of homologies i.e. common characters of several species inherited from a common ancestor, could make the connection between molecular and conchological data. Based on those data common evolutionary history could be thus established between some species. We have choosen to define these conchological characters using the descriptive method developed by Merle (2001) and Merle *et al.* (2011) on the spiral sculpture and ontogenesis of Muricidae cords.

The spiral sculpture is organized around two major elements, primary cords and internal teeth of the lip. In adult Coralliophilinae shells it is not easy to recognize the primary cords because they are often confused with the secondary and tertiary cords of equivalent size. In addition in numerous

Coralliophilinae, denticulation of the internal part of the lip is absent or inconspicuous. In the best case, it just appears in the form of striae or elongated denticles often split which makes their identification difficult. Unlike other groups of Muricidae, in Coralliophilinae topological correspondence between cords and denticles is in numerous cases difficult to establish in adult shells. Consequently identification of primary cords will be carried out on very juvenile shells (see Pl. 2, Figs 1, 4, 9; Pl. 3, Fig. 4; Pl. 4, Figs 1, 4, 10; Pl. 5, Figs 1, 5, 7).

The study of sculptural characters allowed to distinguish two main groups in the species concerned. The first group brings together species close to *Coralliophila caribaea* and *C. violacea* as well as *Babelomurex* spp. (Pl. 2, 4 and 5). Their sculpture pattern is characterized by an hypertrophy of P1, a P2 attached to P1 followed by a space after which appear P3 and P4 (Pl. 2, Fig. 1-2). This pattern is particularly accentuated in *Babelomurex* spp. Among these, the hypertrophy of P1 can be important showing at most a single row of large spines at the shoulder and a P2 merging with P1 (Pl.5, Figs 3, 4, 9). In the second group that we will call *meyendorffii* group, sequences of cords are different. The primary cords are equivalent and have a unique arrangement with an alternation of primary and secondary ones. These last are often smaller (Pl. 3). This pattern is observed in most of species close to *C. meyerendorffii* occurring in Mediterranean and along the West-African Coasts as well as in some Caribbean species such as *C. aberrans* (Pl. 3, Fig. 1). The species which have been sequenced correspond to this pattern and are in the clade A of Oliverio *et al.* (2009). *Coralliophila violacea* is a special case. Its huge range extends in the whole Indo-Pacific area as well as in Polynesia and the Red Sea. Russo (2020) illustrated three specimens of *C. violacea* from Lampedusa in the Mediterranean but without certainty on his part. He identified them as *C. monodonta* (Blainville, 1832). However, according to Blainville (1832) *C. monodonta* is a species which is ornamented with a small tooth at the ending part of the columella. The three specimens of Russo (2020) do not have this small tooth and would, rather belong to the species *C. violacea*. The presence of *C. violacea* in the Mediterranean would not be surprising. Some shells come from Sinaï (see Pl.22, Fig. 17) and many other species have made their way through the Suez Canal. As already seen, *C. violacea* which is the type species of *Coralliophila* appears in the clade B of Oliverio *et al.* (2009) and its spiral sculpture is in agreement with that of the other species of the group (Pl. 2 Fig. 9).

The study of species cords belonging to the genus currently known under the name of *Coralliophila* divides them into two main groups. This conchological result confirms the separation of the two molecular clades of Oliverio *et al.* (2009). Thus it would seem that the *Coralliophila* of the B clade are clearly closer to the *Babelomurex* than the *Coralliophila* of the *C. meyerendorffii* type clade A.

Next to molecular and conchological markers, other characters and environmental parameters can be taken into account (Puillandre, 2019). In our group of Coralliophilinae, range, host dependency as well as the habitat depth can be important factors.

At the present time, data baselines with specimens, their taxonomical identification as well as DNA sequences remain very incomplete (Puillandre, 2019). For reasons of clarity and waiting new molecular studies, we will keep in this paper the current classification. The studied species are then included in the two genera commonly used, i.e. *Coralliophila* H. & A.

Adams, 1853 and *Babelomurex* Coen, 1922. However, there will be the following four exceptions: *Hirtomurex squamosus* (Bivona & Bernardi, 1838) will be placed in the *Coralliophila* genus, *Coralliophila scalariformis* (Lamarck, 1822), *C. pacei* Petuch, 1987 and *C. deburghiae spinosa* Dall, 1889 will be placed in the *Babelomurex* genus.

Genus *Coralliophila* H. Adams, & A. Adams, 1853

Type species: *Murex neritoideus* Gmelin, 1791 accepted as *Coralliophila violacea* (Kiener, 1836) by subsequent designation.

Coralliophila galea (Dillwyn, 1823)

Pictures 1, 3-4; Pl. 1, figs E-F; Pl. 2, Figs 4-6; Pl. 6, Figs 1-20.



Fig. 4 - *Coralliophila galea* Guad MNHN IM-2013-60271

One of the first illustrations of this species is in Chemnitz (1787-1788) where mention is made of *Murex galea alba* referring to Lister and Klein (p. 237, v10, pl. 160, figs. 1518, 1519 here Pl. 6, Fig. 1). Due to the absence of coherent application of the binominal nomenclature, these old volumes are blacklisted by the International Code of Zoological Nomenclature (ICZN). Thus an author coming after and referring to Chemnitz in a book with a coherent application of the binominal nomenclature becomes the author of the name. For example Dillwyn, Gmelin, Röding, Holten, etc...are the authors of numerous names used for the first time by Chemnitz who, with its hundreds of plates remains an essential source until the second part of the 19th century (P. Bouchet pers. com.)

- *Murex galea* Chemnitz, 1788, p. 237, pl. 160, fig. 1518, 1519; (Pl. 6, Fig. 1).
- *Murex galea* Dillwyn, 1823.
- *Purpura abbreviata* Kiener, 1840 (*auct non* Lamarck, 1816), p. 75, pl. 19, fig. 56.
- *Purpura galea* Reeve, 1846; pl. 7, fig. 65.
- *Coralliophila abbreviata* (Lamarck, 1816); Abbott 1974, p. 193, fig. 2028.
- *Coralliophila nodulosa*, H. & A. Adams, 1863; holotype NHMUK 1984110, Guadeloupe (Pl. 6, Fig. 3).
- *Coralliophila undosa*, H. & A. Adams, 1863; two syntypes NHMUK 1982056. These specimens of the H. Cuming collection, would have been collected in Sandwich Islands,

South-Atlantic. Syntype b (Pl. 6, Fig. 4) evokes well *C. galea*, which would greatly extends its range towards the South. On the other hand, syntype a corresponds to another species occurring at the South of Cape Verde Islands along the West-African Coast: *C. adansoni* Kosuge & Fernandes, 1989. The presence of these two 'tropical species' in the South, in a zone with a climate closer to that the Antarctica than the Caribbean is surprising.

- *Coralliophila abbreviata* (Lamarck, 1816); Abbott & Dance 1982, p. 156.
- *Coralliophila galea* (Reeve, 1846); Kosuge & Suzuki, 1985, pl. 23, fig. 8; pl. 42, fig. 5; pl. 49, fig. 11.
- *Coralliophila abbreviata* (Lamarck, 1816); Hess & Abbott, 1994, p. 154.
- *Coralliophila abbreviata* (Lamarck, 1816); Rios, 1994, p. 118, pl. 38, fig. 498; *Pyrula abbreviata* Lamarck, 1816 : junior synonym of *C. erosa* (Röding, 1798), species known only from Pacific (Oliverio, 2008).
- *Coralliophila abbreviata* (Lamarck, 1816); Pointier & Lamy, 1998, p. 121.
- *Coralliophila abbreviata* (Lamarck, 1816); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 272, fig. 602.
- *Coralliophila galea* (Dilwyn, 1823); Redfern, 2013, p. 163, fig. 462a.
- *Coralliophila galea* (Dilwyn, 1823); Potkamp, Vermeij & Hoeksem, 2017, p. 139, fig. 19.
- *Coralliophila galea* (Dilwyn, 1823); Lamy & Pointier, 2017, p. 338, pl. 111, fig. 3a-c.

TYPE MATERIAL: not found

TYPE LOCALITY: unknown

RANGE: The range of *Coralliophila galea* is huge extending from the North in Bermuda and Carolinas to the South in the Caribbean area. The species is reported from several regions of Brazil (Ceara, Bahia, Vitoria, Fernando da Noronha, Abrolhos). Syntype b of *C. undosa* (Pl. 6, Fig. 4) would come from the Sandwich islands (?) located in the deep South to the East of Cape Horn. This surprising locality involves cold waters poorly compatible for a coral reef species that would be dependent on Scleractinarians. During the KARUBENTHOS 2 Expedition, a living specimen has been collected at 68 m deep (Picture 4; Pl. 6, Fig. 19) a quite unusual depth for this species in the Caribbean area. *Coralliophila galea* can probably make inroads into deeper waters by finding a stable temperature of suitable host corals.

HOST CORALS

Only associated with Scleractinarians (Postcamp *et al.*, 2017). The more common host corals in Guadeloupe are *Acropora cervicornis* (Lamarck, 1816) and *A. prolifera* (Lamarck, 1816) (C. Bouchon pers. com.). Pictures 1, Pl. 1, Figs E-F and Pl. 6, Fig. 8 show several *C. galea* bordering a colony of *Orbicella annularis* (Ellis & Solander, 1786) in Guadeloupe. Behind predated areas the coral skeleton appears white (Pl. 1 Fig. E-F).

MAIN CONCHOLOGICAL CHARACTERS AND INTRASPECIFIC VARIATIONS

Ovoid teleoconch of about four whorls up to 10 to 53 mm in height and 7 to 38 mm in diameter. Multispiral protoconch of

four whorls with sculpture formed by two spiral keels and axial riblets (Pl. 6, Figs 10 and 20). Low spire, apical angle between 86 and 118°. More or less incised suture. Axial sculpture of seven to eight rounded ribs. Spiral sculpture of primary, secondary and tertiary almost identical cords, from suture to the end of siphonal canal (Pl. 2, Fig. 5). In some gerontic specimens (Pl. 2, Fig. 6), P1 and P2 more important and connected, spaced from P3 and P4 also connected, on the siphonal canal: ADP hypertrophied then MP and ABP present. Moderately long and wide open siphonal canal. Wide and oval aperture with adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations, internally lirae. Shell background color creamly white. White or orange aperture. D-shaped opercula with subapical nucleus in lower right, orange yellow in colour.

Juveniles with often an angulous shoulder (Pl. 6, Figs. 17-19) which tends to round off during growth the teleoconch then taking an oval shape. Conversely, some old specimens or of large size tend to take again the juvenile form with a very flat spire and an angulous shoulder that may form knots (Pl. 6, Figs. 2, 7). Primary cords are identifiable on very young specimens at the first whorl of the teleoconch (Pl. 2, Fig. 4; Pl. 6, Fig. 10) or on some old specimens (Pl. 2, Fig. 6). We can see on the pictures of living animals, tentacles, eyes, siphon and the yellow colour of the foot spotted with white (photo 4; Pl. 6, Fig. 5; photos MNHN).

INTERSPECIFIC COMPARISONS AND DISCUSSION

This well known species does not look like any other occurring in this area. It is easily identifiable by its oval shape, its numerous spiral cords and its aperture most of orange. Groups of several *C. galea* are often observed bordering colonies of hard corals. Seven specimen of this species were sequenced following MNHN campaigns in the French West Indies. We have illustrated four of them which are very representative of the species: IM-2013-19489, IM-2013-8687, IM-2013-9490, and IM-2013-60271, (Pl. 6, Figs 6, 9, 14 et 19).

Coralliophila salebroso H. & A. Adams, 1863

Pictures 3, 5; Pl. 1, Figs A-D; Pl. 2, Figs 1-3, 7-8; Pl. 7, Figs. 1-15; Pl. 8, Figs 1-16; Pl. 9, Figs. 1-2, 4-13



Fig. 5 - *Coralliophila salebroso*
MADIBENTHOS, Stn. AR571, MNHN-IM-2013-73067

- *Coralliophila plicata* auct. non *Murex plicatus* Wood, 1818 = *Coralliophila erosa* (Röding, 1798).
- *Coralliophila salebrosa* H. & A. Adams, 1863, *Proceedings of the Zoological Society of London*. 1863, p. 431, n° 13.
- *Coralliophila brevis* auct. non Blainville, 1832, Abbott, 1958.
- *Coralliophila caribaea* Abbott, 1958, *Monographs of the Academy of Natural Sciences*, Philadelphia 11, p. 76, text-fig. 3, fig. 1; pl. 1, figs. g, h.
- *Ringicula cruzensis* Usticke, 1969, p. 30, pl. 6, fig. 1247.
- *Coralliophila caribaea* Abbott, 1958; Abbott, 1974, p. 193, fig. 2029.
- *Coralliophila caribaea* Abbott, 1958; Abbott & Dance, 1982, p. 156.
- *Coralliophila caribaea* Abbott, 1958; Kosuge & Suzuki, 1985, pl. 44, figs 6-7.
- *Coralliophila salebrosa* H. & A. Adams, 1863; Kosuge & Suzuki, 1985, p. 40, pl. 42, fig. 4 (syntype).
- *Coralliophila caribaea* Abbott, 1958; Pointier & Lamy, 1998, p. 121.
- *Coralliophila caribaea* Abbott, 1958; Rios, 1994, p. 118, pl. 38, fig. 500.
- *Coralliophila caribaea* Abbott, 1958; Yidi-Daccarett & Sarmiento-Bossio, 2011, 11, p. 272, fig. 602.
- *Coralliophila caribaea* Abbott, 1958; Redfern, 2013, p. 163, fig. 463a.
- *Coralliophila caribaea* Abbott, 1958; Potkamp, Vermeij & Hoeksema, 2017, p. 139, fig. 18.
- *Coralliophila caribaea* Abbott, 1958; Lamy & Pointier, 2017, p. 338, pl. 111, fig. 2a, b.

TYPE MATERIAL: two syntypes (NHMUK 1984109a-b), Cuming collection.

TYPE LOCALITY: Guadeloupe.

RANGE: from South Carolina and Bermuda in the North, the entire Caribbean region and to Brazil in the South.

HOST CORALS: associated to Scleractinarians and Alcyonarians (Pl. 1, Fig. A; Pl. 8, Fig. 4).

MAIN CHARACTERS, INTRASPECIFIC VARIATIONS AND DISCUSSION

Biconic and shouldered teleoconch of five whorls up to 19 to 30 mm in height and 11 to 16 mm in diameter. Multispiral protoconch of five whorls with sculpture formed by two spiral keels and axial riblets (Pl. 8, Fig. 16). Standard spire, apical angle between 70 and 85°. Incised suture. Axial sculpture of seven to eight rounded ribs more or less prominent. The last two ribs preceding the edge of the outer lip tend to close together and flatten. Spiral sculpture of squamous primary, secondary and tertiary cords. Thin equivalent cords on the infrasutural ramp. P1-P6 on the convex part of the whorl and ADP, MP and ADP on the siphonal canal, all well expressed. P1 and P2 connected, P3 spaced and usually hypertrophied (Pl. 2, Fig. 1-3, 7-8). Moderately long and wide open siphonal canal. Wide and oval aperture with adherent columellar lip. Flared outer lip notched between cords terminations. Inner side of the outer lip smooth or weakly striated (Pl. 8, Figs 1, 5). Shell background color cream or purplish. White or violet aperture. D-shaped operculum with subapical nucleus in lower right, red brown in colour.

In some specimens of large size, the last whorl can expand significantly and the shoulder can take a more rounded appearance (Pl. 8, Figs. 9 and 14).

Two species, *Coralliophila caribaea* Abbott, 1958 and *C. salebrosa* H. & A. Adams, 1863, are placed in synonymy following the sequencing of 28 specimens from Guadeloupe and Martinique. The taxon *salebrosa* (1863) is retained due to date priority. We have chosen to show the variability of *Coralliophila salebrosa* by illustrating several morphs on three different plates.

Plate 7 illustrates a morph that is distinguished by a narrower shape and a larger size. (DNA sequenced specimens: Pl. 7, Fig. 3, IM-2013-9556, and Pl. 7, Fig. 12, IM-2013-20428). The shoulder is in the middle part of the teleoconch while in the classic form it is clearly offset toward the apex. The elongated denticles present on the internal of the outer lip are more constant. The last two ribs which precede the edge of the aperture tend to come together and flatten. In their original description of *C. salebrosa*, the Adams brothers specify that this species sometimes takes the form of *Vitularia*. The Guadeloupe specimen illustrated Pl. 7, Fig. 5 agrees with this observation. Plate 8 illustrates a morph that has a distinctly triangular shape (DNA sequenced specimens: Pl. 8, Fig. 7, IM-2013-8881, and Pl. 8, Fig. 15, IM-2013-8880). In some large specimens, the last whorl may widen noticeably and the shoulder take on a more rounded appearance (Pl. 8, Figs. 9 et 14).

Plate 9 illustrates a third morph that was collected in Martinique at Grande Anse d'Arlet (MADIBENTHOS stn. AR153) at 25 m deep (DNA sequenced specimens: Pl. 9, Fig. 1, IM-2019-1863; Pl. 9, Fig. 2, IM-2019-1862 ; Pl. 9, Fig. 13, IM-2013-63906). Other very similar specimens come from Grand Cul-de-Sac Marin in Guadeloupe and from St Barthelemy. In Martinique coralliophilinae were associated with *Gorgonia flabellum* Linnaeus, 1758 (Pl. 9, Fig. 3). Of homogeneous structure, the shells have in common a pyriform appearance and a smoother sculpture although in some juvenile or subadult specimens the primary cords are more apparent (Pl. 2, Fig. 8; Pl. 9, Figs. 5, 10, 12). The apical part of the outer lip can form a circular expansion (Pl. 9, Fig. 6). A growth defect, in the form of a scar, ending in a notch of the outer lip between P3 and P4, is found in several adult specimens (Pl. 9, Fig. 7). The background and the aperture color is usually dark blue or purple. Unlike others morphs, these shells are in the majority of cases completely devoid of calcareous concretions.

A total of 28 specimens of Guadeloupe and Martinique were sequenced and confirmed the conspecificity of the different morphs of *C. salebrosa*.

Oliverio & Mariottini (2001) showed the variability of the shell of *Coralliophila meyendorffii* according to its type of predation. If the host corals are Scleratinarians, the shell is smaller, while it is larger and more fusiform when Alcyonarians are predated. Potkamp *et al.*, 2017 investigated morphology and genetic variations in *Coralliophila galea* and *C. caribaea* (= *salebrosa*) based on their association with host corals in Curaçao. In the two species of Coralliophilinae differences in size and shape of the shell were found as well as changes in morphological development during growth. In particular, the variability of the spire contributed strongly to the overall shape of the shell. In *C. caribaea* minor genetic differences existed between populations associated with Scleratinarian and those associated with Alcyonacea. In French West Indies the different types of

predation of *C. caribaea* are very present and can explain the variability of this species.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Coralliophila salebrosa may be compared to several species superficially similar such as *C. brevis* (Blainville, 1832), *C. africana* Smriglio & Mariottini, 2002, *C. kaofitorum* Vega, Vega & Luque, 2002 or *C. ahui* Cossigniani, 2009 from Mediterranean and East-Atlantic (Pl. 22). However, the spiral sculpture of these last species is of the '*meyendorffii* type' that differentiates them.

***Coralliophila* sp. 1**

Pl. 7, Fig. 16

LOCALITY: Guadeloupe

INTERSPECIFIC COMPARISONS

This specimen trapped alive at 350 m deep off Vieux-Habitants, North of Basse-Terre, Guadeloupe poses a problem. Apart from an hypertrophy of P1 with a small spine at the shoulder and an unusual purple coloring of its multispiral protoconch, its structure is very close to that of *C. salebrosa*. These conchological differences associated to the great depth of its capture suggest a different species.

***Coralliophila curacaoensis* Postcamp & Hocksema, 2017**

Picture3; Pl. 2, Figs. 11-12; Pl. 10, Figs. 1-12.

Coralliophila curacaoensis Potkamp & Hoeksema, 2017, p. 139, fig. 20.

TYPE MATERIAL: holotype (RMNH.5004326), nine paratypes RMNH.5004323-5004325.

TYPE LOCALITY: Playa Daaibooi, leeward coast of Curaçao, at 11 m deep.

RANGE: Only known from Curaçao but recently discovered in the French Antilles between, 8 and 25m deep. This small species poorly known so far and difficult to find is probably present in the whole Southern part of the Caribbean.

HOST CORALS: in Martinique *C. curacaoensis* has been found associated with two species of Scleractinarians, *Madracis decactis* (Lyman, 1859; picture 3) and *M. auretenra* Locke & Coates, 2007 (Pl. 10, Fig. 13). In Curaçao, type specimens are associated only with *M. auretenra* (Potkamp *et al.*, 2017).

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic teleoconch of approximately three whorls up to 4 to 9 mm in height and 2.5 to 7.8 mm in diameter. Multispiral protoconch of four whorls with sculpture formed by two spiral keels and axial riblets (Pl. 10, Figs 6 and 11). Standard spire. Apical angle between 74 and 87°. More or less incised suture. Axial sculpture of eight to ten ribs more apparent on the first whorls. Spiral sculpture of very squamous cords, with large protruding scales at the intersections of the ribs (Pl. 10, Fig. 4c). IP on the infrasutural ramp. On the convex part of the whorl P1,

P2 and P3 hypertrophied, P4 and P5 smaller. On the siphonal canal hypertrophied ADP (Pl. 2, Figs 11-12). Wide, moderately long and open siphonal canal. Oval and wide aperture with adherent columellar lip. Flared outer lip notched between square end cords terminations. Smooth inner side of the outer lip. Shell background color cream with frequently pink spots on the columellar lip. Cream aperture. Red brown operculum. *Coralliophila curacaoensis* is a polymorphic species. Some specimens have an ovoid shape (Pl. 10, Figs 2,7,8) while in others it is triangular (Pl. 10, Figs 1,2,4,12).

INTERSPECIFIC COMPARISONS AND DISCUSSION

Molecular data made it possible to separate *C. curacaoensis* from the close species *C. caribaea* (= *C. salebrosa*) (Potkamp *et al.*, 2017, p. 143). This was confirmed by molecular analysis of a specimen collected during the campaign KARUBENTHOS 2012 (MNHN IM-2013-9121), (Pl. 10, Fig. 3). *Coralliophila curacaoensis* differs from *C. salebrosa* by its spiral sculpture dominated by an hypertrophy of P1 and P3, by very scaly cords and a less angular shoulder. Moreover, *C. curacaoensis* does not look like any other species of *Coralliophila* from the Caribbean area or East-Atlantic.

***Coralliophila cordalata* n. sp.**

Pl. 2, Fig. 10; Pl. 10, Fig. 14.

TYPE MATERIAL: holotype (MNHN-IM-2000-38028), H : 11.2 mm.

TYPE LOCALITY: West of Grande-Anse, Diamant, Martinique, MADIBENTHOS stn AB583, at 19 m deep.

RANGE: only known from the type locality.

ETHYMOLOGY: from latin *corda* = cord and *lata* = wide

HOLOTYPE DESCRIPTION

Biconic teleoconch of five whorls up to 11.2 mm in height and 5.8 mm in diameter. Multispiral protoconch of four whorls (Pl. 10, Fig. 14d). High spire. Apical angle of 52°. Standard suture. Axial sculpture of 12 ribs apparent on the first whorls, less then. Spiral sculpture of squamous and flat cords. On the convex part of the whorl P1, P2 and P3 hypertrophied, P4, P5 and P6 smaller. On the siphonal canal ADP hypertrophied. (Pl. 2, Figs 11-12). Wide, open and dorsally curved siphonal canal of 16% of the total height. Oval and wide aperture with adherent columellar lip. Flared and narrow outer lip notched between cords terminations. Inner side of the outer lip slightly striated. Pseudumbilicus quite apparent. Squamous microsculpture of growth lines. Shell background color cream and brown. White aperture. Operculum unknown.

INTERSPECIFIC COMPARISONS

The closest species of *Coralliophila cordalata* n. sp. is *C. curacaoensis*. Although their first whorls are close, *C. cordalata* has a spire significantly higher, axial ribs more numerous (12 instead of 10), a proportionately smaller aperture and a shell height of 11.2mm while the specimens of *C. curacaoensis*

do not exceed 8.9 mm. The two species share a close spiral sculpture with P1, P2 and P3 hypertrophied cords (Pl. 2, Figs. 10-12). This pattern could bring them closer of another species *C. richardi* (Fischer, 1882) (Syn. *Coralliophila lactuca* Dall, 1889, see Pl. 21, Fig. 1). *Coralliophila richardi* is absent from the studied zone but is known from Georgia, USA (Type locality of *C. lactuca*), from Seamount, South of Azores (Pl. 21, Figs. 2-4) and from Mediterranean.

***Coralliophila* sp. 2**

Pl. 10, Fig. 15.

LOCALITY: West of Basse-Terre City, Guadeloupe, KARUBENTHOS 2015, stn DW4514, at 792-800 m deep.

INTERSPECIFIC COMPARISONS AND DISCUSSION.

This unique specimen of 9.9 mm is in poor condition and does not refer to any known species from our study area. It is likely that future dredging will collect new specimens.

***Coralliophila aberrans* (C.B. Adams, 1850)**

Pl. 3, Fig. 1; Pl. 11, Figs. 1-7.

- *Purpura aberrans* C.B. Adams, 1850, p. 58.
- *Coralliophila deburghiae fusiformis* Dall, 1889, p. 219, holotype USNM 10615, Vera Cruz, Mexico, Mexico Gulf (Pl. 11, Fig. 3).
- *Coralliophila aberrans* (C.B. Adams, 1850); Abbott & Dance 1982, p. 156.
- *Coralliophila aberrans* (C.B. Adams, 1850); Kosuge & Suzuki, 1985, pl. 44, fig. 1 (type).
- *Coralliophila aberrans* (C.B. Adams, 1850); Rios, 1994, p. 118, pl. 38, fig. 499.
- *Coralliophila aberrans* (C.B. Adams, 1850); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 272, fig. 603.
- *Coralliophila aberrans* (C.B. Adams, 1850); Lamy & Pointier, 2017, p. 338, pl. 111, fig. 1a-c.

Reeve (1857) described *Pyrula* (*Rhizochilus*) *deburghiae* (hab. China), a species from Philippines and China Sea. Dall (1889) confuses *Coralliophila deburghiae* Reeve, 1857 with the Caribbean species which will be described by Emerson & D'Attilio (1963) as *Latiaxis dalli*. The specimen illustrated by Dall (1889) (pl. XVI, fig. 5) is a juvenile of the one to be named later *L. dalli* (here Pl. 16, Fig. 1). In the same time, Dall described two varieties: *deburghiae* var. *spinosa* and *deburghiae* var. *fusiformis*, then quoted *deburghiae* var. *lintoni* Verrill. The International Code of Zoological Nomenclature (Art. 45.6.4) specifies that a name of variety or form published before 1961 is a name available for the species group. However (Art. 45.6.3) it is not available if published after 1960 (P. Bouchet pers. com.). *Coralliophila deburghiae spinosa* Dall, 1889, a species that Kosuge (1988) rightly integrated to the genus *Babelomurex*, would then become *Babelomurex spinosus* (Dall, 1889). However, there is a Japanese species named *Latiaxis spinosus* Hirase, 1908. Both classified in *Babelomurex*, *Coralliophila deburghiae* var. *spinosa* dall, 1889 and *Latiaxis spinosus* Hirase, 1908 are not primary homonyms but become secondary homonyms. In that case, it is the oldest name of Dall which has the priority and that of Hirase becomes invalid. The path to renaming *Babelomurex spinosus* (Hirase, 1908) is

complex. Starting from the list of recognized synonymies, it will be necessary to decide between *Latiaxis* (*Babelomurex*) *pagodus* f. *multispinosus* Shikama, 1966 which would become *Babelomurex multipinosus* (Shikama, 1966) and *Latiaxis jeanneae* D'Attilio & Myers, 1984. However *multispinosus* has been established after 1960 to the rank of form, which makes it unavailable for the International Code (Art. 45.6.3). Then the valid name could be *Babelomurex jeanneae* (D'Attilio & Myers, 1984).

In the same paper, Dall (1989) also introduced the taxon *Coralliophila deburghiae* var. *fusiformis*. This species is obviously synonym of *Coralliophila aberrans* (C.B. Adams, 1850) (see the type picture of Dall, Pl. 11, Fig. 3; see also Kosuge, 1988, p. 116).

TYPE MATERIAL: holotype (MCZ 177956), paratype (MCZ 1177957) (Pl. 11, Figs. 1, 2).

TYPE LOCALITY: Jamaica

RANGE: from Florida to Brazil between 5 and 25 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Subcircular teleoconch of six whorls up to 15 to 33 mm in height and 9 to 18.5 mm in diameter. Usually eroded protoconch in adult shells. Standard spire. Apical angle between 71 and 77°. Incised suture. Axial sculpture of nine to ten rounded ribs. Spiral sculpture of squamous cords. Equivalent and arranged regular primary cords (IP, P1-P6 and ADP-MP). Smaller secondary cords interspersed between the primary cords (Pl. 3, Fig. 1). Moderately long and wide open siphonal canal. Oval and wide aperture with adherent columellar lip. Flared outer lip notched between cords terminations. Smooth inner side of the outer lip. Pseudoumbilicus apparent. Shell background color and aperture white. Operculum unknown.

INTERSPECIFIC COMPARISONS

Coralliophila aberrans is getting closer to *C. meyendorffii* (Calcare, 1845), a well-known species from Mediterranean and East-Atlantic. These two species have in common similar shape, size and colour. Their spiral sculpture is comparable with the same layout of cords. The more globular shape of *C. aberrans* as well as its larger aperture distinguishes it from *C. meyendorffii*. *Coralliophila trigoi* Mariottini, Smriglio & Rolán (2005) can also be compared to *C. aberrans* (Pl. 22, Fig. 16). *Coralliophila trigoi* occurs in the East-Atlantic long the Spanish and Portuguese Coasts, from Galicia to Algarve and Alboran Sea in the Western Mediterranean, from Malaga to Almeria between 15 and 50m deep. The two close species are distinguished by an aperture proportionally larger and a lower spire in *C. trigoi*. In addition this last species has more and narrower spiral cords of a reddish-brown colour unlike the constant white tint of *C. aberrans*.

***Coralliophila meyendorffii* (Calcare, 1845)**

Pl. 3, Fig. 2; Pl. 11, Fig. 8, 10-14.

- *Coralliophila scalaris* (Brocchi, 1814).
- *Coralliophila* (*Latimurex*) *meyendorffii* (Calcare, 1845).
- *Murex meyendorffii* Calcare, 1845, p. 38, n° 196.

- *Pseudomurex meyendorffii* (Calcara, 1845).
- *Coralliophila scalaris* var. *capensis* Bellini, 1929.
- *Coralliophila acuti-tenuitas* Settepassi, 1977.
- *Coralliophila meyendorffii elongata* Settepassi, 1977.
- *Coralliophila meyendorffii inflata* Settepassi, 1977.
- *Coralliophila meyendorffii serrata* Settepassi, 1977.
- *Coralliophila meyendorffii squamulata* Settepassi, 1977.
- *Pleurotomoides obliquispira* Nordsieck, 1977, p. 62, pl. 21, fig. 163.
- *Coralliophila meyendorffii* (Calcara, 1845); Abbott & Dance 1982, p. 155.
- *Coralliophila meyendorffii* (Calcara, 1845); Kosuge & Suzuki, 1985, p. 36, pl. 23, fig. 5; pl. 44, figs. 2, 4.
- *Coralliophila meyendorffii* (Calcara, 1845); Poppe & Goto, 1991, p. 142, pl. 27, fig. 7.
- *Coralliophila meyendorffii* (Calcara, 1845); Oliverio & Mariottini, 2001b.
- *Coralliophila meyendorffii* (Calcara, 1845); Oliverio & Gofas, 2006, p. 207, fig. 2.
- *Coralliophila meyendorffii* (Calcara, 1845); Russo, 2020, p. 10, fig. 7A-F.

TYPE MATERIAL: not found

TYPE LOCALITY: near Catania, Sicilia, Italy.

RANGE: present throughout the Mediterranean, Atlantic Ocean from the Canary Islands to the Azores and Senegal (Oliverio & Gofas, 2006). It occurs in the littoral zone between 0 and 20 m deep mainly on rocky bottoms. The specimen collected in Case Pilote, Martinique at 20 m deep (IM-2013-63945) is a real surprise and greatly expands its range.

HOST CORALS: *Coralliophila meyendorffii* is associated with sea anemones or Scleractinarians. It feeds by piercing the pedal disc of the sea anemones. In the case of Scleractinarians it introduces its proboscis in the stomodeum (pharyngeal tube) of the coral and aspirates the predigested content (Oliverio & Mariottini, 2001b). The specimen from Martinique was associated with the Scleractinarian *Montastrea cavernosa* (Linnaeus, 1766) (Pl. 11, Fig. 9).

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic to fusiform teleoconch of five whorls up to 7 to 28 mm in height and 9 to 18.5 mm in diameter. Multispiral protoconch of five whorls with sculpture formed by two spiral keels and axial riblets (picture 6; Pl. 11, Fig. 8d). Variable spire. Apical angle between 60° and 71°. Incised suture. Axial sculpture of nine to ten rounded ribs. Spiral sculpture of squamous cords. Equivalent and arranged regularly primary cords (IP, P1-P6 and ADP-MP). Smaller secondary cords interspersed between the primary cords (Pl. 3, Fig. 2). Moderately long and wide open siphonal canal. Oval and wide aperture with adherent columellar lip. Flared outer lip notched between cords terminations. Smooth inner side of the outer lip. Apparent pseudumbilicus. Shell background color and aperture white. Operculum unknown.

The pattern of spiral sculpture corresponds to that which is observed in the species present in the clade A of Oliverio *et al.* (2009) from the Mediterranean-East-Atlantic zone.

Oliverio & Mariottini (2001) recognize two shapes of different sizes in *C. meyendorffii*: the smallest between 4 and 20 mm being associated to Scleractinarians and (ii) the largest between 8 and 40 mm being associated to Alcyonarians. A same genotype can produce the two different phenotypes (Puillandre, 2019) confirming the conspecificity of the two shape patterns which are linked to the different host types. Specimens belonging to the first population have a biconic shell (Pl. 11, Figs. 8, 10, 12) while the shells belonging to the second population are much more fusiform (Pl. 11, Figs. 11, 13, 14). Also a sex change is observed in this hermaphroditic species which is primarily male then female called protandrous. Males are significantly smaller than females. The same dimorphism is also observed in populations of *C. meyendorffii* from Azores (Pl. 11, Figs. 10-11).

The single known specimen collected alive in Case Pilote, Martinique, stn. AR052 at 20 m deep during the MADIBENTHOS expedition (IM-2013-63945) (Pl. 2, Fig. 2; Pl. 11, Fig. 8) has a size of 7.7 mm and was associated to the Scleractinarian *Montastrea cavernosa* (Pl. 11, Fig. 19). It does not present any significant difference with those collected in Azores by Bouchet & Gofas (1980) (MNHN col., Pl. 11, Figs. 10-11).

The picture of the protoconch of *C. meyendorffii* from the Alboran Sea (picture 6) highlights some of the characters found on multispiral protoconchs of numerous Coralliophilinae. The transition between protoconch 1 and II indicates the hatching time. The sinusigeral scar precedes metamorphosis and the appearance of the teleoconch (Bouchet, 1987). Protoconch 1 is covered with fine granules whereas the sculpture of protoconch II is dominated by numerous axial ribs and two carenated spiral cords. A third spiral cord appears at the location of the suture.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Among the species occurring in the West-Atlantic zone, *C. meyendorffii* may be compared to *C. aberrans*. The two species have the same spiral cord pattern (Pl. 3, Figs. 1-2) but *C. aberrans* has a distinctly more globular shape.

Coralliophila adansoni Kosuge & Fernandes, 1989

Pl. 3, Fig. 3; Pl. 11, Figs. 15-16.

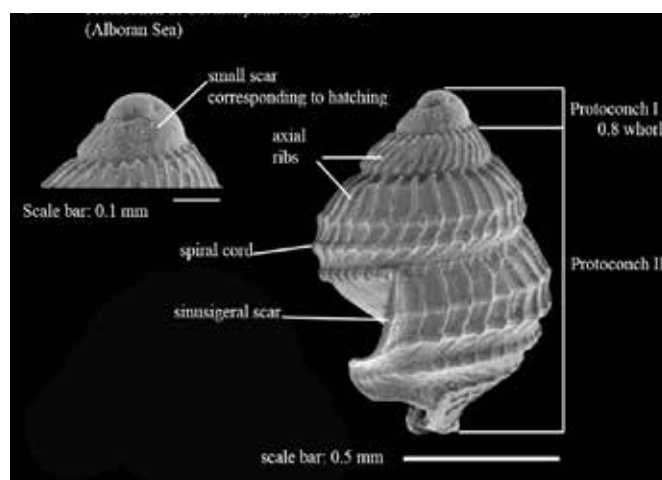


Fig. 6 - Protoconch of *Coralliophila meyendorffii*. (Photo S. Gofas. MEB.)

- *Purpura giton* Adanson M., 1757, p. 124, pl. 8, fig. 17.
- *Purpura giton* Adanson M., 1757; Dautzenberg, 1891. P. 41, pl. 3, fig. 4-b.
- *Coralliophila meyendorffii* (Calcara, 1845); Bernard, 1984, p. 72, fig. 121.
- *Ocenebrina adansoni* Kosuge & Fernandes, 1989, pl. 52, figs. 7-8.
- *Coralliophila adansoni* (Kosuge & Fernandes, 1989); Rolán & Fernandes, 1990, p. 143.

TYPE MATERIAL: IMT ?

TYPE LOCALITY: São Tomé

RANGE: São Tomé, Cape Verde, Gabon, Angola, Guadeloupe between 1 and 30m deep.

HOST CORALS: according to Rolán & Fernandes (1990), this species is associated with Soft Corals.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Ovoid teleoconch of five whorls up to 21 to 28 mm in height and 13 to 16 mm in diameter. Eroded protoconch. Standard spire. Apical angle between 76 and 80°. Slightly incised suture. Axial sculpture of 7 to 8 rounded and slightly protruding ribs. Spiral sculpture of squamous cords. Equivalent and arranged regularly primary cords (IP, P1-P6 and ADP, MP and ADP). Smaller secondary cords interspersed between the primary cords (Pl. 3, Fig. 3). Moderately long and wide open siphonal canal. Oval and wide aperture with adherent columellar lip. Flared outer lip notched between cords terminations. Denticulate inner side of the outer lip. Apparent pseudoumbilicus. Shell background color white or fawn. White aperture. Operculum unknown.

INTERSPECIFIC COMPARISONS AND DISCUSSION

The discovery of the illustrated specimen in a shallow reef of Guadeloupe (Pl. 11, Fig. 15) was a real surprise. There is nothing to distinguish it from the São Tomé shells. The illustrated specimen of São Tomé (Pl. 11, Fig. 16) collected at 1 m deep has a particularly preserved pattern sculpture. This species was first described as an *Ocenebrina*. Afterwards, Rolán & Fernandes (1990) included it in the Coralliophilinae according to several criteria, i.e. its association with Soft Corals, the positioning of the egg capsules in an enlargement of the aperture and the absence of radula. Some specimens have a thicker lip associated with a more apparent denticulation. In other specimens, the aperture is on the contrary wider with a narrower lip. Rolán & Fernandes (1990) report that this thicker lip may harbour the egg mass.

Coralliophila profundicola Haas, 1949

Pl. 3, Figs 4-6; Pl. 12, Figs.1-12.

- *Coralliophila profundicola* Haas, 1949 p. 69.
- *Coralliophila monterosatoi* (Locard, 1897); Kosuge & Suzuki, 1985, pl. 50, fig. 5 (type).
- *Coralliophila nivea* (A. Adams, 1853); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 273, n° 608.
- *Coralliophila* sp. 1, Lamy & Pointier, 2017, p. 338, pl. 111, figs. 6a, b.

TYPE MATERIAL: holotype (FMNH 31655)

TYPE LOCALITY: Bermuda at 3000 m deep.

RANGE: French Guiana, Colombia, Guadeloupe, St. Martin, Bermuda, between 115 and 350 m deep. The holotype of *C. profundicola* has been dredged at 3000 m deep in Bermuda but this unique specimen clearly dead could have sunk in deeper waters of the ocean.

MAINS CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic teleoconch of six whorls up to 13 to 30 mm in height and 8.6 to 16.8 mm in diameter. Multispiral protoconch of four whorls (Pl. 12, Fig. 2c). High spire. Apical angle between 54 and 70°. Incised suture. Axial sculpture of nine to ten rounded ribs. Spiral sculpture of squamous cords. Equivalent and arranged regularly primary cords (IP, P1-P6 and ADP-MP). Smaller secondary cords interspersed between the primary cords (Pl. 3, Fig. 1). Moderately long and wide open siphonal canal. Oval and wide aperture with adherent columellar lip. Flared outer lip notched between cords terminations. Smooth inner side of the outer lip. Apparent pseudoumbilicus. Shell background color and aperture white. Operculum unknown.

The illustrated specimen Pl. 12, Fig. 2 (IM-2013-60332) (BOLD) was collected during the MNHN campaign KARUBENTHOS 2015 in Guadeloupe (stn DW4538) at 320-338 m deep and that of Pl. 12, Fig. 3 (IM-2013-56535) (BOLD) was collected during the campaign in French Guiana 2014 (stn CP4381) at 114-118 m deep. The sequencing confirmed their conspecificity.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Coralliophila profundicola was compared to two neighbouring species collected in Atlantic at equivalent depths i.e. *Coralliophila aedonia* (Watson, 1886) and *C. basileus* (Dautzenberg & Fischer, 1896). *Coralliophila profundicola* was also compared to *Murex niveus* A. Adams, 1853 from undetermined location and *C. panomitana* (Monterosato, 1869) collected between 60 and 335 m deep from Occidental Mediterranean and Spanish and Moroccan Atlantic Coasts.

Haas (1949) makes a good description of *Coralliophila profundicola* (Pl. 12, Fig. 1) and he compares it to *C. aedonia*. The type of *C. aedonia* was collected from the Nightingale Island, South-Atlantic at 182-274 m deep (Pl. 23, Fig. 12). Afterwards, numerous specimens were dredged during the SEAMOUNT 2 Expedition (1993) at various depths between 330 and 1180 m. Oliverio & Gofas (2006) thought that planktotrophy could explain the significant distance between the two capture locations and these authors suggested a possible synonymy between *aedonia* and *profundicola*. This last species was known only by its holotype, a dead shell in poor condition. The important material collected in Guadeloupe and French Guiana allowed to differentiate the two species (Pl.12, Figs 2-12). As written by Haas (1949), *C. profundicola* has a wider and higher aperture, a proportionately longer final whorl, less nodular ribs, less incised sutures and the absence of denticulate structure (Pl. 23, Figs 12, 13).

Specimens of *Coralliophila basileus* (Dautzenberg & Fischer, 1896) were collected from the continental slope around Azores

and Canary Islands between 480 and 1550 m deep. Bouchet & Waren (1985) illustrated several specimens dredged during the BIACORES and TALISMAN campaigns (figs. 362-365) suggesting a possible conspecificity with *Coralliophila squamosa* (Bivona & Bernardi, 1838). Oliverio & Gofas (2006) identified *C. basileus* among the material of the SEAMOUNT 2 campaign of 1993 (Hyeres, 480 and 1060 m; Irving, 1150 and 890 m) (Pl. 23, Figs 2-4). The type of *Pseudomurex basileus* (MOM 241661) (Pl. 23, Fig. 1) was dredged in Azores (stn. 69) at 1300 m deep during the scientific campaigns of Prince Albert 1 on the Hirondelle ship between 1885 and 1915. Pictures of the complementary material (non type) from other sites in Azores allowed to identify an unknown species (Pl. 23, Fig. 11) which distinguishes from *basileus* by a higher spire and a larger size. Oliverio & Gofas (2006) mention p. 226 a specimen probably belonging to the same species (*Coralliophila* sp.3) collected during the SEAMOUNT2 expedition (here Pl. 23, Fig. 10).

Coralliophila profundicola differs from *C. basileus* by a lower spire, a shoulder closer to the suture with a flatter infrasutural ramp.

Coralliophila nivea (A. Adams, 1853) was described without type locality. It superficially resembles *C. profundicola* but the pictures of the three syntypes (NHMUK 1984115) show a very different spiral sculpture pattern and a general shape more globular.

Coralliophila panormitana (Monterosato, 1869) differs from *C. profundicola* by its very dilated last whorl and a very smaller size (Pl. 23, Figs. 17-18).

***Coralliophila lintoni* (Verrill & Smith, 1882)**

Pl. 3, Figs. 7-8, Pl. 13, Figs. 1-12

- *Trophon lintoni* Verrill & Smith, 1882, p. 365.
- *Coralliophila deburghiae lintoni* (Verrill & Smith, 1882); M. Smith, 1939, n° 482b, pl. 15, fig. 19,
- *Coralliophila lamellosa* (Philippi, 1836); Bayer, 1971, p. 192, fig. 51(?).
- *Coralliophila squamosa* (Bivona & Bernardi, 1838); Gracia *et al.*, 2004, p. 58, fig. 34 (?).
- *Coralliophila squamosa* (Bivona & Bernardi, 1838); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 273, n° 607 (?).

TYPE MATERIAL: holotype (USNM 77269)

TYPE LOCALITY: Martha's Vineyard, Massachusetts, USA, United States Fish Commission, Fish Hawk R/V, stn 1118, dredged at 128 m deep.

RANGE

Specimens recently dredged in Guadeloupe, between La Desirade and Marie-Galante Islands at 250 and 300 m deep are in agreement with the detailed description of Verrill & Smith (1882). Specimens figured by Bayer (1971) from Florida (677, 659, 115 m deep) and Yucatan (695, 772 m deep), by Gracia *et al.* (2003) from Colombia (200, 276 m deep), as *Coralliophila lamellosa* Philippi, 1836, and by Yidi-Daccarett & Sarmiento-Bossio (2011) as *C. squamosa* (Bivona, 1838) could belong to the *C. lintoni* species. As Bayer (1971) points out, the illustrated specimen from Yucatan (p. 193, fig. 51) has a more angulous shoulder than the holotype of *Trophon lintoni* and this character is also present in the Colombian specimens. In addition, the

aperture has a more triangular shape that is absent in the population from Guadeloupe identified as *C. lintoni*. This aperture shape evokes *C. salebrosa* (see Gracia *et al.*, 20094, p. 58, fig. 34) but due to the lack of available material, it is difficult to verify this conspecificity.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic teleoconch of six to seven whorls up to 15 to 27 mm in height and 8.6 to 16.8 mm in diameter. Multispiral protoconch (Pl. 13, Fig. 5c). High spire. Apical angle between 56 and 63°. Incised suture. Convex part of the world funnel-shaped. Axial sculpture of nine to ten rounded ribs. Spiral sculpture of squamous narrow cords. Well expressed primary cords: IP, P1-P6, ADP, MP and ABP (Pl. 3, Figs 7-8). At the shoulder, larger P1. Secondary cords apparent with relative hypertrophy of s1, s2 and s3 which could be the same size as primary cords in adult specimens. Relatively flat sutural ramp. Siphonal canal rather short, open and curved dorsally at its end. Moderately long and wide open siphonal canal. Subcircular and wide aperture. Adherent columellar lip. Flared outer lip notched between cords terminations, lined with short spines with round or square ends. Smooth inner side of the outer lip. Apparent pseudoumbilicus. Shell background color and aperture whitish, light brown, sometimes tan or pinkish. D-shaped operculum with subapical nucleus in lower right, red brown in colour (Pl. 13, Fig. 2d). The study of a large number of specimens collected in the southern part of Desirade Island has shown that the infrasutural ramp can be flatter with a protruding P1 (Pl. 13, Figs 4, 5, 7, 12) but sometimes convex given to the shoulder a more rounded shape (Pl. 13, Figs, 2, 3, 11).

INTERSPECIFIC COMPARISONS AND DISCUSSION

Although superficially close, *Coralliophila squamosa* (Bivona & Bernardi, 1838) (Pl. 24, Figs 1-6) from Mediterranean and East-Atlantic, differs from *C. lintoni*. In *C. squamosa*, the shoulder is clearly more rounded and primary cords flatter and wider with atrophied secondary cords (Pl. 3, Fig. 9 and Pl. 24, Fig. 6b). This atrophy of secondary cords is not found in *C. lintoni* (Pl. 3, Figs 8 and Pl. 13, Fig. 2c). All specimens examined are from the coasts of Provence, France, from Malaga region, Spain, or from the Gulf of Lion. All have a homogeneous morphology with a very marked scaly character. *Pseudomurex ruderatus* Sturany, 1896 from the Mediterranean deep waters was considered as a possible synonym of *C. squamosa* by Bouchet & Waren (1985), Oliverio & Gofas (2006) and Taviani *et al.*, (2009). A single specimen of '*C. squamosa*' collected by Taviani *et al.* (2009) as a *runderatus* deep-water morphotype was dredged alive at 500 m deep in the Strait of Sicilia associated with corals (Pl. 24, Fig. 10). Russo (2020) suggests the validity of this species illustrating the two syntypes (see Pl. 24, Figs. 7-8) and another specimen dredged off Cagliari between 600 and 1000 m deep (Pl. 24, Fig. 9). Due to the lack of additional material it seems difficult to separate this specie from *C. squamosa*. However, it would seem that *P. ruderatus* is distinguished by a flatter infrasutural ramp, a rather constant character in the few specimens observed. This conchological character would tend to bring it closer to *C. lintoni*. However, the spiral sculpture of *P. ruderatus* is much closer to that of *C. squamosa* than that of *C. lintoni* (Pl. 24, Figs 9c).

Genus *Babelomurex* Coen, 1922

Type species: *Fusus babelis* Requier, 1848 accepted as *Babelomurex cariniferus* (G.B. Sowerby II, 1834) by original designation.

***Babelomurex mansfieldi* (McGinty, 1940)**

Pl. 4, Figs. 1-3; Pl. 14, Figs. 1-13.

- *Muricidea mansfieldi* McGinty, 1940, p. 83, pl. 10, figs 5-5a (Pl. 14, Fig. 1).
- *Coralliophila mansfieldi* (McGinty, 1940); Pilsbry & McGinty, 1949, p. 11, pl. 1, figs 3-3a (Pl. 14, Fig. 2).
- *Latiaxis (Babelomurex) mansfieldi* McGinty, 1940; Abbott, 1974, n° 2040, fig. 2039 (under the name *Latiaxis costatus*, left picture).
- *Babelomurex mansfieldi* (McGinty, 1940); Kosuge & Suzuki, 1985, pl. 43, figs 7-8.
- *Latiaxis mansfieldi* (McGinty, 1940); Rios, 1994, p. 119, pl. 38, fig. 503.
- *Babelomurex mansfieldi* (McGinty, 1940); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 272, n° 599.
- *Babelomurex mansfieldi* (McGinty, 1940); Redfern, 2013, p. 163, fig. 64.
- *Coralliophila salebrosa* H. & A. Adams, 1864; Lamy & Pointier, 2017, p. 338, pl. 111, fig. 4a-b.

TYPE MATERIAL: holotype in the author collection (Pl. 14, Fig. 1), one paratype (USNM)

TYPE LOCALITY: Clewiston, Hendry County, Caloosahatchee marl., Pliocene.

RANGE: In the whole Caribbean area to Brazil from 3 to 80 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic and shouldered teleoconch of 6-7 whorls up to 20 to 36 mm in height and 12 to 19 mm in diameter. Multispiral protoconch of four whorls (Pl. 14, Figs 6a,13). Standard spire, apical angle between 62 and 75°. Standard suture. Flat infrasutural ramp giving the shell the shape of a pagoda roof. Carinated shoulder adorned with a short triangular spine. Axial sculpture of seven to eight ribs. Spiral sculpture of fine squamous cords. Primary cords P1 and P3 more important; P2 attached to P1; P2, P, P5 and P6 of equivalent size (Pl. 4, Figs 1-3). Presence of secondary cords s2 and s3. Short and open siphonal canal slightly curved dorsally at its extremity, 19% of the total height. Oval aperture. Adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations. Striated inner side of the outer lip. Shell background color cream to light brown. Cream aperture D-shaped operculum with subapical nucleus in lower right, yellow or brown in colour (Pl. 14, Fig. 10b).

INTERSPECIFIC COMPARISONS AND DISCUSSION

The holotype of *Babelomurex mansfieldi* is a fossil from the Miocene of Florida (Pl. 14, Fig. 1). Pilsbry & McGinty (1949) illustrated two recent specimens collected in shallow waters from the Palm Beach area (Pl. 14, Fig. 2a-b) and attributed their

conchological differences to a sexual dimorphism, males being smaller than females and having a carenated shell. However regardless of these conchological characters these authors do not precise if anatomical dissections have been carried out to confirm this hypothesis. As we can see plate 14, similar strong size differences are observed among Guadeloupe and Martinique populations. The biggest shells with a higher spire would be females (Pl. 14, Figs. 2a, 3, 8, 10 and 12) while the smaller with lower spire would be males (Pl. 14, Figs. 2b, 4, 5 and 9). However, this hypothesis remains to be confirmed by anatomical dissections. It should be specified that sequenced specimens IM-2013-60288 (Pl. 14, Fig. 5), IM-2013-70633 (Pl. 14, Fig. 3) and IM-2013-60476 (Pl. 14, Fig. 4) are conspecific. We have chosen to begin our list of *Babelomurex* with *B. mansfieldi* because of its superficial resemblance to *Coralliophila salebrosa* in order to illustrate the convergence between the two genera. However, the shape of *B. mansfieldi* reflects the most important conchological trait in *Babelomurex*, i.e. a flat infrasutural ramp ornamented with spines arranged in a crown at the shoulder. In this species, these spines are among the shortest among those of most other *Babelomurex* occurring in the study area. In addition to this particular difference of *Babelomurex*, *B. mansfieldi* also differs from *C. salebrosa* which has a more triangular aperture. As we will see below, the closer species of *B. mansfieldi* will be *B. scalariformis*.

***Babelomurex scalariformis* (Lamarck, 1822)**

Pl. 4, Figs 4, 5; Pl. 14, Figs. 14-22.

- *Purpura scalariformis* Lamarck, 1822, p. 74, pl. 19, fig. 55 ; p. 241, n° 20 (Pl. 14, Fig. 14).
- *Coralliophila scalariformis* (Lamarck, 1822); Kosuge & Suzuki, 1985, pl. 50, fig. 12.
- *Coralliophila scalariformis* (Lamarck, 1822); Pointier & Lamy, 1998, p. 120.
- *Coralliophila scalariformis* (Lamarck, 1822); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 272, n° 606.
- *Babelomurex mansfieldi* (McGinty, 1940); Lamy & Pointier, 2017, p. 332, pl. 108, fig. 3a-b.
- *Coralliophila scalariformis* (Lamarck, 1822); Lamy & Pointier, 2017, p. 338, pl. 111, fig. 5a-b.

TYPE MATERIAL: two syntypes (MHNG-INVE-52064) (Pl. 14, Fig. 14).

TYPE LOCALITY: unknown

RANGE: Florida, Gulf of Mexico, Caribbean Coast of Colombia, French Antilles between 2 and 84 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic and shouldered teleoconch of six whorls up to 23 to 30 mm in height and 16 to 23 mm in diameter. Multispiral protoconch of 3½ whorls (Pl. 14, Fig. 22). Low spire, apical angle between 73 and 80°. Standard suture. Flat infrasutural ramp giving the shell the shape of a pagoda roof. Carinated shoulder adorned with a triangular spine arranged in a crown. Axial sculpture of six to seven ribs. Spiral sculpture of fine squamous cords. Primary cords P1, P3 and P4 more important; smaller P2 attached to P1 (Pl. 4, Figs 4-5). ADP and MP on

the siphonal canal, ADP being more important. Presence of secondary cords. Short and open siphonal canal slightly curved dorsally at its extremity, 20% of the total height. Subcircular aperture. Adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations. Striated inner side of the outer lip. In juvenile specimens presence of denticulations from D1 to D5. Shell background colour and aperture white or beige. Orange apex. D-shaped operculum with subapical nucleus in lower right, yellow in colour (Pl. 14, Fig. 21).

INTERSPECIFIC COMPARISONS AND DISCUSSION

Babelomurex scalariformis has long been classified in the *Coralliophila* genus but it has conchological characteristics very close to *B. mansfieldi*. Moreover, a specimen from Martinique collected during the MADIBENTHOS expedition was sequenced (IM-2013-72464), (Pl. 14, Fig. 16) which showed a low genetic distance (2-3%) with the *B. mansfieldi* specimens. On one hand, this result adds a good argument to classify *scalariformis* in the *Babelomurex* genus and on the other hand suggests a conspecificity with *B. mansfieldi*. However, despite this short genetic distance, several conchological characters encourage to separate the two species. *Babelomurex scalariformis* differs from *B. mansfieldi* by a much lower spire, a convex part of the whorl wider with a larger expansion of the external lip and more developed spines. Its sculpture is noticeably coarser. However, it is difficult to distinguish juveniles of the two species, especially when it comes to specimens which could be males of *B. mansfieldi* (Pl. 14, Figs. 2b,4,9).

The two syntypes of Lamarck are surprising at first glance because they are very eroded shells (see Pl. 14, Fig. 14). To try to link this shell with intact specimens of the *scalariformis* species, a gerontic shell from Guadeloupe is illustrated (Pl. 14, Fig. 15) which is likely to be intermediate between the syntypes and the shells in good condition.

Babelomurex pacei (Petuch, 1987)

Pl. 4, Fig. 6, 7; Pl. 15, Figs. 1-9.

- *Coralliophila pacei* Petuch, 1987, p. 27, pl. 3, figs 11-12.
- *Babelomurex* sp. 2, Lamy & Pointier, 2017, p. 333, pl. 108, fig. 6a-b.
- *Babelomurex* sp. 7, Lamy & Pointier, 2017, p. 333, pl. 108, fig. 11a-b.

TYPE MATERIAL: holotype (USNM 859850) (Pl. 15, Fig. 1), one paratype (coll. R. Pace).

TYPE LOCALITY: known from its type locality at 18 m deep and from Guadeloupe between 110 and 250 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS.

Biconic and shouldered teleoconch of 5½ to 7 whorls up to 8 to 23 mm in height and 7 to 15.6 mm in diameter. Multispiral protoconch of 3½ whorls. Scalariform spire of variable height. Apical angle between 53 and 72°. Poorly incised suture. Flat sutural ramp. Carinated shoulder traversed by a scaly cord P1. Spatula spines at the intersections with the axial ribs. Axial sculpture of seven to nine ribs. Spiral sculpture of flat and squamous cords. P1, P2 and P3 more important; equivalent

cords in adis, IP, abis, P4-P6; ADP and MP on the siphonal canal; presence of secondary cords s1-s4 (Pl. 4, Figs 6-7). Short and open siphonal. Subcircular to oval aperture. Adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations lined with spatulate or square spines. Smooth or slightly striated inner side of the outer lip. Shell background colour and aperture cream sometimes tinged with pink or orange. Squamous microsculpture. D-shaped operculum with subapical nucleus in lower right, yellow in colour (Pl. 15, Fig. 5c).

This species found in Guadeloupe was only known from its type locality. The depth differences between samplings from Florida and Guadeloupe are surprising. Petuch (1987) classified *Babelomurex pacei* in the *Coralliophila* genus but its membership in *Babelomurex* seems more likely. Moreover, the molecular analysis of a specimen collected during the KARUBENTHOS II campaign (IM-2013-61050) included it among the other *Babelomurex*.

Babelomurex pacei is very different from all other known species. We observed a *Coralliophila meyendorffii* polymorphism in relation to its type of host. It would seem that this polymorphism also exists in *B. pacei*. We collected in Guadeloupe at various depths between 100 and 250 m deep identical specimens to that of the Petuch' type (Pl. 15, Figs. 2-4) and others with a much higher spire (Pl. 15, Figs. 6, 7, 9), that of Fig. 5 being intermediate. This variability is independent of the degree of maturity, adult specimens may have a low whorl. Larger specimens have a greater number of whorls. But apart of the height of the whorl, no character can distinguish the two forms. We have no data on their respective host corals.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Again the limit of genera is in question, the spiral sculpture of *Babelomurex pacei* would bring this species closer of some *Coralliophila*. *Babelomurex pacei* share with *Coralliophila curacaoensis* and *C. cordolata* n. sp. the same pattern of P1, P2 and P3. This pattern characterized by the flat and wide shape of primary cords cannot be found in the other *Babelomurex* from the study area.

Babelomurex dalli (Emerson & D'Attilio, 1963)

Pl. 5, Figs. 1-3; Pl. 16, Figs. 1-19.

- *Coralliophila deburghiae* (Reeve, 1857), Dall, 1889, p. 218, pl. 16, fig. 5, non *Pyrula (Rhizochilus) deburghiae* Reeve, 1857 (Pl. 16, Fig. 1).
- *Latiaxis (Babelomurex) dalli* Emerson & D'Attilio, 1963, p. 2, figs 1-2 (holotype: Pl. 16, Fig. 2).
- *Latiaxis dalli* Emerson & D'Attilio, 1963; Abbott, 1974, fig. 2038.
- *Latiaxis dalli* (Emerson & D'Attilio, 1963); Abbott & Dance 1982, p. 156.
- *Babelomurex dalli* (Emerson & D'Attilio, 1963); Kosuge & Suzuki, 1985, pl. 3, figs 3, 5 (5: type).
- *Latiaxis dalli* Emerson & D'Attilio, 1963; Pointier & Lamy, 1998, p. 1210.
- *Babelomurex dalli* (Emerson & D'Attilio, 1963); Gracia *et al.*, 2004, p. 57, fig. 33.
- *Babelomurex dalli* (Emerson & D'Attilio, 1963); Oliverio & Gofas, 2006, p. 225, fig. 12 (Pl. 16, Fig. 4).
- *Babelomurex dalli* (Emerson & D'Attilio, 1963); Yidi-

Daccarett & Sarmiento-Bossio, 2011, p. 272, fig. 601.

- *Babelomurex dalli* (Emerson & D'Attilio, 1963); Lamy & Pointier, 2017, p. 333, pl. 108, figs. 1a-b-c, 7a-b.

TYPE MATERIAL: holotype (USNM 87215) (Pl. 16, Fig. 2), one paratype (AMNH 102799), one paratype (ANSP 306434).

TYPE LOCALITY: holotype, Guadeloupe at 1600 m deep, paratype, Egmont Cayes, Florida at 220 m deep.

RANGE: West-Atlantic, Florida, Bahamas, St. Barthelemy, Guadeloupe, Colombia, Northern part of Central-Atlantic, Meteor Seamount between 220 and 1600 m deep. The most common depth for collecting this species would be 220 to 1600 m. The depth of 1600 m of the holotype seems to be an exception but few samplings have exceeded 500 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS.

Biconic and shouldered teleoconch of seven whorls up to 20 to 42 mm in height and 25 to 45 mm in diameter, spines included. Multispiral protoconch of four whorls with sculpture formed by two spiral keels and axial riblets (Pl. 16, Fig. 19). High spire, apical angle between 46 and 54°. Incised suture. Flat infrasutural ramp. Carinated shoulder adorned with large triangular spine straight or curved toward the apex. Convex part of the whorl forming an angle at the junction with the siphonal canal. Axial sculpture consisting of seven to eight rounded and slightly expressed ribs. Spiral sculpture consisting of squamous cords. On the sutural ramp: adis, predominant IP and abis (Pl. 16, Fig. 9c); on the convex part of the whorl: hypertrophied P1, P2 against P1 spine then roughly equivalent s2, P3, s3, P4, P5, P6; on the siphonal canal: equivalent ADP, MP and ABP (Pl. 5, Figs 1-3). Open siphonal canal slightly curved dorsally and laterally of 30% of the total height. Oval aperture. Adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations. Smooth or slightly striated inner side of the outer lip. Microsculpture of scales where fine lines of growth intersect spiral cords. Shell background white or light brown. Aperture bright white. D-shaped operculum with subapical nucleus in lower right, brown in colour.

Numerous specimens have a rather homogeneous conchological pattern in particular with regard to the height of the spire and the sculpture pattern. Conchological variations mostly observed are the arrangement and the size of the spines which can be straight like in the holotype (Pl. 16, Figs. 2, 18), or very curved towards the apex (Pl. 16, Figs 4, 9). The siphonal canal is more or less deviated at its extremity.

INTERSPECIFIC COMPARISONS AND DISCUSSION

The first appearance of *B. dalli* in the literature is in Dall (1889) where he illustrated a typical specimen from the Caribbean area (pl. XVI fig. 5; here in Pl. 16, Fig. 1). However, this author referred to *Latiaxis deburghiae* Reeve, 1857 which he named *Coralliophila deburghiae*. It was not until 1863 that Emerson & D'Attilio discovered that the Caribbean Coralliophilinae was quite distinct from Reeve's species (Habitat: China), and named it *Latiaxis dalli* (see holotype Pl. 16, Fig. 2). Oliverio & Gofas (2006) report the presence of *Babelomurex dalli* from

the East-Atlantic zone at 325 m deep at the Great Meteor Seamount, Southern part of the Azores (Pl. 16, Fig. 4). Some specimens harboured ovigerous capsules confirming the local reproduction of the species. In Guadeloupe, *B. dalli* is locally abundant. However, sampling specimens are mainly juveniles, and adults seem rarer or perhaps live in deeper waters.

It should also be mentioned that a specimen of *B. dalli* collected south of Marie-Galante (KARUBENTHOS 2015, stn DW4646, 250-254 m) has been sequenced (IM-2013-61551) and, interestingly, this sequencing brings closer to some *Coralliophila*.

Babelomurex basilium (Penn, Neme & Leme, 1978) is usually considered as a synonym of *B. dalli* (Rios, 1994; Oliverio & Gofas, 2006). Unfortunately it seems that the holotype and a part of paratypes have been lost (L.R. Simone pers. com.) but a picture of a specimen indicated as a paratype has been kindly sent to us by L.R. Simone as well as its original description (Pl. 21, Figs. 7a-b). Four other specimens of Brazilian *Babelomurex* dredged at 300 m deep from off the Santa Catarina State, are also illustrated Pl. 21 (Figs. 8-11). They differ from *B. dalli* by their number of ribs per whorl (around 9 to 10 instead of 7) and by shorter shoulder spines. Moreover, in *B. basilium* the last whorl is narrower and proportionally longer. The ratio of length of the last whorl to height of the shell is of 0.63 to 0.66 for *B. basilium* and of 0.66 to 0.71 for *B. dalli*. In addition, some specimens of *B. basilium* the spiral sculpture is made of a regular alternation of primary cords from P1 to P6 with smaller secondary cords (Pl. 21, Figs. 10-11). The aperture often takes a triangular form without the narrowing at the base of canal siphonal usual in *B. dalli* (Pl. 21, Figs 9-12).

Babelomurex dalli will be compared below with *B. sentix*.

Babelomurex sentix (F.M. Bayer, 1971)

Pl. 5, Figs. 4-5; Pl. 17, Figs. 1-11.

- *Coralliophila sentix* Bayer, 1971, p. 189, fig. 49 (here Pl. 17, Fig. 12).
- *Latiaxis sentix* (F.M. Bayer, 1971); Abbott & Dance 1982, p. 156.
- *Coralliophila sentix* Bayer, 1971; Bouchet & Warén, 1985, p. 154, fig. 367.
- *Latiaxis (Babelomurex) sentix carcassii* Nicolay & Angioy, 1985.
- *Babelomurex sentix* (Bayer, 1971); Kosuge & Suzuki, 1985, pl. 3, fig. 6 (type); pl. 50, fig. 7 (type de *B. carcassii*)
- *Babelomurex sentix* (Bayer, 1971); Oliverio & Gofas, 2006, p. 222, fig. 10 (here Pl. 17, Figs 4, 8-11).
- *Babelomurex sentix* (Bayer, 1971); Taviani *et al.*, 2009, p. 109, figs 10-12; p. 111, figs 16-20.
- *Babelomurex sentix* (Bayer, 1971); Lamy & Pointier, 2017, p. 333, pl. 108, fig. 4a-b, 9a-b.
- *Babelomurex sentix* (Bayer, 1971); Russo, 2020, p. 6, fig. 3A-H (here Pl. 17, Fig. 7).

TYPE MATERIAL: holotype USNM 701155 (Pl. 17, Fig. 1), one paratype USNM 701156.

TYPE LOCALITY: Pillsbury P-876 stn. East from St. Vincent, Lesser Antilles at 231-258 m deep.

RANGE: Lesser Antilles (300-400 m deep); East-Atlantic, Monaco 113 stn. Azores (1287 m deep); BIACORES, Azores

(450-475 m deep); SEAMOUNT 2: Hyeres (310-750 m deep); Atlantis Seamount (610 m deep); Meteor Seamount (585 m deep); Irving Seamount (490-790 m deep); Tyro Seamount (805 m deep); South of Malta, Mediterranean (460 m deep).

HOST CORALS: Taviani *et al.* (2009) report the presence of two specimens of *B. sentix* dredged South of the island of Malta on deep coral reefs including *Lofelia pertusa* (Linnaeus, 1758), *Madrepora oculata* Linnaeus, 1758, *Desmophyllum dianthus* (Esper, 1794) and *Corallium rubrum* (Linnaeus, 1758).

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS.

Biconic teleoconch of seven whorls up to 20 to 36 mm in height and 16 to 27 mm in diameter, spines included. Multispiral protoconch of three whorls (Pl. 17, Fig. 11). High spire, apical angle between 47 and 64°. Incised suture. Concave infrasutural ramp. Carinated shoulder adorned with large and flat triangular spine more or less curved toward the apex, very variable in size and appearing since the first whorl of the teleoconch (Pl. 17, Fig. 10). Rounded convex part of the whorl. Axial sculpture consisting of eight to nine slightly expressed ribs. Spiral sculpture consisting of fine cords. On the convex part of the whorl: hypertrophied P1 then many equivalent primary, secondary and tertiary cords among which P2 against P1 spine then P3 and P5 well expressed in the juvenile specimen (Pl. 5, Fig. 5). On the siphonal canal: equivalent ADP, MP and ABP. Open siphonal canal slightly curved dorsally of 16% of the total height. Oval aperture. Adherent columellar lip. Little apparent pseudumbilicus. Flared outer lip notched between cords terminations. Smooth or slightly striated inner side of the outer lip. Microsculpture of lines of growth. Shell background white or pinkish brown. Aperture bright white, sometimes pink. D-shaped operculum with subapical nucleus in lower right, orange-brown in colour.

As illustrated Pl. 17, the Caribbean form is stockier and ornamented with longer spines. The antepenultimate anterior canals can persist (Pl. 17, Figs. 2a-b). This specimen collected during KARUBENTHOS II campaign was sequenced (IM-2013-60303). Ribs clearly visible in juveniles then mitigate in adults whose shell takes on a smoother appearance.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Babelomurex sentix has a less squamous and finer spiral sculpture than *B. dalli* and a wider convex part of the last whorl. Apex views clearly show the confluence of the shoulder spines which is constant in *B. sentix* whereas they are dissociated in *B. dalli* (Pl. 16, Fig. 17; Pl. 17, Fig. 6e). Cecalupo (1985) compared *B. sentix* to three species, i.e. *Latiaxis kawamurai* Kira, 1959, *Latiaxis helenae* Azuma 1973 and *Babelomurex fusiformis* (Martens, 1902) from Japan, Philippines and Mozambique Channel between 232 and 620 deep (see Marais & Seccombe, 2010, p. 276; Kosuge, 1999, p. 109-110, pl. 40, figs 1-2). It is certain that there are disturbing conchological convergences between all these species whose ranges are very distant. *Babelomurex sentix* will be compared below with *B. fax*.

Babelomurex fax (F.M. Bayer, 1971)

Pl. 5, Fig. 6-7; Pl. 17, Figs 12-16.

- *Coralliophila fax* Bayer, 1971; p. 191, fig. 50 (holotype Pl.

17, Figs12).

- *Babelomurex fax* (F.M. Bayer, 1971); Kosuge & Suzuki, 1985, pl. 43, fig. 4 (type).
- *Babelomurex fax* (F.M. Bayer, 1971); Lamy & Pointier, 2017, p. 333, pl. 108, figs 2a-b.

TYPE MATERIAL: holotype USNM 701154 (Pl. 17, Fig. 12).

TYPE LOCALITY: GERDA, G-1125 stn., Florida Straits, Settlement Point, Greater Bahamas between 494 and 530 m deep.

RANGE: this species is only known by a few specimens collected from Bahamas, the Gulf of Mexico and Guadeloupe between 250 and 500 m deep.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS.

Biconic teleoconch of seven whorls up to 20 to 36 mm in height and 16 to 27 mm in diameter, spines included. Multispiral protoconch of three whorls (Pl. 17, Fig. 13c). Low spire, apical angle between 63 and 65°. Incised suture. Concave infrasutural ramp. Carinated shoulder adorned with large and serrated triangular spines, fused together and curved toward the apex, appearing since the first whorl of the teleoconch (Pl. 17, Fig. 14b). Oblique convex part of the world. Axial sculpture consisting of eight to ten slightly expressed ribs. Spiral sculpture consisting of fine cords. On the convex part of the world: hypertrophied P1 then many equivalent primary, secondary and tertiary cords among which P2 against P1 spine then P3, P4 and P5 slightly more important (Pl. 5, Fig. 6-7). Long and open siphonal canal slightly curved dorsally of about 30% of the total height. Triangular aperture. Narrow and adherent columellar lip. Apparent pseudumbilicus. Narrow outer lip with smooth inner side. Microsculpture of fine lines of growth. Shell background colour and aperture cream or dew, dead specimens dull gray. D-shaped operculum with subapical nucleus in lower right, orange-brown in colour.

Axial ribs are clearly visible on the first whorls but then mitigate.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Babelomurex fax differs from *B. dalli* by a smoother surface and its carenated shape. The convex part of the last whorl is less rounded. In *B. dalli*, spines are less numerous, generally longer and are not welded together. Compared to *Babelomurex sentix*, *B. fax* has a thinner shell, smoother and narrower with a lower spire. In addition, the aperture of *B. fax* has a triangular shape with a siphonal canal longer.

Babelomurex spinosus (Dall, 1889).

Pl. 4, Fig. 8; Pl. 18, Figs 1-6.

- *Coralliophila deburghiae spinosa* Dall, 1889, p. 219 (as
- *Coralliophila deburghiae* var. *spinosa*) (Pl. 18, Fig. 1).
- *Coralliophila deburghiae* var. *spinosa* Dall, 1889; Tomlin, 1935, v. 20, p. 183.
- *Babelomurex spinosa* (Dall, 1889); Kosuge, 1988, p. 115, pl. 45, figs 1-2.
- *Coralliophila deburghiae* "Reeve", var. *spinosa* Dall, 1889; D'Attilio, 1978, p. 77.

TYPE MATERIAL: syntype (USNM 87212) (Pl. 18, Fig. 1).

TYPE LOCALITY: St. James, Barbados at 183 m deep.

RANGE: known from Barbados and Guadeloupe between 90 and 250 m deep. In Guadeloupe all specimens were dredged in the Southern part of Desirade Island.

MAIN CHARACTERS AND INTRASPECIFIC VARIATIONS

Biconic and robust teleoconch of 6½ whorls up to 13 to 18 mm in height and 10.2 to 13 mm in diameter, spines included. Protoconch unknown. Apical angle, without the spines, between 52 and 55°. Standard suture. Convex infrasutural ramp. Short shoulder spines, oriented toward the apex and the edge of the aperture. (Pl. 18, Figs 2d, 5c) appearing from the first whorls of the teleoconch. Oblique convex part of the whorl, continuous with the siphonal canal. Axial sculpture of five to seven nodular ribs. Spiral sculpture of primary and secondary cords. IP on the sutural ramp. On the convex part of the whorl: hypertrophied P1, then roughly equivalent P2, P3, P4, P5 and P6 and intercalated secondary cords (Pl. 4, Fig. 8). ADP and MP on the siphonal canal. Short and open siphonal canal, of about 17% of the total height. Oval aperture. Narrow and adherent columellar lip. Apparent pseudumbilicus. Flared outer lip notched between cords terminations. Striated inner side of the outer lip. Shell background colour beige to light brown. White or beige aperture. Operculum unknown.

All known specimens of this species are illustrated Plate 18 (Figs. 1-6). Their shell morphology is rather homogeneous. Striae on the inner part of the lip only appear in adults. The nodular appearance of the shells is clearly visible Figs. 2 and 6. In some specimens the shoulder spine is sometimes longer but always turned towards the apex and the edge of the aperture (Pl. 18, Figs 2d-5c).

INTERSPECIFIC COMPARISONS AND DISCUSSION

Kosuge (1988) separates "*Babelomurex spinosa*" from *B. dalli* and *B. mansfieldi*. The last whorl more globular, the shorter siphonal canal, knobby axial ribs and shoulder spines clearly shorter distinguish it from *B. dalli*. The short shoulder spines are close to those of *B. mansfieldi* but rounded shoulders and knobby ribs are quite distinctive. It seems that since its description and the work of Tomlin (1935) this species has been completely ignored (Kosuge, 1988) or considered as a synonym of *B. dalli*. The recent discovery of some specimens in Guadeloupe undoubtedly allows it to be rehabilitated.

Babelomurex colettiae n. sp.

Pl. 4, Figs 10-11; Pl. 18, Figs 7-13.

- *Coralliophila mansfieldi* (McGinty, 1940); Bayer, 1971; p. 186, fig. 47.
- *Babelomurex* sp.4, Lamy & Pointier, 2017, p. 333, pl. 108, figs 8a-b.

TYPE MATERIAL : holotype (MNHN-IM-2000-38029), Vaisseaux Bank, Guadeloupe, at 100 m deep, H : 21.1 mm (Pl. 18, Fig. 8); paratype A (MNHN-IM-2000-38030), East La Désirade, Guadeloupe, KARUBENTHOS II stn DW4553, at 111-152 m deep, H:6 mm; paratype B (MNHN-IM-2000-38031), South

La Désirade, Guadeloupe, at 200-250 m deep, H :20.9 mm, paratype DL, paratype BG.

TYPE LOCALITY: Banc des vaisseaux, between St. François and Marie-Galante, Guadeloupe at 100 m deep.

RANGE: Guadeloupe (100-250 m deep); Martinique (250 m deep); Banco Gorda, Roatan, Honduras from the reef (25-30 m deep); Uraba Gulf, Colombia, PILLSBURY stn P-405 (92-93 m deep).

ETHYMOLOGY: in honor of Colette Lamy, second author' wife.

HOLOTYPE DESCRIPTION

Biconic teleoconch of five whorls up to 2.1 mm in height and 18.2 mm in diameter. Eroded protoconch. Apical angle: 49°. Incised suture. Axial sculpture of five to seven varix. Long and curved spines at the shoulder, oriented in the opposite direction of the aperture and appearing from the first whorls of the teleoconch (Pl. 18, Fig. 8c). Convex part of the whorl forming an angulation at the junction with the siphonal canal. Spiral sculpture of primary and secondary squamous cords. On the convex part of the whorl: hypertrophied P1, P2 attached to P1, then roughly equivalent P3, P4 and P5. Presence of smaller s2, s3 and P6 (Pl. 4, Fig. 10-11). Hypertrophied ADP and smaller MP on the siphonal canal. Short and open siphonal canal, of about 18% of the total height. Circular aperture. Narrow and adherent columellar lip. Apparent pseudumbilicus. Flared outer lip notched between cords terminations. Smooth inner side of the outer lip. Squamous microsculpture. Shell background cream, orange brown varix. Cream aperture. Operculum unknown.

INTRASPECIFIC VARIATIONS

The adult height varies from 17 to 21 mm and the diameter from 15 to 18 mm, included spines. Protoconch is multispiral with three whorls (Pl. 18, Fig. 7c). The apical angle without spines varies from 46 to 60°. Denticles appear on the internal part of the lip only in adult shells (Pl. 18, Fig. 12) and the departure of the siphonal canal then marked by a more accentuated narrowing at the level of the junction with the convex part of the whorl. In juvenile specimens this narrowing is not yet formed (Pl. 18, Figs 7, 11, 13).

INTERSPECIFIC COMPARISONS AND DISCUSSION

Babelomurex colettiae differs from *B. spinosus* by a non-nodular structure and by more scaly cords. In *B. colettiae* n. sp. the shoulder spines are clearly longer and differently oriented in direction opposite to the edge of the aperture. In addition, in *B. colettiae*, the aperture is more rounded-shaped with an external flared lip and a strong narrowing at the junction with the siphonal canal.

Bayer (1971) confused *B. colettiae* n. sp. with *B. mansfieldi* (p.186, fig. 47) reporting that this last species was in shallower waters. However the two species differ by the narrower shape of *B. mansfieldi* which is never ornamented with the long curved spines of *B. colettiae*. In addition, the aperture of *B. mansfieldi* is very flared, without the strong narrowing at the junction with the siphonal canal, characteristic of *B. colettiae*.

***Babelomurex bayeri* n. sp.**

Pl. 5, Fig. 8; Pl. 19, Figs 1-3.

- *Coralliophila tectumsinensis* (Deshayes, 1856); Bayer, 1971, p. 187, fig. 48.
- *Hirtomurex tectumsinense* (Deshayes, 1856), Kosuge & Suzuki, 1985, pl. 43, fig. 9 (fig. 48 of Bayer).
- *Babelomurex tectumsinensis* (Deshayes, 1856); Yidi-Daccarett & Sarmiento-Bossio, 2011, p. 272, fig. 600.
- *Babelomurex tectumsinensis* (Deshayes, 1856); Garrigues & Lamy, 2017, p. 31, 34, pl. 3, fig. 5a-b.

TYPE MATERIAL: holotype (MNHN IM-2013-56493) (Pl. 19, Fig. 1), sequenced DNA (); paratype A (MNHN IM-2013-43163) (Pl. 19, Fig. 2); paratype B (MNHN IM-2013-43163) (Pl. 19, Fig. 3).

TYPE LOCALITY: French Guiana ACOUPA CP 4379, at 130 m deep.

RANGE: French Guiana, South-East of Tortuga Isl., Venezuela, Colombia between 46 and 725 m deep.

ETHYMOLOGY: in honor of Frederick Bayer (1921-2007), marine biologist who was the first worked on this species from French Guiana.

HOLOTYPE DESCRIPTION

Globular shell with carinated shoulder. Teleoconch six whorls up to 14.2 mm in height and 10 mm in diameter, spines included. Eroded protoconch. Apical angle off spines of 50°. Standard suture. Flat infrasutural ramp. Axial sculpture of seven to eight ribs corresponding on the shoulder to triangular spines. Shoulder spines oriented toward the apex in a crown and appearing from the first whorl or the teleoconch (Pl. 19, Fig. 1c). Rounded convex part of the whorl. Spiral sculpture of primary and secondary squamous cords. On the convex part of the whorl: hypertrophied P1, roughly equivalent P2 to P5, smaller P6 (Pl. 5, Fig. 8). ADP on the siphonal canal. Short siphonal canal, about 14% of the total height. Oval aperture. Adherent and narrow columellar lip. Apparent pseudoumbilicus. Outer lip notched between cords terminations. Striated inner side of the outer lip. Squamous microsculpture. Shell background color white tinged of light brown. White aperture. Operculum unknown.

INTRASPECIFIC VARIATIONS

The adult height varies from 12.5 to 21 mm and the diameter from 10 to 17 mm included spines. Protoconch is multispiral with about three whorls (Pl. 19, Fig. 3b). The flat infrasutural ramp of the holotype can be more oblique and convex.

INTERSPECIFIC COMPARISONS AND DISCUSSION

Bayer (1971) named this species *Coralliophila tectumsinensis* (Deshayes, 1856; p. 88, fig. 48) according to a comparison with a Mediterranean shell from the USNM collections. However he expressed doubt about this conspecificity and according to him further studies could resolve this problem. Deshayes (1856, p. 8) described in the same paper *Murex Tectum Sinense* and *M. laceratum* from the Algerian Coast and an illustration of these shells. Unfortunately the figure numbers of the two species

plate III have been reversed, hence the confusion between *Murex laceratum* (figs. 1-2 but not 3-4, see here Pl. 25, Fig. 6) and *Murex Tectum Sinense* (figs 3-4 but not 1-2, here Pl. 25, Fig. 9). Cossignani (2010) found this mistake and validated *Murex Tectum Sinense* Deshayes, 1856 by *Babelomurex tectumsinensis* (Deshayes, 1856). Bayer (1971) compared a specimen from French Guiana (p. 188, fig. 48) to the USNM specimen identified as *C. tectumsinensis* but it was probably a *Murex laceratum* identified before the study of Cossignani (2010)! To simplify nothing, *M. laceratum* Dehayes, 1856 was put in synonymy with *Babelomurex cariniferus* (G.B. Sowerby II, 1834; see Pl. 25, Fig. 5-8). *Babelomurex tectumsinense* as it is currently known (Pl. 25, Figs 9-11), is quite different from the French Guiana species which is conchologically closer to *B. cariniferus*.

Babelomurex bayeri n. sp. is compared below to the closest species *B. tectumsinense* (Deshayes, 1856), *B. cariniferus* (G.B. Sowerby II, 1834) and *B. benoiti* (Tiberi, 1855).

Babelomurex tectumsinense (Pl. 25, Figs. 9-11) is reported from the Western part of Mediterranean to the Canary Islands at about 15 m deep. The two names in latin *Tectum Sinense* probably alludes to a Chinese roof and the word *tectumsinense* seems more adapted than the place of origin *tectumsinensis*. *Babelomurex bayeri* quite easily differs from *B. tectumsinense* by its thinner spiral sculpture and its oval shape of its aperture which is much more triangular in *B. tectumsinense*. In addition its shell height is between 12.5 and 24 mm whereas it is 33 to 48 mm in the Mediterranean species.

Babelomurex cariniferus occurs in the whole Mediterranean zone at 2 to 30 m deep (Pl. 25, Figs 5-8). Its conchological structure is rather constant and its shell height varies between 25 and 35 mm. It differs from *B. bayeri* n. sp. by a coarser spiral sculpture dominated by an hypertrophy of P3, a greater number of ribs (10 instead of 7 to 8), a more robust structure and a larger size.

Babelomurex benoiti (Tiberi, 1855) occurs between 50 and 120 m deep in the Western Mediterranean and off the Moroccan Atlantic Coast (Pl. 25, Figs. 1-4). As it can be seen, this species is polymorphic, the last whorl being more or less narrow and the siphonal canal more or less long. The illustrated specimen Pl. 25, Fig. 4, was dredged at Safi, West Morocco between 50 and 60 m deep and is probably the one which has the most similarities with *B. bayeri* n. sp. However, its spiral sculpture is coarser, with a greater number of whorls (8 instead of 6), a greater number of axial ribs (12 instead of 7 to 8) and a much larger size (36 mm instead of 12 to 21 mm).

***Babelomurex stupa* n. sp.**

Pl. 5, Fig. 9; Pl. 19, Fig. 4.

TYPE MATERIAL: holotype (MNHN -IM-2000-38032), H: 12 mm (Pl. 19, Fig. 4).

TYPE LOCALITY: off Macouba, Martinique, MADIBENTHOS stn. AD265 (14°55,1'N ; 61°08,9'W), at 80 m deep.

RANGE: only known from its type locality.

ETHYMOLOGY: stupa evokes a Buddhist architectural structure.

HOLOTYPE DESCRIPTION.

Biconic and large teleoconch of five whorls up to 12 mm in

height and 11.5 mm in diameter, spines included. Multispiral protoconch partly eroded. Low spire in the shape of pagoda roof. Apical angle without spines between of 61°. Standard suture. Flat infrasutural ramp. Carinated shoulder adorned with large triangular spines in crown. Rounded convex part of the whorl. Axial sculpture consisting of seven ribs from the first to the last whorl of the teleoconch. Spiral sculpture consisting of squamous cords. On the sutural ramp: numerous fine cords and equivalent to the number of ten (Pl. 19, Fig. 4d); on the convex part of the whorl: hypertrophied P1, P2 against P1 spine, more important P3 and P4, smaller and roughly equivalent s3, s4, P5, s5, P6; on the siphonal canal: wider ADP and MP (Pl. 5, Fig. 9). Open and short siphonal canal of 17% of the total height. Oval aperture. Adherent columellar lip. Apparent pseudoumbilicus. Outer lip notched between cords terminations. Striated inner side of the outer lip. Squamous microsculpture. Shell background cream. Aperture bright white. Operculum unknown.

INTERSPECIFIC COMPARISONS

Babelomurex stupa n. sp. differs from *B. dalli* by a much lower spire (apical angle of 61° whereas 46 to 54° in *B. dalli*). This character is important because the spire height is fairly constant in *B. dalli*. The last whorl in *B. stupa* is much wider with a proportionately larger aperture and a shorter siphonal canal. Its spiral sculpture is thinner, particularly at the level of the infrasutural ramp. Here, the hypertrophy of IP is constant in *B. dalli* but lacks in *B. stupa* (see Pl. 16, Fig 9c and Pl. 19, Fig. 4d). The internal part of the lip is smooth in *B. dalli* but striped in *B. stupa*. Finally, this new species was collected alive at 80 m deep while none of the many specimens of *B. dalli* has been collected at depths less than 250 m.

Babelomurex pruvosti n. sp.

Pl. 5, Fig. 10; Pl. 19, Figs 5–8.

Babelomurex dalli (Emerson & D'Attilio, 1963); Garrigues & Lamy, 2017.

TYPE MATERIEL : holotype (MNHN IM-2013-56494), DNA sequenced, French Guiana at 130 m deep, H : 13.3 mm (Pl. 19, Fig. 5); paratype (MNHN-IM-2000-38033), South La Désirade, Guadeloupe, at 250 m deep, H : 7.7 mm.

TYPE LOCALITY: French Guiana, ACOUPA CP4379, at 130 m deep.

RANGE: known from French Guiana and South of Desirade Island, Guadeloupe between 130 and 250 m deep.

ETHYMOLOGY: in honor of Laurent Pruvost who collected in difficult conditions numerous specimens.

HOLOTYPE DESCRIPTION

Biconic with rounded shoulder teleoconch of six whorls up to 13.3 mm in height and 8.2 mm in diameter, spines included. Multispiral protoconch partly eroded. High spire. Apical angle without spines between of 48°. Standard suture. Convex infrasutural ramp. At the shoulder short triangular spine in crown especially apparent on the last whorl. Convex part of the whorl forming a slight angle with the siphonal canal. Axial

sculpture consisting of eight to ten ribs on the first whorls and of seven ribs on the last whorl of the teleoconch. Spiral sculpture consisting of primary and secondary squamous cords. On the sutural ramp: adis, IP and abis equivalents (Pl. 19, Fig. 5c); at the shoulder hypertrophied P1; on the convex part of the whorl: P2, P3 and P4 well expressed, s2, s3, s4, P5 and P6 smaller; on the siphonal canal: ADP, MP and ADP well expressed (Pl. 5, Fig. 10). Open siphonal canal of 22% of the total height. Oval aperture. Adherent columellar lip. Little apparent pseudoumbilicus. Outer lip notched between cords terminations. Smooth inner side of the outer lip. Squamous microsculpture. Shell background fawn tinted cream. Aperture white. D-shaped operculum with subapical nucleus in lower right, orange-brown in colour.

INTRASPECIFIC COMPARISONS

No particular character differentiates the specimen collected at a depth of 250 m south of La Désirade, in Guadeloupe from the holotype from French Guiana. The protoconch is multispiral with four whorls (Pl. 19, Fig. 8d).

INTERSPECIFIC COMPARISONS

Babelomurex pruvosti n. sp. was confused with a juvenile of *B. dalli* (Pl. 19, Fig. 5) collected during the 'La Planète Revisitée' expedition in French Guiana (See Garrigues & Lamy, 2017). Sequencing of the holotype confirmed the separation of the two species. *Babelomurex pruvosti* differs from *B. dalli* by a higher spire, more prominent ribs, a rounded shoulder not crenated and reduced spines. In addition, the spiral sculpture of *B. pruvosti* is coarser and is characterized by the absence of IP hypertrophy (see Pl. 16, Fig. 9c and Pl. 19, Fig. 5c) and P2 well differentiated from P1 and equivalent to P3 and P4 (Pl. 5, Fig. 10).

Babelomurex rugosus n. sp.

Pl. 4, Fig. 9; Pl. 20, Figs 1-2.

TYPE MATERIAL: holotype (MNHN-IM-2000-38034), South of Désirade Isl., Guadeloupe, at 250 m deep, H: 18.5 mm (Pl. 20, Fig. 1); paratype (MNHN-IM-2000-38285), Macouba, Martinique, MADIBENTHOS stn. AD260, at 78 m deep, H: 10.8 mm (Pl. 20, Fig. 2).

TYPE LOCALITY: South of La Désirade, Guadeloupe at 250 m deep.

RANGE: South La Désirade, Guadeloupe at 250 m deep; Macouba, Martinique, at 78 m deep.

ETHYMOLOGY: from latin *rugosus*, rough, scaly.

HOLOTYPE DESCRIPTION.

Biconic teleoconch with rounded shoulder of seven whorls up to 18.5 mm in height and 12.5 mm in diameter. Eroded protoconch. Apical angle of 55°. Standard suture. Convex infrasutural ramp. Axial sculpture of nodular ribs: six ribs on the last whorl, seven to eight on the previous whorls. At the shoulder, short spines directed towards the apex and in the opposite direction to the aperture, appearing at the fifth whorl or the teleoconch. Rounded convex part of the whorl forming a slight angulation at the level of the junction with the

siphonal canal. Spiral sculpture of very squamous primary and secondary cords: equivalent adis, IP and abis on the sutural ramp; on the convex part of the whorl: most important P1, P2 atrophied and attached to P1, then well expressed and roughly equivalent P3, s3, P4, P5 and P6 (Pl. 4, Fig. 9); on the siphonal canal equivalent ADP, MP and ABP. Short and open siphonal canal, of about 18% of the total height. Oval aperture. Narrow and adherent columellar lip. Apparent pseudoumbilicus. Flared outer lip notched between cords terminations. Striated inner side of the outer lip. Shell background color brown stained cream. Cream aperture. Operculum unknown.

INTRASPECIFIC VARIATIONS

Adult size varies from 11 to 18 mm in height and from 6.8 to 12.5 mm in diameter, spines included. Multipiral protoconch. The specimen illustrated Pl. 20, Fig. 2 is a juvenile but denticles on the internal part of the lip are already well marked. The atrophy of P2 is particularly well visible on this specimen (Pl. 20, Fig. 2c). P1 tends to hypertrophy and P2 remains equivalent. However, P2 decreases and approaches P1 (arrow). At the same time s2 is developing and becomes equivalent to P3.

INTERSPECIFIC COMPARISONS

Babelomurex rugosus n. sp. is compared to *B. spinosus* and *B. colettae* n. sp. respectively occurring in the same areas of Guadeloupe (Pl. 18). *Babelomurex rugosus* differs from *B. spinosus* by a more scaly sculpture, spines pointing in the opposite direction of the edge of the aperture and less nodulous varices. Regarding the spiral sculpture, the important P2 atrophy of *B. rugosus* does not exist in *B. spinosus* (Pl. 4, Figs 8-9). *Babelomurex rugosus* differs from *B. colettae* by wider ribs and much shorter spines. In addition the aperture of *B. colettae* is more flared with a strong narrowing at the junction with the siphonal canal and an thinner external lip.

Babelomurex sp. 1

Pl. 20, Fig. 3.

LOCALITY: Guadeloupe at 10 m deep.

INTERSPECIFIC COMPARISONS

This unique specimen presents several similarities with *Babelomurex pazei* (Petuch, 1987, see Pl. 15). It differs from this last species by wider and less scaly P1 and P3 cords, a less scaly microsculpture and a proportionately wider aperture.

Babelomurex sp. 2

Pl. 20, Fig. 4.

LOCALITY: Guadeloupe at 130 m deep.

INTERSPECIFIC COMPARISONS

Shell that can make you think to *Babelomurex mansfieldi* (Pl. 14) but more globular-shaped with a lower spire and a proportionately larger aperture. It was collected at 130 m much deeper than *B. mansfieldi*. The general form may recall that of *Coralliophila guancha* Smriglio, Mariottini & Engle, 2003 from East-Atlantic (Pl. 22, Figs 13, 14) but the spiral sculpture is fundamentally different and *C. guancha* has no shoulder spines,

a feature of the *Babelomurex* genus.

Babelomurex sp. 3

Pl. 20, Fig. 5.

LOCALITY: Case-Pilote, Martinique at 3 m deep.

INTERSPECIFIC COMPARISONS

This unique specimen is like no other with a very high spire and well marked teeth. Its spiral sculpture is close to that of *Babelomurex mansfieldi* (Pl. 14).

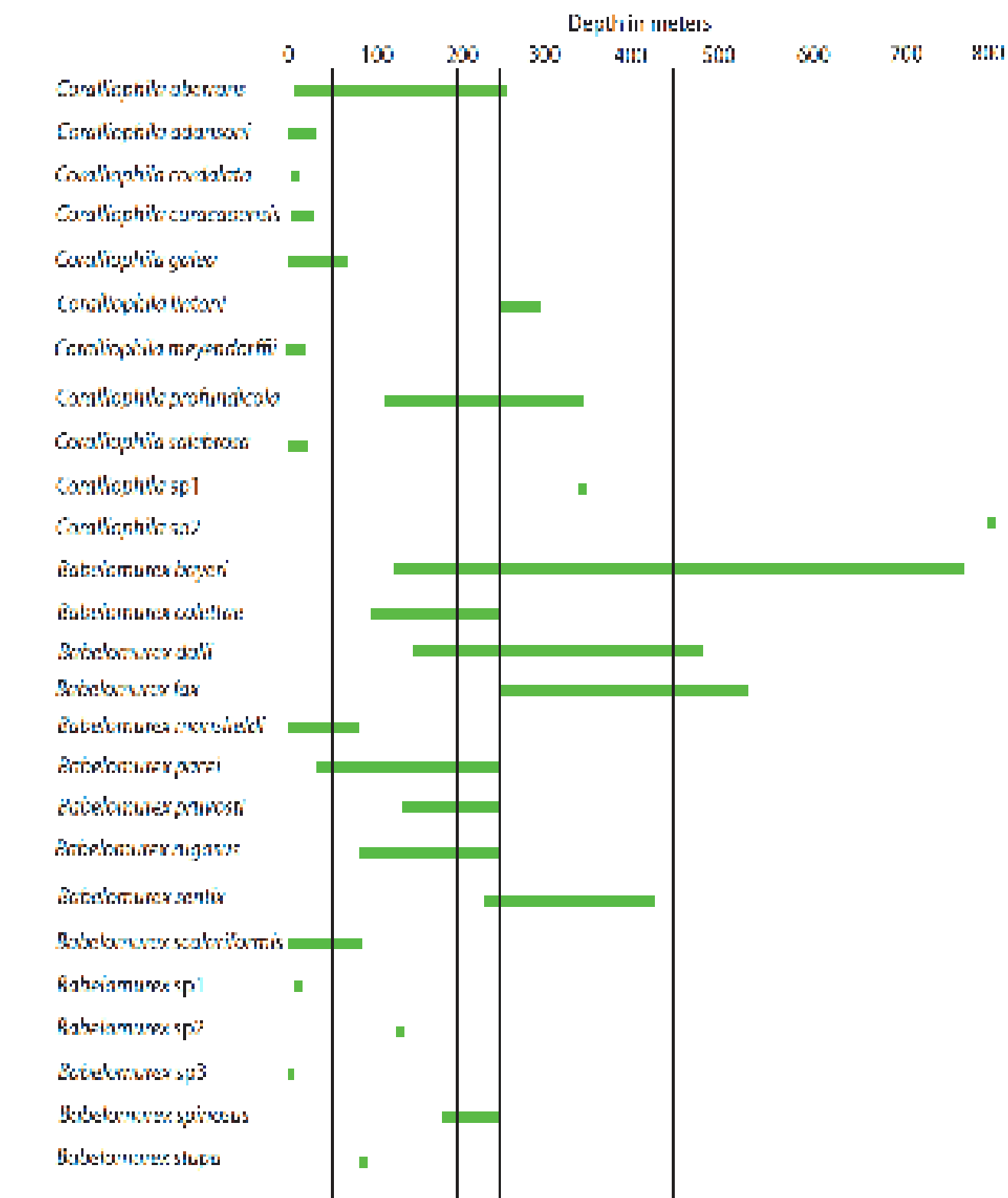
CONCLUSIONS

As has been observed in other groups of molluscs, the Coralliophilinae fauna from the Caribbean area is revealed to be surprisingly rich. Only three species out of the 18 listed species have not been found in the study area. This wide distribution is probably related to their planktotrophic larval development. However, against all odds, few species are Amphiatlantic. Several hypotheses may explain this phenomenon. For example, despite strong oceanic currents, planktonic larvae cannot survive over such great distances, interrupting gene flow. Another hypothesis would be that the larvae do not find favourable environmental conditions such as salinity, temperature or coral species on which they are dependant. Two species spread over the littoral zone from the other side of the Atlantic are represented by only one specimen in the study area, *Coralliophila meyendorffii* and *C. adansoni*. The transport of larvae by the ballast of the boats could be implicated in this accidental introduction. Taking into account both molecular and conchological data seems today essential to the development of a better classification for this difficult group of molluscs.

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Table 2 - Bathymetric map of Coralliophilinae

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Table 3 - List of sequenced specimens of Coralliophilinae collected in the Lesser Antilles and French Guiana followed by GenBank and BOLD accession numbers.

Taxon	MNHN acc. number	BOLD ID	GenBank ID
<i>Babelomurex bayeri</i> n. sp.	IM-2013-56493	MUBA928-22	ON668371
<i>Babelomurex dalli</i> (Emerson & D'Attilio, 1963)	IM-2013-61551	MUBA936-22	ON668343
<i>Babelomurex mangfieldi</i> (McGinty, 1940)	IM-2013-60288	MUBA932-22	ON668332
<i>Babelomurex mangfieldi</i> (McGinty, 1940)	IM-2013-60476	MUBA933-22	ON668346
<i>Babelomurex mangfieldi</i> (McGinty, 1940)	IM-2013-70633	MUBA939-22	ON668335
<i>Babelomurex mangfieldi</i> (McGinty, 1940)	IM-2013-8021	MUBA679-15	ON668357
<i>Babelomurex mangfieldi</i> (McGinty, 1940)	IM-2013-9555	MUBA663-15	ON668349
<i>Babelomurex pacei</i> Petuch, 1987	IM-2013-61050	MUBA935-22	ON668352
<i>Babelomurex pruvosti</i> n. sp.	IM-2013-56494	MUBA929-22	ON668364
<i>Babelomurex scalariformis</i> (Lamarck, 1822)	IM-2013-72464	MUBA937-22	ON668375
<i>Babelomurex sentis</i> (Bayer, 1971)	IM-2013-60303	MUBA930-22	ON668331
<i>Coralliophila curacaoensis</i> Potkamp & Hoeksema, 2017	IM-2013-9121	MUBA685-15	ON668370
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-60271	MUBA934-22	ON668360
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-8685	MUBA652-15	ON668347
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-8686	MUBA653-15	ON668374
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-8687	MUBA654-15	ON668368
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-9490	MUBA662-15	ON668348
<i>Coralliophila galea</i> (Dillwyn, 1823)	IM-2013-9565	MUBA666-15	ON668333
<i>Coralliophila profundicola</i> Haas, 1949	IM-2013-56535	MUBA927-22	ON668340
<i>Coralliophila profundicola</i> Haas, 1949	IM-2013-60332	MUBA931-22	ON668367
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20158	MUBA686-15	ON668378
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20428	MUBA687-15	ON668372
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20495	MUBA669-15	ON668345
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20496	MUBA688-15	ON668376
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20497	MUBA670-15	ON668336
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20498	MUBA671-15	ON668341
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-20575	MUBA672-15	ON668354
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-63903	MUBA940-22	ON668361
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-63904	MUBA941-22	ON668353
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-63905	MUBA942-22	ON668355
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-63906	MUBA943-22	ON668334
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-73152	MUBA938-22	ON668338
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8352	MUBA651-15	ON668365
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8354	MUBA681-15	ON668337
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8833	MUBA682-15	ON668359
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8836	MUBA655-15	ON668351
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8859	MUBA656-15	ON668369
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8867	MUBA657-15	ON668377
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8878	MUBA658-15	ON668350
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8879	MUBA659-15	ON668358
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8880	MUBA660-15	ON668356
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8881	MUBA683-15	ON668366
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-8894	MUBA684-15	ON668373
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-9058	MUBA661-15	ON668339
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-9556	MUBA664-15	ON668362
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2013-9557	MUBA665-15	ON668344
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2019-1862	MUBA944-22	ON668363
<i>Coralliophila salebrosa</i> Abbott, 1958	IM-2019-1863	MUBA945-22	ON668342

Pl. 1 - *Coralliophila salebroso* and *C. galea* in their habitat.



A

on *Briarum asbestinum*



B

Coralliophila salebroso Martinique (Yann Buske)



C

Coralliophila salebroso Guadeloupe (Jean-Pierre Pointier)



D

on *Scolymia lacera*

Coralliophila salebroso Martinique (Yann Buske)



E

on *Orbicella annularis*



F

on *Orbicella annularis*

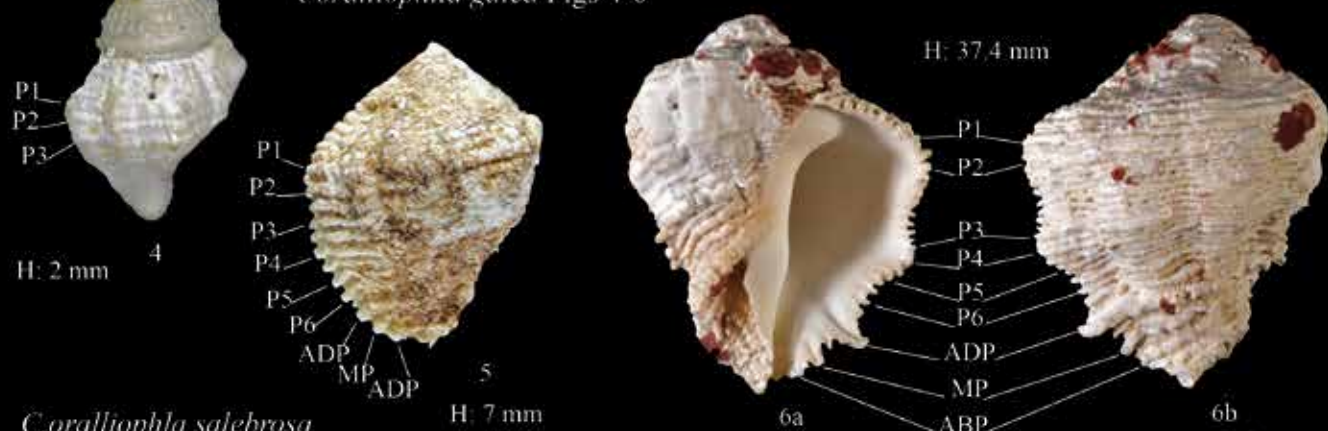
Coralliophila galea Bouillante, Guadeloupe (Jean-Pierre Pointier)

Pl. 2

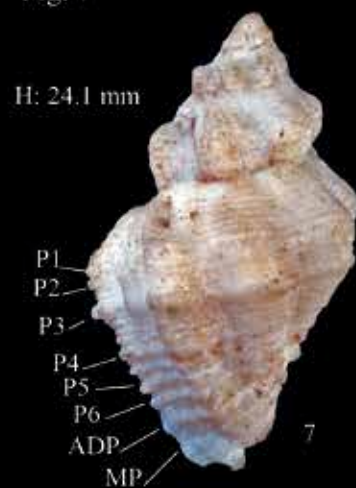
Coralliophila salebrosa Figs 1-3



Coralliophila galea Figs 4-6



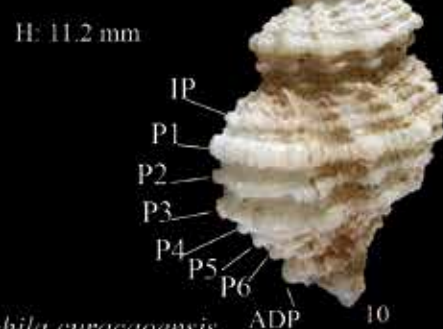
Coralliophila salebrosa
Fig. 7



Coralliophila violacea
Fig. 9



Coralliophila cordalata n. sp.
Fig. 10

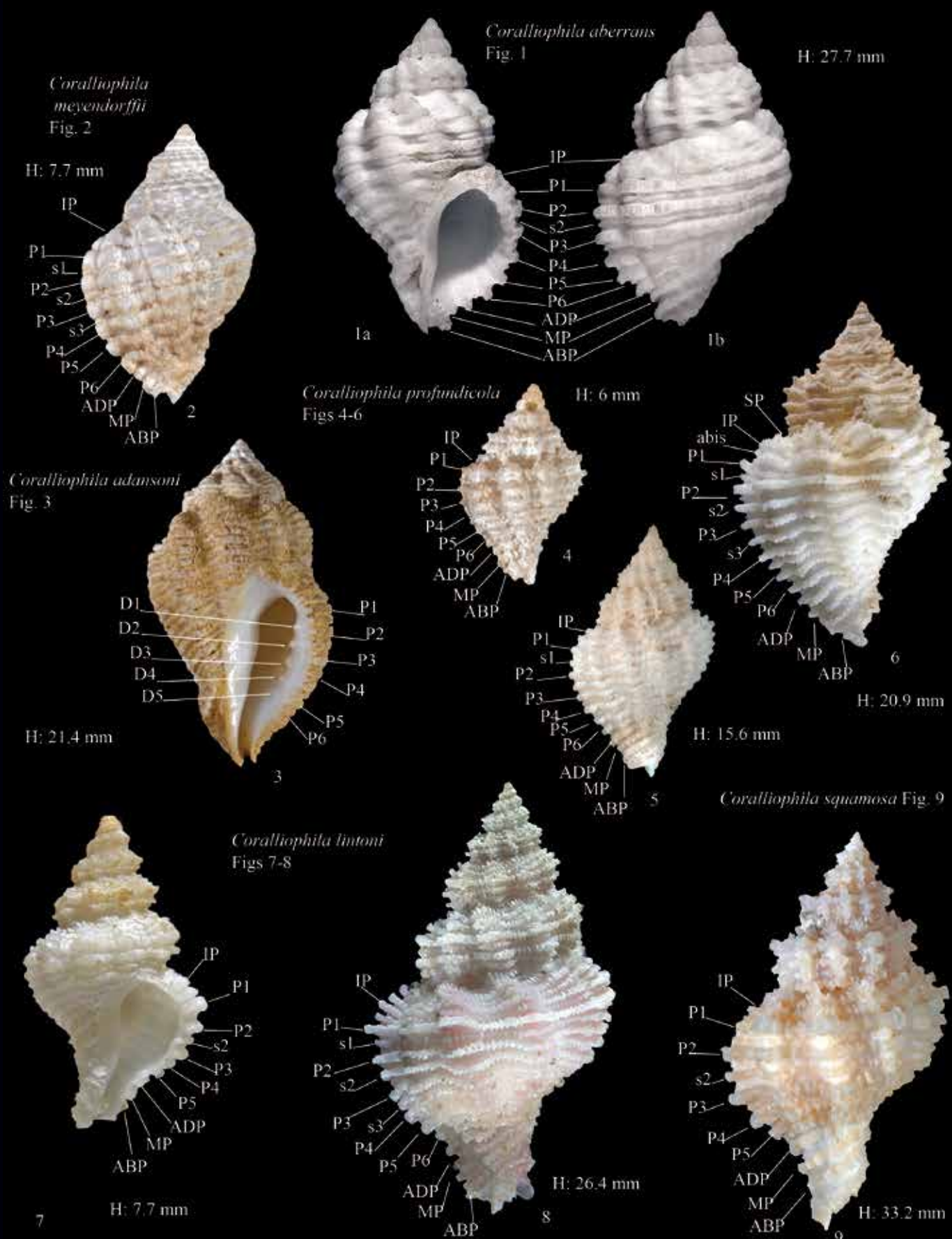


Coralliophila curacaoensis
Figs 11-12

Coralliophila salebrosa
Fig. 8

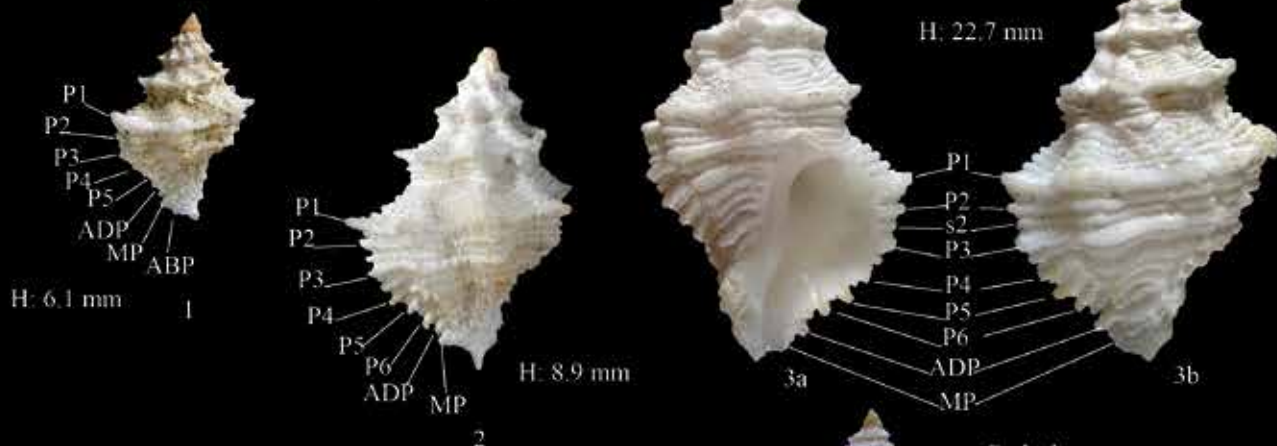


Pl. 3 - Spiral sculpture of Coralliophilinae type «meyendorffii» close to clade A

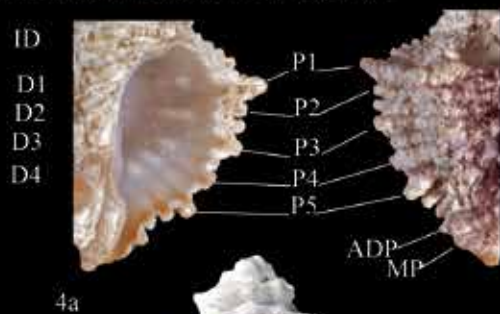


Pl. 4

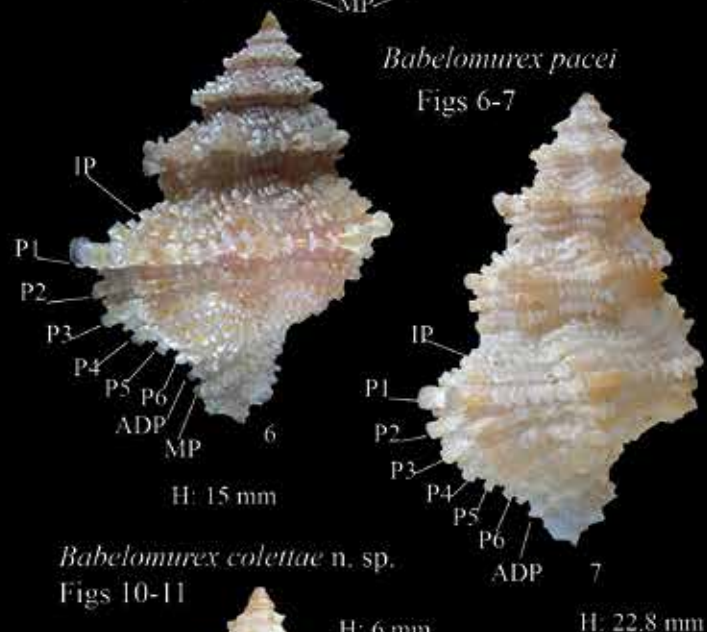
Babelomurex mansfieldi Figs 1-3



Babelomurex scalariformis Figs 4-5



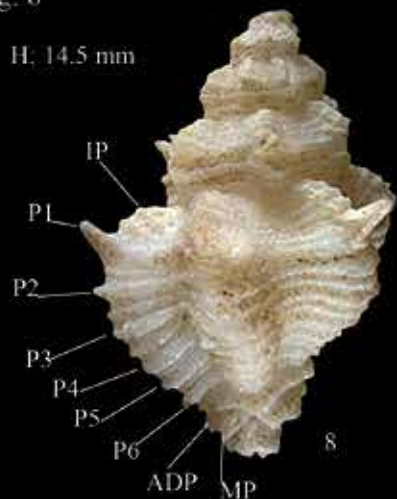
Babelomurex pacei
Figs 6-7



Babelomurex colettae n. sp.
Figs 10-11



Babelomurex spinosus
Fig. 8

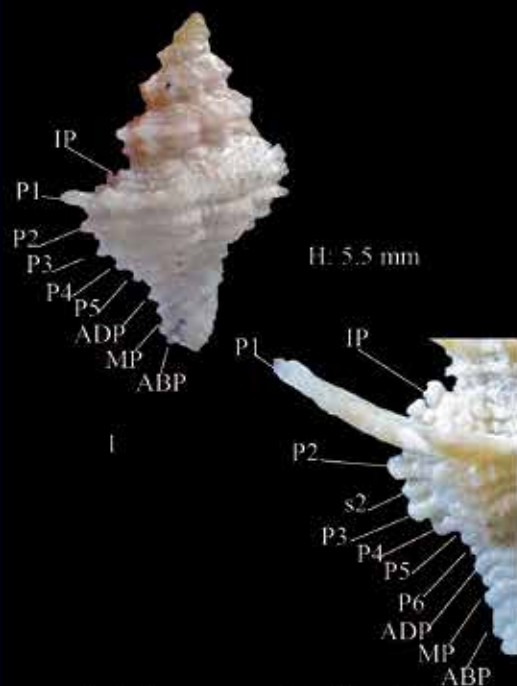


Babelomurex rugosus n. sp.
Fig. 9



Pl. 5

Babelomurex dalli Figs 1-3



H: 5.5 mm

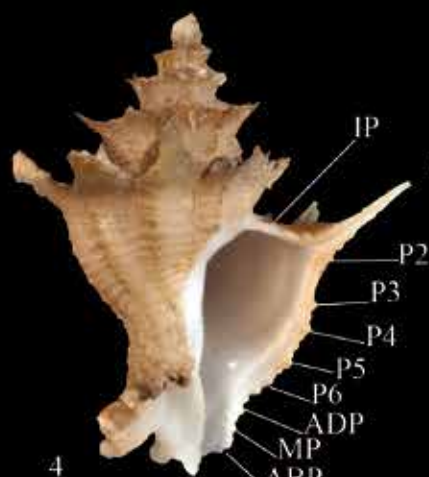
H: 9 mm



H: 26.5 mm

Babelomurex fax Figs 6-7

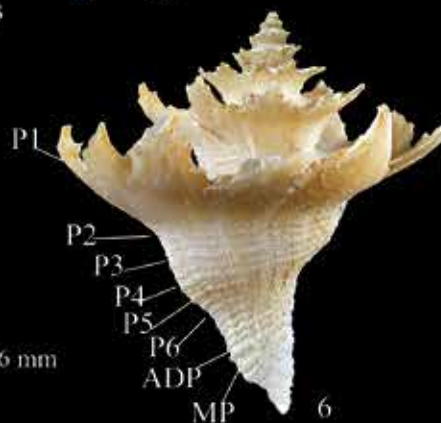
Babelomurex sentix Figs 4-5



H: 21.7 mm



H: 4.6 mm



H: 21.2 mm



H: 9.6 mm

Babelomurex stupa n. sp.
Fig. 9

H: 12 mm



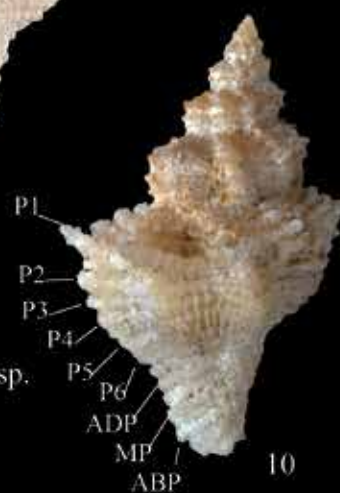
Babelomurex bayeri n. sp.
Fig. 8

H: 16.2 mm

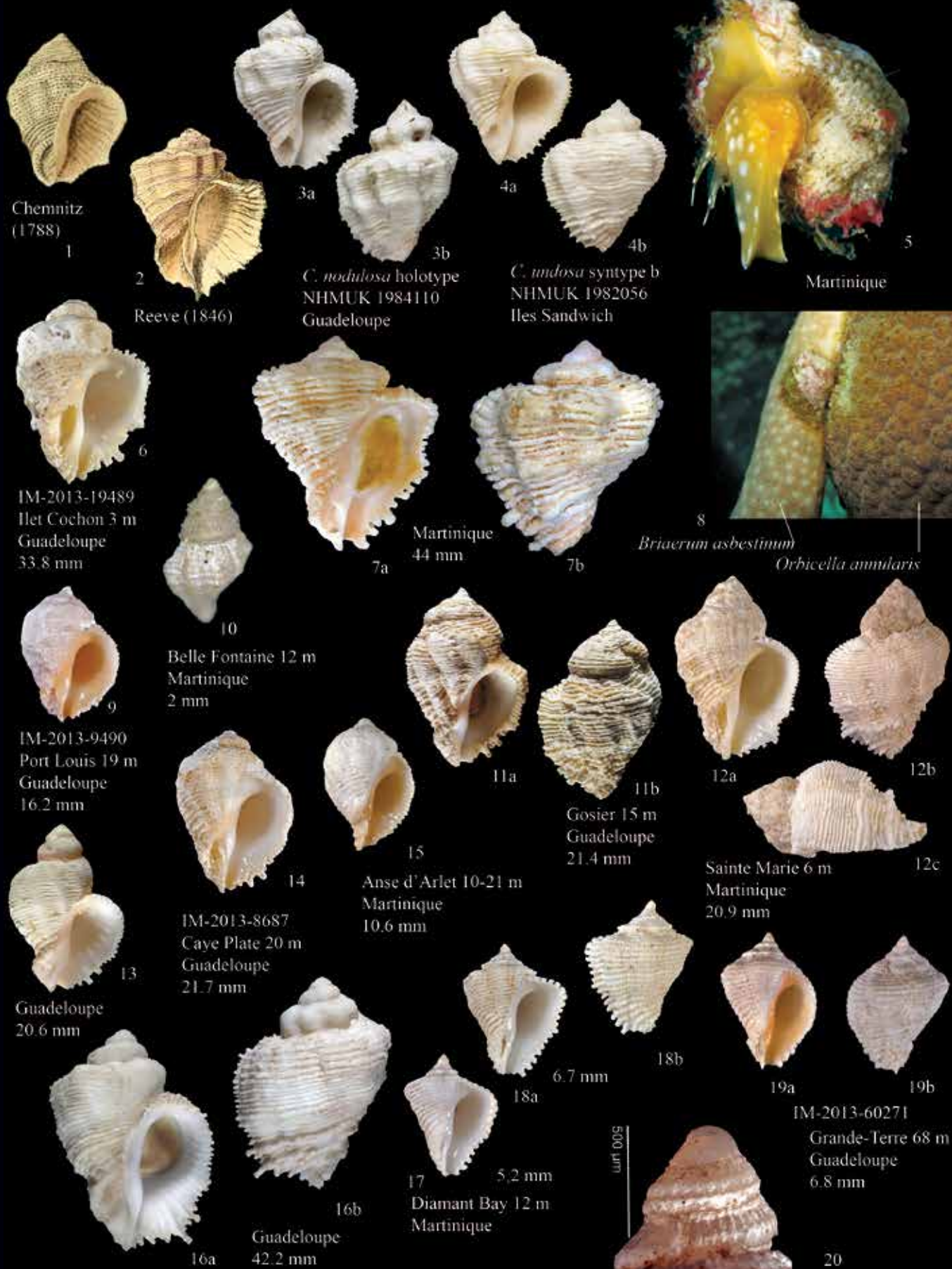


Babelomurex pruvosti n. sp.
Fig. 10

H: 13.3 mm



Pl. 6 - *Coralliophila galea* 1-20



Pl. 7 - *Coralliophila salebrosa* - Figs 1-15

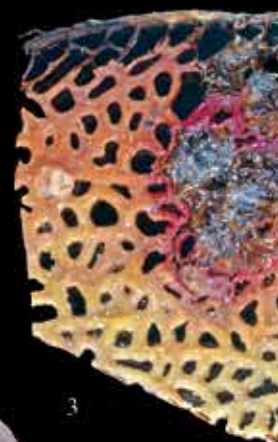


Pl. 8 - *Coralliophila salebrosa*
Figs 1-16



Pl. 9 - *Coralliophila salebrosa* Figs 1-13

Figs 1-3 - Grande Anse d'Arlet
Martinique, 25 m



3
Gorgonia flabellum



1a

1b

IM-2019-1863
10.7 mm



2a



2b

IM-2019-1862
13.6 mm



4

5a

10.1 mm

5b



6a

13.4 mm



6b



7a

Guadeloupe
23.6 mm



7b

Figs 4-6, 8-10
Grand Cul-de-Sac
Guadeloupe



8a

11.4 mm

8b



9

19.7 mm



10a

15.7 mm



10b

Figs 11-13
Grande Anse d'Arlet
Martinique, 25 m



11a

11b

IM-2013-63905

scale bar: 0.5 mm



12a

IM-2013-63905

10.5 mm



12b



13a

IM-2013-63906

6.4 mm



13b

Pl. 10

Coralliophila curacaoensis Figs 1-12



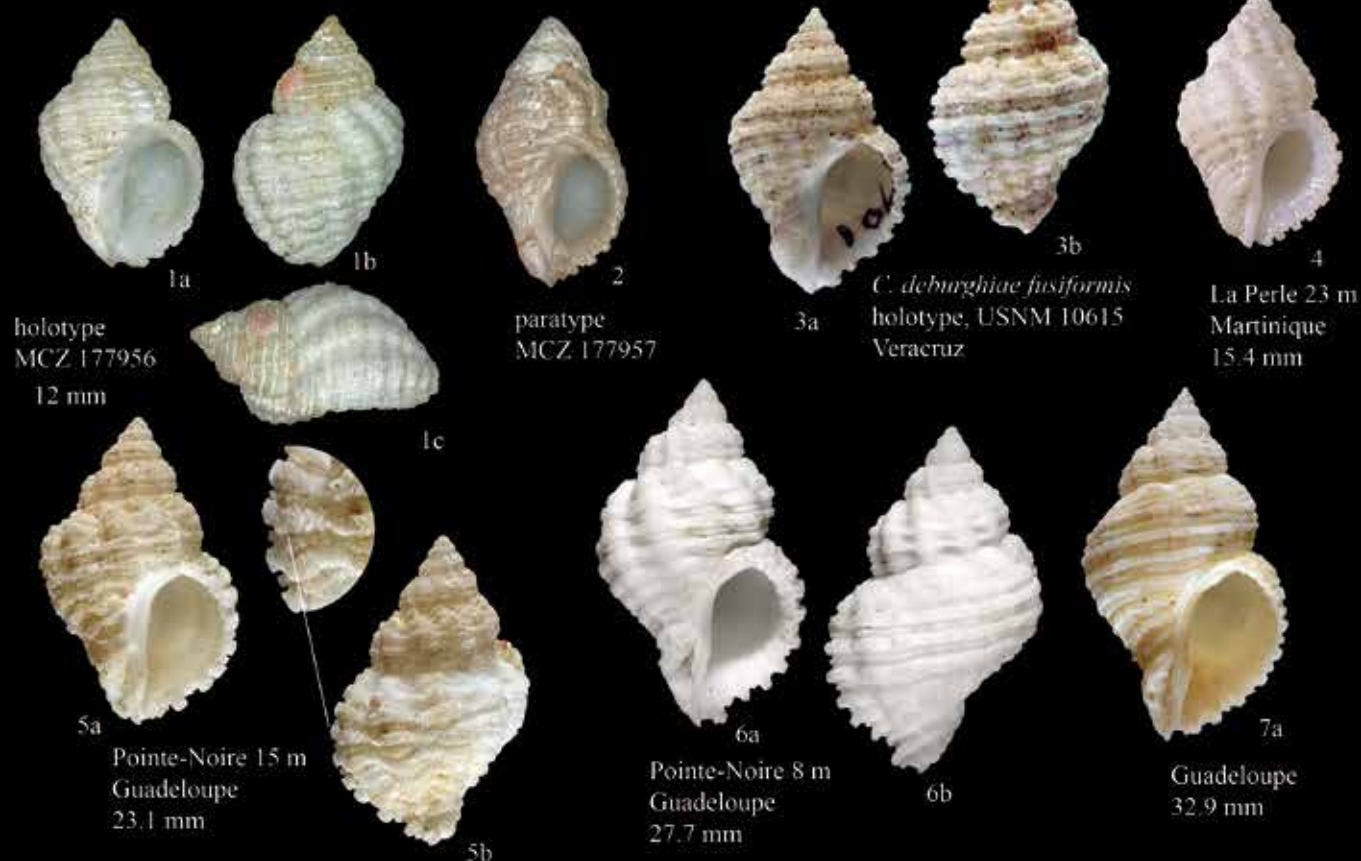
Coralliophila cordalata n. sp. Figs 14

Coralliophila sp. 2 Fig. 15



Pl. 11

Coralliophila aberrans Figs 1-7



Coralliophila meyndorffii Figs 8, 10-14



Coralliophila adansoni Figs 15-16

Pl. 12 - *Coralliophila profundicola* Figs 1-12



31655 FIELD MUSEUM OF NATURAL HISTORY
MOLLUSCA: CORALLIOPHILINAE 1 specimen
HOLOTYPE
Coralliophila profundicola
Harr, F. 1949
(NORTH ATLANTIC OCEAN), ... Harb. No. 50, off
Desirade coast, ~1700 m 32°R.2'N 64°33'W
imm. marked: 0927
20 August 1948 F. Harr, RV CARYN
ring net & y. coll.
FIELD MUSEUM BERMUDA DEEP SEA EXPEDITION
1948

12.8 mm



IM-2013-60332
N Grande-Terre
320-338 m
Guadeloupe
15.6 mm



2c



IM-2013-56535
French Guiana 114-118 m
13.8 mm



IM-2013-56425
French Guiana 195-200 m
16.8 mm



4b



Desirade Isl. 228-264 m
Guadeloupe
25.8 mm



S Desirade Isl. 250 m
Guadeloupe
20.9 mm



6b



6c



6d



Basse-Terre 300 m
Guadeloupe
29.6 mm



7b



Marie-Galante 250 m
27 mm

8b

8a



St François 250 m
Guadeloupe
10.9 mm

11a

11b



10

Pigeon Isl. 350 m
Guadeloupe
28.4 mm



12a

Saba Bank
19.2 mm



12b

scale bar: 0.5 mm

Pl. 13 - *Coralliophila lintoni* Figs 1-12

Figs 2-12
S Desirade,
Marie-Galante 250 m
Guadeloupe



Pl. 14

Babelomurex mansfieldi Figs 1-13



Babelomurex scalariformis Figs 14-22



Pl. 15 - *Babelomurex pucei* Figs 1-9



Pl. 16 - *Babelomurex dalli* Figs 1-19



«*Coralliophila deburghiae*»

Reeve
(Dall, 1889)
20 mm



2a

Holotype
(USNM 87215)
Guadeloupe 1600 m
40 mm



2b



3

MNHN
IM-2013-61551
Marie-Galante
Guadeloupe 250 m
20.1 mm



4

Guadeloupe 300 m
15 mm



5

Great Meteor
Seamount II 335 m
MNHN
29.2 mm



6

S Desirade 250 m
17.8 mm



7a

Port-Louis 350 m
Guadeloupe
26.1 mm



7b



8

Desirade 300 m
42 mm



9a

Desirade
26.5 mm



9b

Figs 9-15 S Desirade 250 m
Guadeloupe



10

5.5 mm



11

7.4 mm



12

9.4 mm



13

9.8 mm



14a



14b

9 mm



15a

10.4 mm



15b



16

10.5 mm



17

Desirade 300 m
41.3 mm

18b

Petite-Terre 250 m
Guadeloupe
21.6 mm



18a

19

Pl. 17

Babelomurex sentix Figs 1-11



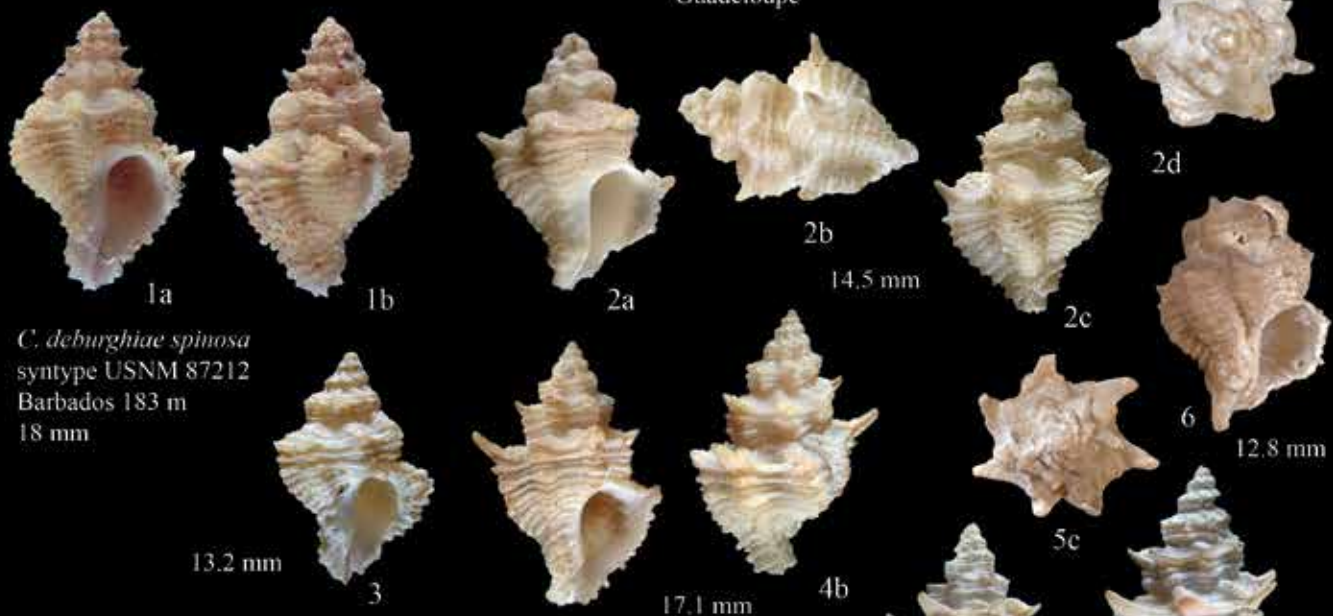
Babelomurex fax Figs 12-16



Pl. 18

Babelomurex spinosus Figs 1-6

Figs 2-6 S Desirade. 90 -250 m
Guadeloupe



C. deburghiae spinosa
syntype USNM 87212
Barbados 183 m
18 mm

Babelomurex colettae n. sp. Figs 7-13



Paratype A
IM-2000-38030
E Desirade
111-162 m
6 mm

Holotype
MNHN IM-2000-38029^{8b}
Vaisseaux Bank 100 m
Guadeloupe
21.1 mm

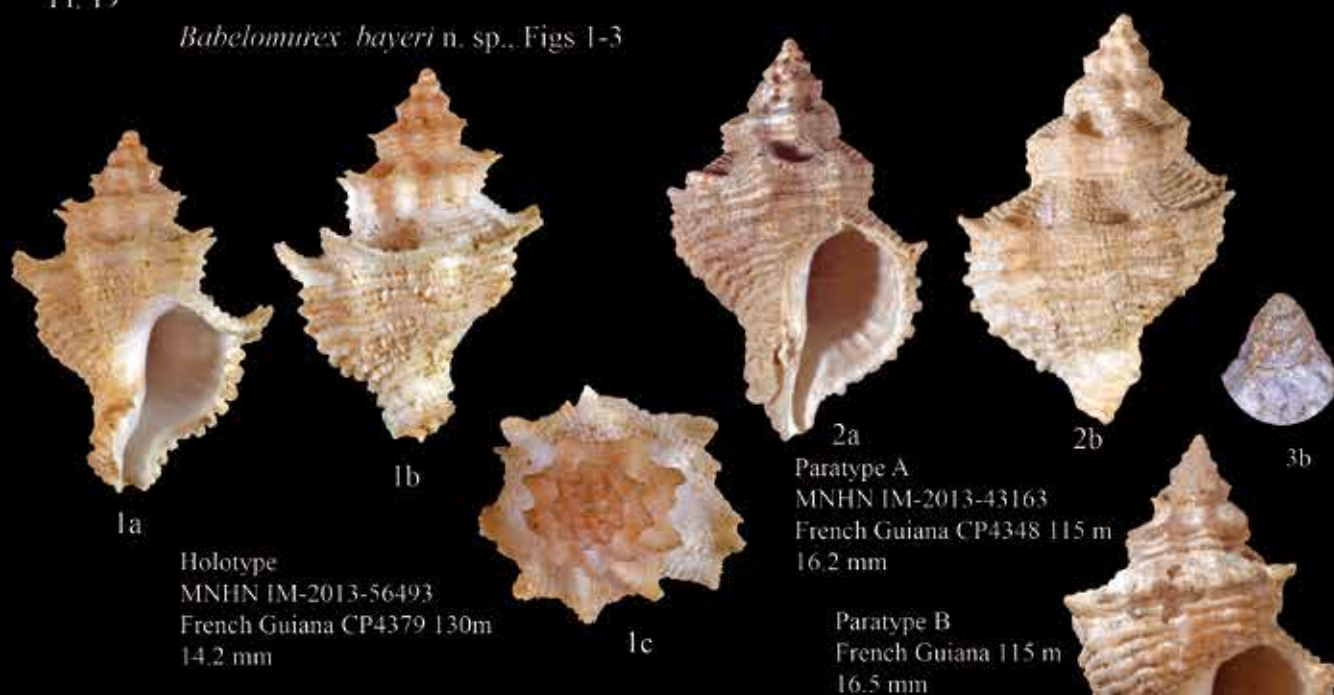
Paratype B
IM-2000-38031
S Desirade 250 m
20.9 mm

Honduras 30 m
18.6 mm

Martinique
250 m
17.5 mm

Pl. 19

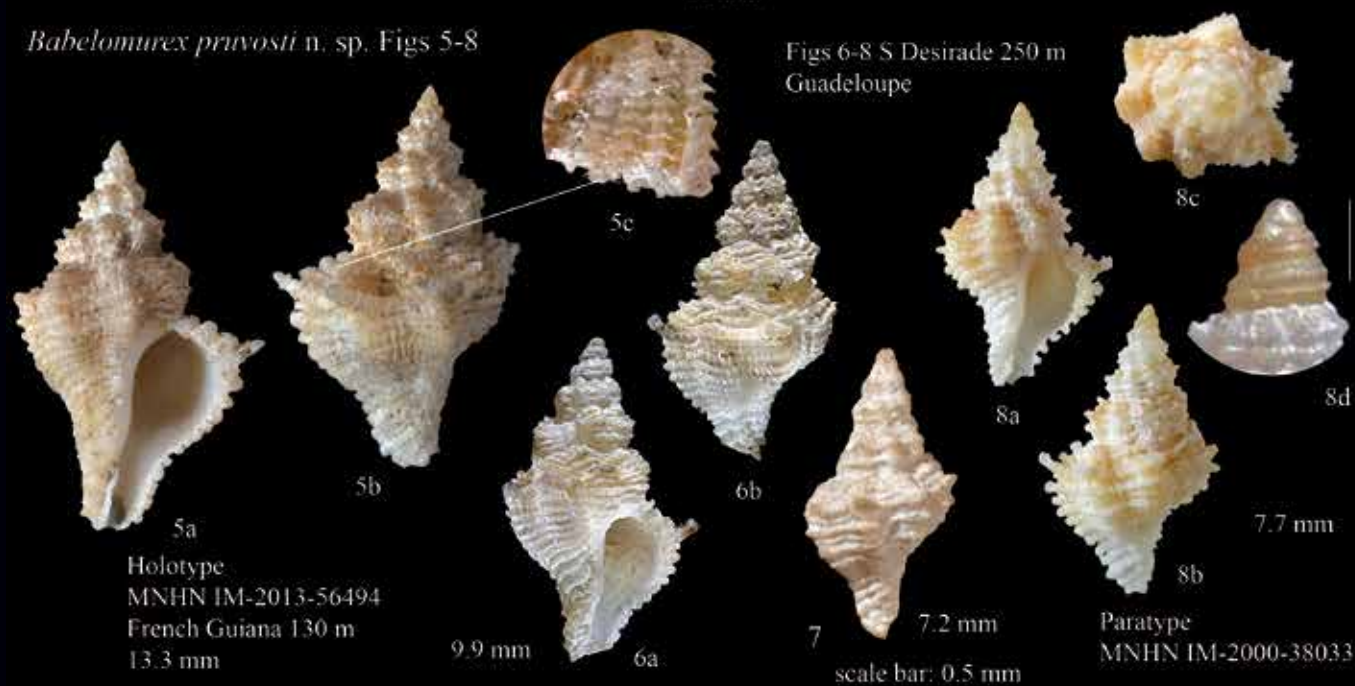
Babelomurex bayeri n. sp., Figs 1-3



Babelomurex stupa n. sp., Fig. 4



Babelomurex privosti n. sp., Figs 5-8



Pl. 20

Babelomurex rugosus n.sp. Fig. 1-2



1a



1c



1b



1d

Holotype
MNHN IM-2000-38034
S Desirade 250 m
Guadeloupe
18,5 mm



2a



2b



P1

P2

s2

P3

Paratype
MNHN IM-2000-38285
Macouba 78 m
Martinique
10,8 mm

2c

Babelomurex sp. 1



3a

Guadeloupe
13,5 mm



3b



3c

Babelomurex sp. 2



4a



4c



4b



4d

Guadeloupe 130 m
13,9 mm

Babelomurex sp. 3



5c



5a



5b

Case-Pilote
Martinique
21 mm

Pl. 21 - Coralliophilinae from Eastern Atlantic absent from the study area

Coralliophila richardi Figs 1-4



Coralliophila lactuca
syntype USNM 87012
Georgia USA 644 m
20 mm



Hyeres Seamount 705 m
8 mm

Figs 2-4 MNHN SEAMOUNT 2



Hyeres Seamount
480 m
3.4 mm

Plato Seamount
710 m
4.3 mm

Quoyula kalafuti Fig. 5

Holotype USNM 859851
Florida Keys 2 m
14 mm



Latiaxis juliae Fig. 6

Holotype MCZ 89969
Barbados 137-232 m
28.2 mm



Latiaxis basilium Fig. 7-12



Fig. 7 - paratype
Paranagua 124-133 m
Brazil
33 mm



24 mm
scale: 0.5 mm



34 mm



10a
31.7 mm



10b



11a



33 mm



Brazil 300 m
36.6 mm DL

12c

Pl. 22 - *Coralliophila* from Eastern Atlantic and Mediterranean Sea, absent from the study area

Coralliophila brevis Figs 1-4



2a Figs 2-3 MNHN Seamount 1
Ampere Seamount 225-280 m

MNHN Seamount 1
Josephine Seamount 200 m
11 mm



Coralliophila kaofitorum
holotype MNCN 15.05.32583
Tenerife 22 m 24.6 mm



Coralliophila sp. Figs 6-9
MNHN Seamount 2
Atlantis Seamount 340 m



Coralliophila africana
holotype MZB 12993
Sierra Leone
14.6 mm



Coralliophila almiri
holotype
Gibraltar
11.28 mm



Coralliophila fontanangioae
N Gran Canaria 15-20 m
5 mm JFL



MNHN Zarco
Madeira 220-290 m
8.3 mm

MNHN
Azores 0-18m
10.3 mm



Coralliophila sofiae
MNHN
Morocco 50 m
21.7 mm



Coralliophila trigoi
Algarve 50 m
Portugal
21.6 mm BG



Coralliophila violacea
Sinai 10 m
23.6 mm BG

Fig. 23 - *Coralliophila* from the Atlantic Ocean absent from the Caribbean area

Figs 1-9 - *Coralliophila basileus*

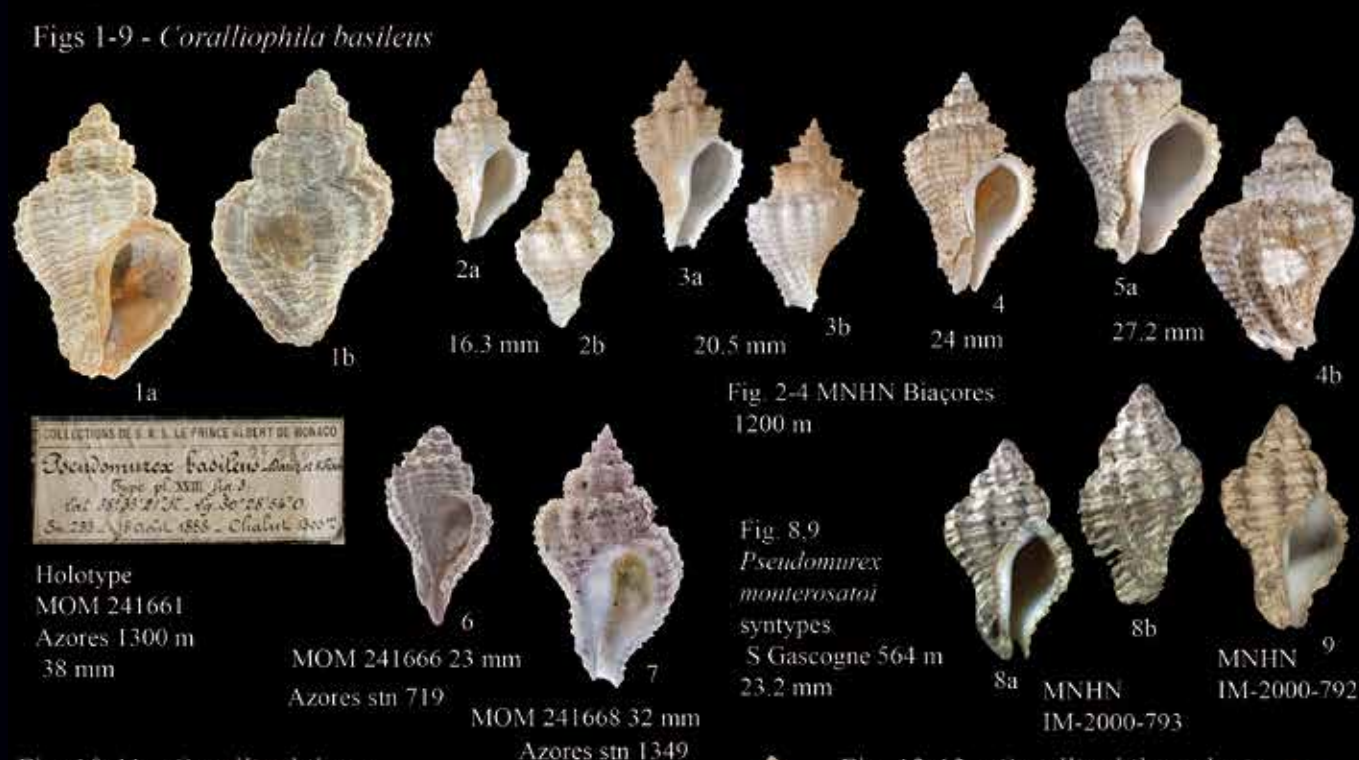


Fig. 10-11 - *Coralliophila* sp.



Fig. 12-13 - *Coralliophila aedonia*



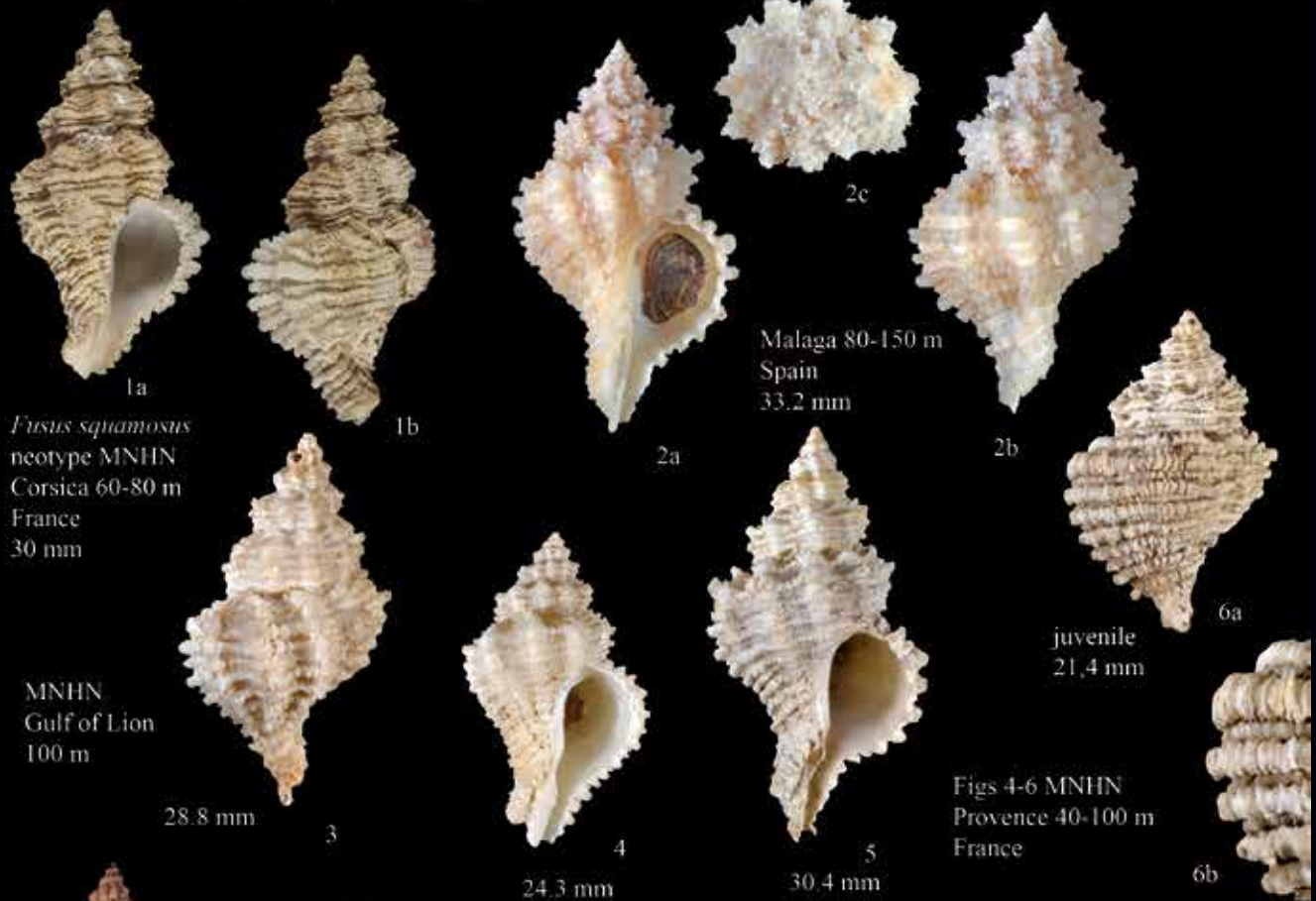
Fig. 14-16 - *Murex niveus*



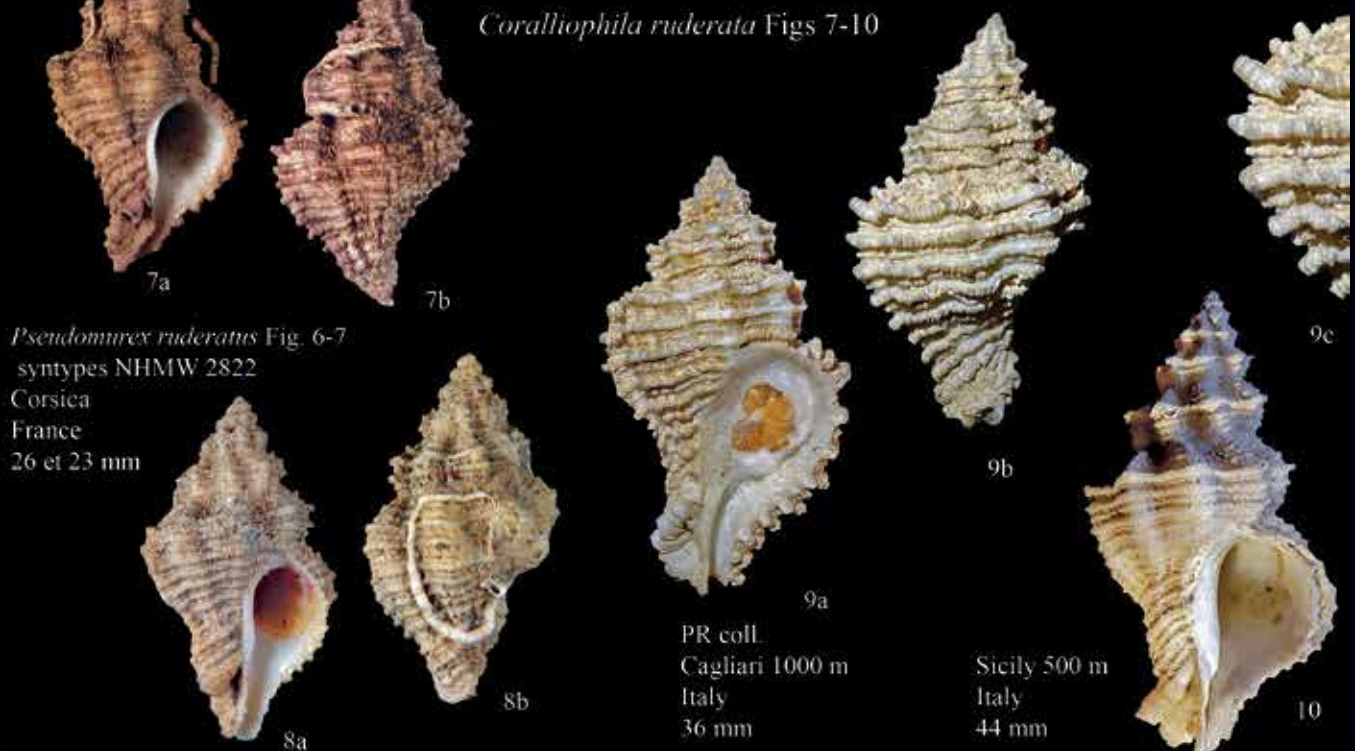
Fig. 17-18 - *Coralliophila panormitana*

Pl. 24 - *Coralliophila* from Mediterranean Sea and Eastern Atlantic Ocean absent from the study area

Coralliophila squamosa Figs 1-6



Coralliophila ruderata Figs 7-10



Pl. 25 - *Babelomurex* from Mediterranean Sea and N.E. Atlantic absent from the study area

Babelomurex benoitii Figs 1-4



Babelomurex cariniferus Figs 5-8



Babelomurex tectumsinense Figs 9-11



Babelomurex atlantis
Fig. 12



DESCRIPTION OF A NEW SPECIES OF THE GENUS *RAPHITOMA* BELLARDI, 1847 FROM THE MEDITERRANEAN SEA (MOLLUSCA, NEOGASTROPODA, CONOIDEA, RAPHITOMIDAE)

Constantinos KONTADAKIS

Email: costaskontadakis@yahoo.com

Aristotelous 24, 16777 Hellinicon, Athens, Greece

Thanasis MANOUSIS *

Email: athanasiosmanousis@gmail.com

PO Box 48 K, 57500 Epanomi, Greece

* Corresponding author

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Raphitoma, new species, Conoidea, Greece, Mediterranean Sea

Abstract

The genus *Raphitoma* Bellardi, 1847 is widely known in the Mediterranean Sea with about 40 species and some still undescribed. One of them is here identified as a new species on morphological characters based on 92 specimens.

Introduction

Conoidea is a diverse superfamily of exclusively marine and venomous gastropods within the Neogastropoda with more than 300 genera, 4,000 known species and an estimated number of more than 12,000 extant species (Bouchet, 1990, Taylor *et al.*, 1993, Tucker, 2004). Due to the species diversity and an extensive homoplasy, they have withstood repeated attempts to be permanently classified with those attempts to be hindered primarily by the absence of a stable phylogenetic framework. Recently, the taxonomy of Conoidea has been put on a more stable background based mainly on extensive new material from the tropical Western Pacific. This has led both to a detailed molecular phylogeny of the entire superfamily (Puillandre *et al.*, 2008; 2011, Bouchet *et al.*, 2011) and to several generic revisions [e.g. Olivera *et al.*, 2008, Puillandre *et al.*, 2009; 2010, Morassi and Bonfitto, 2010, Fedosov, 2011]. As a result, the artificial “family” Turridae (sensu Powell 1966) (Powell, 1966) has been divided into 13 monophyletic families with the most diverse that of Raphitomidae.

The Raphitomidae family in the Mediterranean Sea appears as a morphologically homogeneous group of rather uncommon infralittoral species easily recognizable by their sculpture and colour pattern of the shell. The under way revision of the Mediterranean members of the genus *Raphitoma* by Pusateri *et al.* (e.g. 2012, 2013, 2016, 2017a, b) and by Manousis *et al.* (2018) and Kontadakis *et al.* (2019) harbours more than 40 species.

A comprehensive survey of the distribution of *Raphitoma* species faces a number of issues (Pusateri *et al.*, 2012, 2013). They derive from the extensive variability in the shell morphological characters and the overlapping in the morphology between, supposedly, closely related species. The up to now revision of the Mediterranean Raphitomae has been based on several pairs of species that differ mainly in the size and shape of their protoconch (Pusateri *et al.*, 2012, 2013). That distinction, in particular, was based on the assumption that the dichotomy “multispiral protoconch/planktotrophic

development vs. paucispiral protoconch/lecithotrophic development” (Jablonski and Lutz, 1980) could be used in Caenogastropoda to recognise the sister species (Bouchet and Warén, 1979, Bouchet, 1989, Oliverio, 1995; 1996). Recently, it was shown statistically by Orthogonal Regression Analysis (ORA) that poecilogony is possibly responsible for the existence of Mediterranean “sibling” species of *Raphitoma* (Manousis *et al.*, 2019) and subsequent, though not conclusive, results indicated that this must be the case (Russini *et al.*, 2020).

While studding the Hellenic raphitomids we had the opportunity to examine specimens that could belong to a new species. These samples were collected along the coasts of the Aegean Sea and show features typical of the genus *Raphitoma* and at the same time others that evidently distinguish them from the known Mediterranean cogenes. After comparing them with freshly collected similar and sympatric members of the family, we are of the opinion that they represent an undescribed species that is described below.

Methods

The collection of specimens was conducted from October 2008 to August 2020 in various locations of Greece, according to Manousis and Galinou-Mitsoudi (2014). For each specimen collected, the following data have been recorded: location, depth, type of habitat/substrate and size (length, unless otherwise stated). For the species nomenclature updates (February 2022) besides the Marine Biodiversity and Ecosystem Functioning EU Network of Excellence and World Register of Marine Species, the Taxonomic on-line Database on European Marine Mollusca were also used. In addition, the Hellenic Network on Aquatic Invasive Species and the Marine Mediterranean Invasive Alien Species database were used for the alien species status in the Hellenic and Mediterranean Seas. Protoconch whorls were counted according to Verduin (1976), the measurement of the protoconch dimensions was performed at side view with its transition to the teleoconch at the far left, and the measurement of the protoconch maximum diameter was performed at top view according to Gofas and Oliver (2010). Te slenderness (h/w) of the shell was estimated including the outer lip of the aperture in the shell's width. The specimens are deposited in the private collection of Dr. Kontadakis. Scientists are welcome to have access to the biological material for observation after arrangement. The holotype of *Raphitoma georgiae* Kontadakis, 2022 is deposited at MNHN-IM-2000-37914.

Results

Abbreviations:

CGC - Central Gulf of Corinth,
CS - Coralligenous Substrate, **CSG** - Central Saronic Gulf,
HMB - Hard Mixed Bottom,
HS - Hard Substrate,
HSC - Hard Substrate Coralligenous,
SGFN - Small Gear Fishing Nets,
SSG - South Saronic Gulf

Raphitoma georgiae Kontadakis, 2022, n. sp. (Figs. 1a-c, 2a-j)

Systematics:

Superfamily **Conoidea** J. Fleming, 1822
 Family **Raphitomidae** Bellardi, 1875
 Genus **Raphitoma** Bellardi, 1847

Type Species: *Raphitoma hystrix* Bellardi, 1847⁺ (type by subsequent designation)

Description: Shell small for the genus. Holotype 9.45 mm x 4.10 mm, turritiform, porcelanously opaque and almost 2.3 times as long as wide. Multispiral protoconch II (larval shell), pinkish-beige in colour, 460 µm wide and 490 µm high, of 3.25 regularly cancellated and convex whorls, exhibiting on the last half whorl a weak keel continuous with the first spiral cord of the teleoconch. Embryonic shell (protoconch I) of 1 whorl, with of lighter colour nucleus and 200 µm in diameter. The teleoconch consists of 6.5 slightly convex whorls separated by a conspicuous suture. Moderately wide subsutural ramp. The body whorl occupies some 55% of the total length, is conical in shape, and bears on its body whorl 12 orthocline and narrow axial ribs with interspaces as wide as the ribs and 16 alternating in width spiral cords much thinner than the ribs, 6 of which are situated over the suture and the rest 10 below to the distinct tail of the shell. The spiral cords in their intersections with the axial ribs are smooth, elongated and acute. The relatively low number of ribs and spirals endow the shell with a cancellated and thorny appearance. The first 2 adapical cords increase rapidly in size and form an oblique and conspicuous shoulder immediately below the suture. The aperture is elongated lanceolate, occupies some 40% of the shells length and exhibits a smooth and slightly sinuous columella in its lower part, angled at its upper part. The anterior siphonal canal is long and wide while the posterior one is deep and narrow. The outer lip exhibits externally the endings of the spiral cords, while internally 7 conspicuous and regularly positioned teeth. Shell surface dull with the appearance of sandpaper in the form of fine micro granules, and with evident the incremental scars. Background colour light beige with irregularly placed light chestnut-brown and white areas. The body whorl bears at its middle a lighter colour spiral band as a prolongation of the suture and the shoulder below the suture exhibits alternating lighter and darker in colour radially placed brush strokes. Live animal white and with black siphon.

Type Material:

Holotype (Fig. 1a), shell, CSG, h: 9.45 mm, 50-60 m, SGFN, HS, CCK, December 2017 MNHN-IMM-2000-37914
 Paratype 1 (Fig. 1b), shell, CSG, h: 8.16 mm, 50-80 m, SGFN, HSC, CCK, March 2017
 Paratype 2 (Fig. 1c), shell, SSG, h: 9.97 mm, 50-80 m, SGFN, HS, CCK, July 2013
 Paratype 3 (Fig. 2a), shell, CGC, h: 9.2 mm, 100-200 m, SGFN, CS, CCK, August 2017
 Paratype 4 (Fig. 2b), shell, CGC, h: 7.5 mm, 100-200m, SGFN, CS, CCK, August 2017
 Paratype 5 (Fig. 2c), shell, CGC, h: 8 mm, 100-200 m, SGFN, CS, CCK, August 2017
 Paratype 6 (Fig. 2d), shell, CSG, h: 6.5 mm, 50-80 m, SGFN, HS, CCK, April 2019
 Paratype 7 (Fig. 2e), shell, CSG, h: 8.2 mm, 50 m, SGFN, HS, CCK, August 2020
 Paratype 8 (Fig. 2f), shell, CSG, h: 9.7 mm, 50 m, SGFN, HS, CCK, November 2019
 Paratype 9 (Fig. 2g), live, CSG, h: 8 mm, 50 m, SGFN, HMB, CCK, November 2019
 Paratype 10 (Fig. 2h), live, CSG, h: 7.5 mm, 50 m, SGFN, HS, CCK, November 2018
 Paratype 11 (Fig. 2i), shell, CSG, h: 6 mm, 70 m, SGFN, HS, CCK, November 2018

Type Localities: Central and south Saronic Gulf, central Gulf of Corinth, Potidea (Chalkidiki), Limnos Island, Alonnisos Island and Astypalea Island.

Distribution: Known only from the type localities.

Habitat: The specimens were collected from coralligenous substrates and hard mixed bottoms.

Etymology: This species is named after Constantinos Kontadakis's younger daughter Georgia.

Remarks

Raphitoma georgiae n. sp. (Figs. 1a-c, 2a-j) has been previously reported for Greece as *R. echinata* (sensu auctores) morphotype II (Manousis *et al.*, 2018, page 14, fig. 9a, b). Its individuals reach a size between 6.00 mm to 10.90 mm at maturity (9.30 mean, of 45 mature specimens). They exhibit a teleoconch surface microsculpture of varying roughness never reaching that of *R. densa* (Monterosato, 1884) or *Cyrrillia aequalis* (Jeffreys, 1867) (Manousis *et al.*, 2018). They can only be compared with similar looking species such as *R. andrehoarui* Pelorce & Horst, 2020 [*R. echinata* (sensu auctores) morphotype I in Manousis *et al.*, 2018] (Fig. 2k-n), *R. antipolitana* Pelorce & Horst, 2020, *R. azuari* Pelorce & Horst, 2020, *R. echinata* (Brocchi, 1814), *R. pupoides* (Monterosato, 1884) and *R. stanici* Prkić, Giannuzzi-Savelli & Pusateri, 2020. A comprehensive comparison of the characters of the above species is given in Table 1. *R. georgiae* n. sp. inhabits the same environment as all other Mediterranean *Raphitoma* species and can easily be distinguished from its sympatric congeners mainly due to its small size, the relatively few axial ribs, the sharp rib/cord crosses, the sandpaper-like teleoconch surface, the angular subsutural ramp, its inverted dome shape, the lack of radial colour brush strokes subsuturally and its overall thorny appearance.

The decisive stage of any taxonomic outcome in malacology

is the critical evaluation of the shell characters with the aim to designate and exemplify reliable discriminating features enriched with detailed and high quality images. The taxonomy of *Raphitoma* species continues to be almost entirely based on shell morphology (see also, Fassio *et al.*, 2019, Prkić *et al.*, 2020, Russini *et al.*, 2020 for employment of molecular analysis). For nearly 150 years of scientific research shell characters have proved to be rather effective species-level tools of identification, especially for specimens with intact protoconch. Moreover, reliance on shell characters is particularly justified by the fact that many species have never been encountered alive.

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Table 1: Comparison of *Raphitoma georgiae* n. sp. characters with those of similar congenates.

Species/ Characteristics	<i>R. georgiae</i> n. sp.	<i>R. macleodensis</i> (Koumou & Manousis, 2014)	<i>R. angustipinna</i> (Koumou & Manousis, 2014)	<i>R. murex</i> (Koumou & Manousis, 2014)	<i>R. reticulata</i> (Koumou, 2014)	<i>R. georgiella</i> (Koumou et al., 2017)	<i>R. murex</i> (Fosberg, 1945; Koumou & Manousis, 2014)
Shell shape type	Mitragast	Mitragast	Mitragast	Mitragast	Mitragast	Mitragast	Mitragast
Number of growth spiral whorls	5-6	4	5	5			10-11
Length (mm) (total shell height)	2.00-2.41	1.00-2.00	1.0-2	1.0-1.5	2.00-2.41	2.0-3.0	3-10
Number of axial ribs on the shell	4-10	11-17	1-10	4-10	5-14	10-27	4-10
Axial rib form	Slightly convex	Convex	Convex	Convex	Slightly convex	Convex	Convex
Number of growth cords on body whorl	18	14-20	20-24	16-20	16-17	16-23	15-18
Number of growth cords on the posthumeral whorl	18-20	17-20	16-20	17-21	18-20	17-20 (secondary cordless)	17-21
Form of dorsal apices	Sharp	Roundish nodules	Sharp	Elongate sharp	Elongate sharp	Thin elongate	Elongate elevated nodules
Apical cord	Obvious	Obvious	Obvious	apical	0	Thin	Obvious
Color	Maroonish, brown	Brown	Violet, greyish	Brown	Maroonish, brown	Brown	Brown
Internal ornamentation	None, smooth, shiny, due to the irregularity	Striated	Striated	Striated	Striated	Striated	Four distinct longitudinal
Surface ornamentation	Angular	Irregular	Irregular	Irregular	Irregular	Irregular, smooth	Irregular
Body whorl curvature	Irregular, curved shaped	Flat, flat	Radially	Flat, flat	Flat, flat	Concave up	Radially
Color on the interior surface	Randomly placed light brown patches on white surface via light beige background	Randomly placed purple patches on light beige background	Irregular lines with light brown patches and dark brown/black areas	Random brown with irregular lines	Dark brown with irregular white lines Flicking of irregular lines of brown, green, black	Irregularly light brown areas on green and white background	Randomly placed light brown patches and light brown and brown areas with dark green, beige, black and white patches
Terminal aperture	Throaty	Conical	Conical	Throaty	Conical	Conical	Conical and
Surface ornamentation of the body whorl	Absent	White marks, comma shaped	White marks, comma shaped	White marks, comma shaped		White marks, comma shaped	White marks, comma shaped
Surface ornamentation	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
External color	White with black spots	Brown with dark brown areas of the aperture	White, dark spots with white patches	Yellowish white, iridescent and black spots	Soft greenish brown	Soft greenish brown	White, dark spots with spots of yellowish black
Location	Thrace	Aegean & Black Sea	Adriatic, Ionian, Aegean	Aegean & Ionian, TT1	Adriatic & Ionian, TT1, Thracian, 2020	Adriatic & Ionian, TT1	Aegean & Ionian, TT1

Plate 1

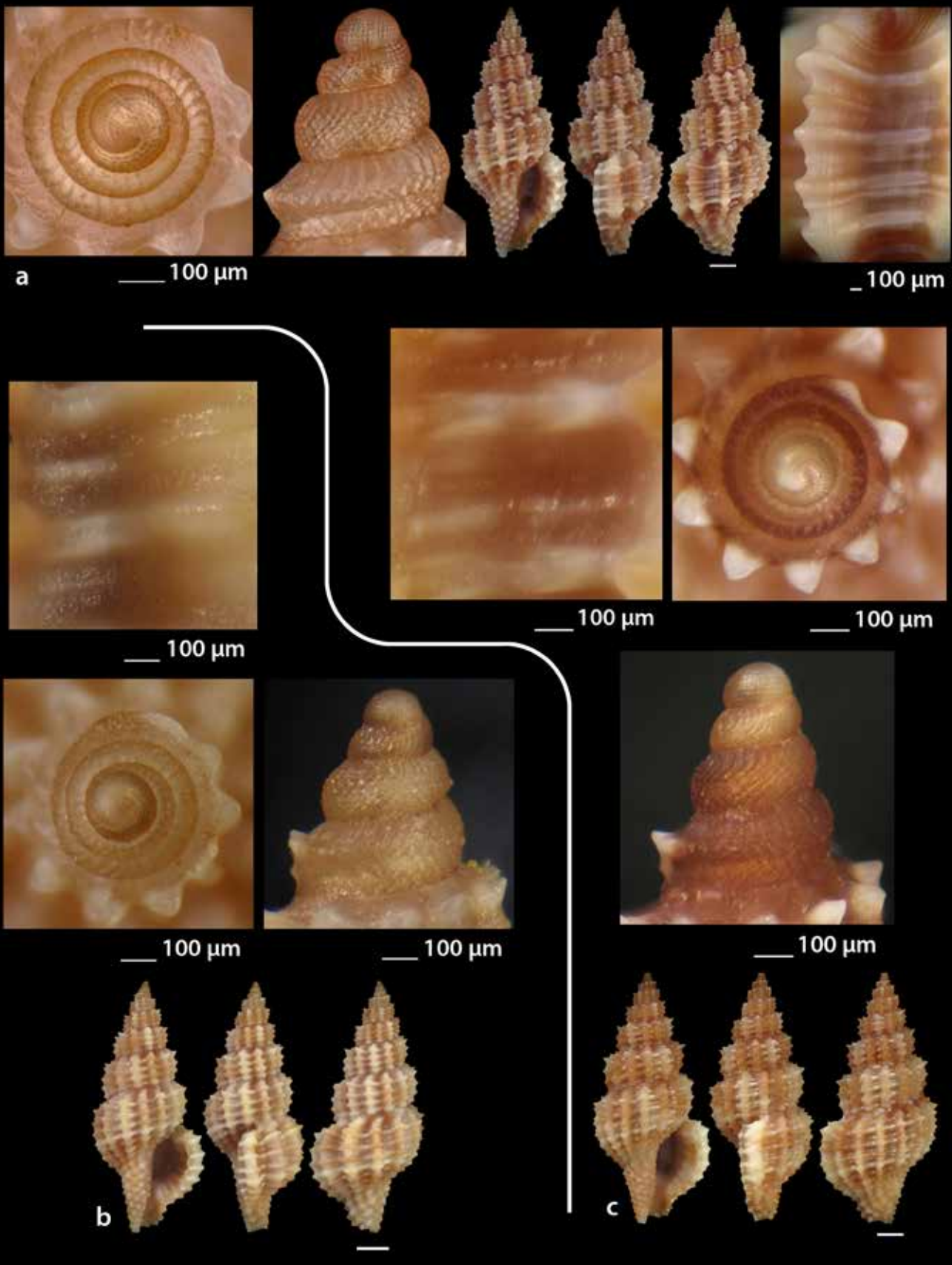


Figure 1: *Raphitoma georgiae* n. sp.. a. Holotype, MNHN-IM-2000-37914, b. Paratype 1, c. Paratype 2. Bar = 1 mm, unless otherwise indicated.

Plate 2



Figure 2: a-j. *Raphitoma georgiae* n. sp.. a. Paratype 3, b. Paratype 4, c. Paratype 5, d. Paratype 6, e. Paratype 7, f. Paratype 8, g. Paratype 9, h. Paratype 10, i. Paratype 11, j. Live individual. k-n. *R. andrehoaraui* Pelorce & Horst, 2020. k. Live individual, l-n shells. Bar = 1 mm, unless otherwise indicated.

Cerithiopsidae from Indian Ocean

Part. 1 - Oman, Dhofar Region and Description of 2 new species.

Alberto CECALUPO

Research Associate c/o Acquario Civico e Stazione Idrobiologica di Milano,
Viale Gadio 2, 20121 Milano, Italy.

Address: Via Grancino, 6, 20090 Buccinasco (MI) Italy
acecalupo@gmail.com

Ivan PERUGIA

Via Roncalceci 152, 48125 Ravenna, loc. Filetto, Italy
ivanperugia@virgilio.it

Résumé

Dans cet article, le matériel malacologique de la Superfamille Triphoroidea Gray, 1847, signalée de Mirbat dans le Gouvernorat de Dhofar au Sultanat d'Oman est analysé: 12 espèces de la famille Cerithiopsidae H. Adams & A. Adams, 1853 sont signalées, dont deux, *Clathropsis omanensis* et *Prolixodens gorii* sont décrites.

Abstract

In the present paper malacological material of the Superfamily Triphoroidea Gray, 1847 collected in Mirbat in Dhofar, a Governorate in the Sultanate of Oman, is analyzed: 12 species of the family Cerithiopsidae H. Adams & A. Adams, 1853 are reported, of which two, *Clathropsis omanensis* and *Prolixodens gorii* are described.

Key words

Triphoroidea, Cerithiopsidae, Oman, Mirbat, Dhofar, new species, range extension.

Introduction

Analyzing sediment reported from an medium depth of 20-28 m from the Mirbat area, Dhofar Region, a Governorate of the Sultanate of Oman, have been separated and identified 19 specimens for the Superfamily Triphoroidea Gray, 1847; 12 species of the family Cerithiopsidae H. Adams & A. Adams, 1853 of which 2 are new to science, *Clathropsis omanensis* and *Prolixodens gorii*; 7 are reported for the first time from this area (*Cerithiopsidella cornea* Cecalupo & Perugia, 2017; *Clathropsis multispirae* Cecalupo & Perugia, 2012; *Clathropsis charlesi* Cecalupo & Perugia, 2014; *Clathropsis fosterae* (Melvill & Standen, 1896); *Prolixodens lutea* (Cecalupo & Perugia, 2012); *Horologica gwenellae* Cecalupo & Perugia, 2013; *Seila maxima* Cecalupo & Perugia, 2014); 3 lack their protoconch are only illustrated. We also found a species of the family Triphoridae Gray, 1847, *Metaxia bacillum* (Issel, 1869) typical of the Red Sea (Suez).

The area of the Persian Gulf has been previously studied by some authors who have also reported species of the family Cerithiopsidae in their contributions; see Melvill (1893; 1896; 1898; 1904; 1906; 1910) and Melvill & Standen (1896; 1901) and more recently the area has been studied by Bosch & al. (1995) but there are no reported some species for Dhofar.

Materials and methods

The purpose of this work is the identification of some species

present in material of the Superfamily Triphoroidea Gray, 1847 from Dhofar, a Governorate in the Sultanate of Oman, reported by Sandro Gori. Being non-living micromolluscs, their identification is based only on the analysis of the morphological characteristics of the shell being the soft parts unknown. The material was washed with fresh water and selected specimens in good condition were photographed with digital camera and with ESEM. The size of the shells were measured manually with a microscope 20/40x (objective with millimeter scale). In the generic classification we have always given priority to the peculiar feature of the protoconch. However, after the many species analyzed, we believe that an evaluation based only on the examination of the protoconch or teleoconch is an understatement leaving many doubts that can be clarified by the examination of the soft parts. The systematics follows Bouchet et al. (2017), to the level of subfamilies and is derived from Marshall (1978) for the genera, pending analysis of the soft parts.

Cerithiopsidae species reported from the Persian Gulf and also from other geographic areas.

1893 - *Seila bandorensis* (Melvill, 1893): 62, pl. 1, fig. 19; Melvill & Standen, 1901: 377; Bosch et al. 1995: 105, fig. 381; Jay & Drivas, 2002: 35, pl. 9, D; colour pl. 2, fig. 57; Cecalupo & Perugia, 2014: 114, 119, fig. 17, Q. R.

1896 - *Cerithiopsis tenthrenois* (Melvill, 1896): 109, pl. 8, fig. 1, [*Bittium*]; Aartsen van et al., 1989: 69, pl. 1, fig. 4; Tringali & Villa, 1989: 34, pl. 1, fig. 2; Buzzurro, 1999: 10, fig. 2; Giannuzzi-Savelli, 1999: 38, fig. 59; Chang, 2004: 12, species n° 535 in Hawaiian Shell News; Bogi & Gallil, 2006: 17, fig. 1b; Prkic & Buzzurro, 2007: 2, fig. h; Delongueville & Scaillet, 2007: 65, fig. 68.

Cerithiopsis aurantiaca Melvill & Standen, 1896: 300, pl. 10, fig. 50 [invalid junior homonym of *Cerithiopsis aurantiaca* Gould, 1861] = ***Cerithiopsis melvilli*** Jay & Drivas, 2002: 1, 30, (is a replacement name); Syntype EE.3705 in Manchester Museum (illustrated online).

Cerithiopsis fosterae Melvill & Standen, 1896: 301, pl. 10, fig. 53; Jay & Drivas, 2002: 4, pl. 1, B; color pl. 1, fig. 2; Poppe, 2011: 554, pl. 1268, figs. 5-6; Severns, 2011: 238, pl. 102, fig. 2.

Cerithiopsis pulcherrima Melvill, 1896: 110, pl. 8, fig. 3; Chang, 2004: 13, species n° 518 in Hawaiian Shell News.

Cerithiopsis rubricincta Melvill, 1896: 109, pl. 8, fig. 15; Chang, 2004: 12, species n° 516 in Hawaiian Shell

News.

Cerithiopsis sykesii Melvill, 1896: 109, pl. 8, fig. 8; Chan Sow-Yan & Lau Wing Lup, 2019: 146, figs. 1, 3.

1898 - ***Seila hinduorum*** (Melvill, 1898): 20, pl. 1, fig. 13 [***Cerithiopsis (Seila) hinduorum*** unaccepted]; Bosch et al, 1995: 105, fig. 382; Jay & Drivas, 2002: 35, pl. 9 fig. E, color plate 2, fig. 58; Poppe, 2011: 554, pl. 1268, figs. 5-6; Cecalupo & Perugia, 2014: 119, figs. 3°, 13I, J.

1904 - ***Bittium caudatum*** Melvill, 1904: 161, pl. 10, fig. 8 (*Taxon inquirendum*) [= *genus Cerithiopsis*]

1906 - ***Cerithiopsis mathildaeformis*** Melvill, 1906: 71, pl. 7, fig. 4 [= ? *genus Metaxia*]

1910 - ***Cerithiopsis eutreta*** Melvill, 1910: 10, pl. 2, fig. 16 [*nomen dubium*] [species not reported in WoRMS]
Cerithiopsis henjamensis Melvill, 1910: 10, pl. 2, fig. 17 [*nomen dubium*] [species not reported in WoRMS]

Seila ochrolivens Melvill, 1910: 10, pl. 2, fig. 18 [***Cerithiopsis (Seila) ochrolivens***] [*nomen dubium*] [species not reported in WoRMS]

Acronyms and abbreviations

auct.	auctores (lat.) authors
et al.	<i>et alii</i> (latin) and others
fig./figs.	figure/figures
juv.	juvenile form
MNHN	Muséum National d'Histoire Naturelle, Paris, France
ESEM	Environmental Scanning Electron Microscope
spm(s)	specimen (s)
W/H	width/height

Systematics

Clade **Hipsogastropoda** Ponder & Lindberg, 1997
Informal Group **Ptenoglossa** Gray, 1853
Superfamily **Triphoroidea** Gray, 1847
Family **Cerithiopsidae** H. Adams & A. Adams, 1853

Cerithiopsidella cornea Cecalupo & Perugia, 2017
(plate 1, figs. A-C; D)

Material type: holotype - (MNHN-IM-2000-30478) dim. 3.08 x 1.17 mm, protoconch 0.33 x 0.26 mm.

Type locality: Touho Bay, 0-1 m, New Caledonia.

Distribution: New Caledonia, first report from North Indian Ocean, Oman Dhofar Region.

Material examined: 1 spm, South Mirbat, Dhofar, stn 29, 16°58'178"N- 54°41'273"E, 20 m, rocks brushing, 25/11/2016; 1 spm, The Hill, Mirbat, Dhofar, Oman, 20 m, stn 20, 16°57'827"N- 54°41'666"E, 14/11/2015.

Figured specimen: pl. 1, figs. A-C, dim. 2.90 x 1.20; fig. D, protoconch 0.31 x 0.25 mm.

Animal not observed.

Clathropsis charlesi Cecalupo & Perugia, 2014

(plate 2, figs. A-B)

Material type: holotype - (MNHN-IM-2000-27607), dim. 4.19 x 1.14 mm, protoconch 0.68 x 0.29 mm, point east of Galions Bay, 5-6 m, South Madagascar.

Type locality: point East of Galions Bay, South Madagascar, 5-6 m.

Distribution: South Africa, South Madagascar, Mozambique, first report from NE Indian Ocean, Oman Dhofar Region.

Material examined: 2 spms, Hamdy's Block South Mirbat, Dhofar, Oman, stn 28, 16°58'849"N- 54°45'606"E, 25 m, 24/11/2016.

Figured specimen: pl. 2, figs. A-B, dim. 3.30 x 0.82 mm. Animal not observed.

Clathropsis fosterae (Melvill & Standen, 1896)
(plate 2, fig. G)

Cerithiopsis fosterae Melvill & Standen, 1896: 301, pl. 10, fig. 53.

Cerithiopsis fosterae Melvill & Standen, 1896 in Jay & Drivas, 2002: 4, pl. 1, fig. B; color pl. I, fig. 2.

Material type: *Cerithiopsis fosterae* Melvill & Standen, 1896, in Manchester Museum, figured syntype EE.3736, 3 syntypes EE.7760 and 2 possible syntypes EE.8118.

Type locality: Loyalty Islands, New Caledonia.

Distribution: Lifu and Uvea, Loyalty Is., Oman Dhofar Region.

Material examined: 1 spm, Bird Island offshore, Mirbat, Dhofar, stn 24, 16°56'466"N- 54°44'479"E, 25 m, 21/11/2016; 1 spm, South Mirbat, offshore, Dhofar, Oman, stn 29, 16°58'178"N- 54°41'273"E, 20 m, rocks brushing, 25/11/2016.

Figured specimen: pl. 2, fig. G, dim. 5.6 x 1.1 mm.

Animal not observed.

Clathropsis multispirae Cecalupo & Perugia, 2012
(plate 1, figs. E-G; H-I)

Material type: holotype - (n° Moll. 23998) dim. 8.45 x 1.72 mm, protoconch 0.61 x 0.29 mm.

Type locality: Panglao Is., Momo Beach, Philippines, 80 m.

Distribution: Philippines, Papua New Guinea, Indonesia, Japan, Vanuatu, Red Sea, Yemen, South Madagascar, Mozambique, Oman Dhofar Region.

Material examined: 1 spm, Deep Platou, Mirbat, Dhofar, Oman, stn 16, 16°56'491"N- 54°43'377"E, 30 m, rocks brushing, 12/11/2015; 1 spm, The Hill, Mirbat, Dhofar, 20 m, stn 20, 16°57'827"N- 54°41'666"E, 14/11/2015; 1 spm, South Mirbat, offshore, Dhofar, stn 29, 16°58'178"N- 54°41'273"E, 20 m, rocks brushing, 25/11/2016; 1 spm, Marriott's Deep, wall, stn 31, Mirbat, Dhofar, 20 m, 26/11/2016.

Figured specimen: pl. 1, figs. E-G, dim. 3.10 x 0.90 mm; figs. H-I, dim. 2.80 x 0.88 mm.

Animal not observed.

Clathropsis omanensis n. sp.
(plate 1, figs. J-L; M)

Type material: holotype (MNHN-IM-2000-38243) dim. 3.60 x 1.14 mm, protoconch 0.57 x 0.33 mm, stn 23.

paratype 1 - dim. 3.01 x 1.12 mm, stn 23 [Gori Coll.].

Type locality: Mirbat, Dhofar, Oman, 20 m.

Distribution: Mirbat, Oman, Dhofar Region.

Material examined: 2 spms, Deep Platou, Mirbat, Dhofar, stn 23, 16°56'494"N- 54°43'367"E, 20 m, rocks brushing, 21/11/2016.

Description of holotype

Shell medium in size, conical, regularly increasing, wide sutures, ratio W/H 0.32. Protoconch conical, 4.5 smooth convex whorls; color whitish. Teleoconch of 6.5 whorls with reticulate sculpture of 3 narrow spiral cords crossed by weaker axial ribs, about 21 on last whorl; small beads at each intersection. A fourth cord at the base of last whorl emerging from insertion of outer lip; limit between columella and base highlighted by a very thin furrow. Columella short, acuminate, smooth; weak columellar callus bordering a circular aperture with thin outer lip bordered by sculpture of the teleoconch. Sandy color, semitransparent. Animal not observed.

Figured specimen: pl. 1 figs. J-L, dim. 3.60 x 1.14 mm; fig. M, dim. 3.01 x 1.12.

Comparison:

Clathropsis omanensis n. sp. is compared with: *Clathropsis marinesquae* Cecalupo & Perugia, 2021 from Comoro Is. that differs mainly having a ratio W/H 0.36; *Clathropsis atimovatae* Cecalupo & Perugia, 2014 from South Madagascar with ratio W/H 0.32, protoconch 0.55 x 0.26 mm of 4.5 whorls and a similar color but with a different sculpture of the teleoconch; *Clathropsis multispirae* Cecalupo & Perugia, 2012 with a wide Indopacific distribution and also reported here by Dhofar that differs having ratio W/H 0.20, protoconch 0.61 x 0.29, and teleo after 8° world, sculpture 5 spirals; *Clathropsis semiclara* Cecalupo & Perugia, 2012 from Philippines and South Madagascar differs having ratio W/H 0.30, protoconch longer and narrower 0.66 x 0.28 and for color whitish, semitransparent.

Etymology:

omanensis, from Oman, the known distribution area.

Clathropsis sp.

(plate 2, figs. C; D-F)

Locality: Mirbat, Oman.

Material examined: 4 spms, Hamdy's Block offshore, Mirbat, Dhofar, stn 27, 35 m, rocks brushing, 23/11/2016.

Figured specimen: pl. 2, fig. C, dim. 6.85 x 0.80 mm; figs. D-F, protoconch.

Description:

Shell small, dim. 2.85 x 0.80 mm, conical, regularly increasing, deep sutures. Protoconch damaged. Teleoconch of 9.5 whorls with reticulate sculpture of 3 spiral cords equal in size crossed by weaker axial ribs, about 30 on last whorl; beads at each intersection. A fourth dead cord at the base of last whorl emerging from insertion of outer lip; limit between columella and base highlighted by a very thin line. Columella short, acuminate, smooth; weak columellar callus bordering a circular aperture.

Animal not observed.

(plate 2, fig. K)

Type Material: holotype - MNHN-IM-2000-25927 dim. 3.04 x 1.18 mm, protoconch 0.37 x 0.21 mm.

Type locality: Vanuatu, South Turtle Is., 7 m.

Distribution: reported from West Pacific to East Indian Ocean, first report from North Indian Ocean, Oman, Dhofar Region.

Material examined: 1 spm, Eagle Bay, Mirbat, Dhofar, Oman, stn ST 14, 16°56'412"N- 54°47'827"E, 13 m; 1 spm, Deep Platou, Mirbat, Dhofar, Oman, stn 23, 16°56'494"N- 54°43'367"E, 20 m, rocks brushing, 21/11/2016; 1 spm, South Mirbat, Dhofar, Oman, stn 29, 16°58'178"N- 54°41'273"E, 20 m, rocks brushing, 25/11/2016.

Figured specimen: pl. 2, fig. K, dim. 3.01 x 1.16 mm.

Animal not observed.

Prolixodens gorii n. sp.

(plate 3, figs. A-C; D)

Type material: holotype - (MNHN-IM-2000-38244) dim. 3.56 x 1.26 mm, protoconch 0.38 x 0.30 mm.

paratype 1- dim. 3.02 x 1.02 mm, protoconch 0.34 x 0.28 mm [Gori Coll.].

Type locality: Mirbat, Dhofar, Oman.

Distribution: only known from type locality.

Material examined: 3 spms, Deep Platou, Mirbat, Dhofar, stn 23, 16°56'494"N- 54°43'367"E, 20 m, rocks brushing, 21/11/2016.

Description of holotype:

Shell medium, subcylindrical with protoconch acuminate and slightly contracted base, moderately impressed sutures; colour uniformly pale yellow. Protoconch conical of 4.5 convex whorls; seen under ESEM first 1.5 embryonic whorls show an obsolete sculpture of spiral thread, next whorls show a sculpture of thin axial prosocline riblets (about 21 per whorl), suture to suture, regularly spaced. Teleoconch of 7 whorls with reticulate sculpture of 2 spiral cords (under ESEM it is noted that the first cord is divided by a groove, the separation into 2 cords is evident in the last 2 whorls), crossed by axial ribs, about 18 on last whorl, beads at each intersection; seen under ESEM all surface is crossed by fine very close-set axial threads. A fourth beaded cord at the base of last whorl emerging from insertion of outer lip; limit between columella and base highlighted by a groove. Columella short and broad, obliquely truncated, columellar callus bordering an oval aperture; anal sulcus and siphonal canal well defined. Animal not observed.

Comparison:

Prolixodens gorii is characterized by the axial sculpture of the protoconch typical of the genus and by the spiral of the teleoconch found in some species of the genus *Horologica* (see *H. gwenellae* Cecalupo & Perugia, 2013); for outline can be compared with *Prolixodens lutea* (Cecalupo & Perugia, 2012), species with wide geographic distribution, which differs in the sculpture of the protoconch and having 3 spirals in the teleoconch.

Etymology: *gorii*, after Sandro Gori of Livorno (Italy) who provided the material for this paper.

(plate 2, figs. H-J)

= *Marshallopsis lutea* Cecalupo & Perugia, 2013: 38.**Type material:** holotype - MNHN-IM-2000-24136), dim. 3.87 x 1.25 mm, protoconch 0.50 x 0.29 mm.**Type locality:** Philippines, Pamilacan Is., 3-5 m.**Distribution:** reported from West Pacific to East Indian Ocean; Mirbat, Dhofar, Oman.**Material examined:** 3 spms, Marriott's Wreck, Mirbat, Dhofar, Oman, stn 1, under sand on limestone, 15 m, dim. 3.20 x 1.20 mm, 10/11/2014; 2 spms, South Mirbat, Dhofar, Oman, stn 29, 16°58'178"N- 54°41'273"E, 20 m, rocks brushing, 25/11/2016.**Figured specimen:** pl. 2, figs. H-J, dim. 3.20 mm.*Seila maxima* Cecalupo & Perugia, 2014
(plate 3, figs. E-G)**Type material:** holotype - (MNHN-IM-2000-27655), dim. 17.40 x 3.30 mm, protoconch 1.00 x 0.68 mm.**Type locality:** South Madagascar, Albatross Rock, 11-12 m.**Distribution:** South Madagascar, New Caledonia, first report from NE Indian Ocean, Oman Dhofar Region.**Material examined:** 2 spms damaged, Hamdy's Block, Mirbat, stn 2, coral reef, 11/11/2014; 1 spm, The Hill, Mirbat, Dhofar Oman, 20 m, stn 20, 16°57'827"N- 54°41'666"E, 14/11/2015.**Figured specimen:** pl. 3, figs. E-G, dim. 15.04 x 3.01 mm.

Animal not observed.

Seila sp.
(plate 3, figs. H-J)**Locality:** Mirbat, Dhofar, Oman.**Material examined:** 4 spms, Marriott's Deep, wall, stn 31, 20 m, dim. 3.00 x 0.84 mm, 26/11/2016.**Figured specimen:** pl. 3, figs. H-J, dim. 3.00 x 0.84 mm, Mirbat, Oman.**Description:** Shell small, juvenile, conical with flat outline, sutures not discernible; light orange color, probably discolored, with indefinite whitish flames. Protoconch, conical with impressed sutures of 3.5-4.5 smooth convex whorls; see under ESEM apex missing (subsequent whorls showing a sub-sutural band of very minute grains. Teleoconch of 10.5 whorls with spiral sculpture of 3 spiral cords; under ESEM spiral interspaces crossed by fine close-set axial threads. A fourth cord at the base of last whorl emerging from insertion of outer lip following by another very thinner; aperture incomplete. Animal not observed.*Tubercliopsis* sp.
(plate 3, figs. K-L)**Locality:** Mirbat, Dhofar, Oman.**Material examined:** 1 spm damaged, Marriott's Wreck, Mirbat, Dhofar, stn 13, 16°56'954"N- 54°43'650"E, 08/11/2015; 1 spm, Deep Platou, Mirbat, Dhofar, Oman, stn 23, 16°56'494"N- 54°43'367"E, 20 m, rocks brushing, 21/11/2016.**Figured specimen:** pl. 3, figs. K-L, dim. 7.51 mm, Mirbat, Oman.**Description:**

Shell medium in size, dim. 5.73 x 0.85 mm, conical, regularly

increasing, sutures moderately impresse, outline flat. Protoconch missing. Teleoconch of 12.5 whorls with reticulate sculpture of 3 spiral cords crossed by axial ribs, about 21 on last whorl; beads at each intersection. Aperture damaged, color brown. Animal not observed.

Comparison: *Cerithiopsis sykesii* Melvill, 1896: pl. 8, fig. 8, shows an outline of the teleoconch very similar.*Metaxia bacillum* (Issel, 1869)
(plate 3, figs. M-N; O)**Material type:** *Cerithium bacillum* Savigny, 1817: pl. 8, fig. 11 [name based on Savigny's figure. A single specimen in "Collection Savigny" is considered to be the holotype] in Bouchet & Danrigal, 1982.**Type locality:** original description from the Egypt, Gulf of Suez, Red Sea.**Distribution:** Red Sea, the remaining Indo-Pacific distribution not documented.**Material examined:** 1 spm, Bird Island offshore, Mirbat, Dhofar, stn 24, 16°56'466"N- 54°44'479"E, 25 m, 21/11/2016; 2 spms, damaged, Hamdy's Block, South Mirbat, Dhofar, Oman, stn 28, 16°58'849"N- 54°45'606"E, 25 m, 24/11/2016.**Figured specimen:** pl. 3, figs. M-N, dim. 3.30 x 0.82 mm; fig. O, dim. 2.40 x 0.60 mm.**Remarks:** first report from South Oman.

Animal not observed.

Acknowledgements

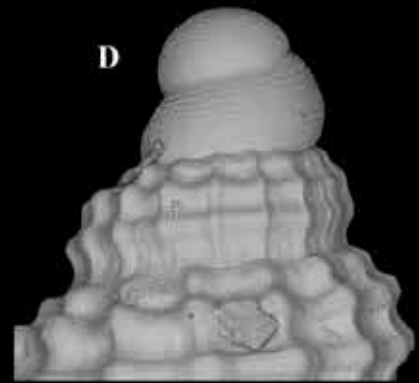
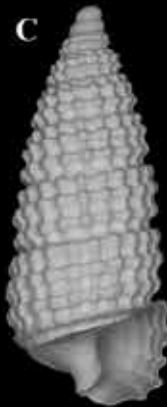
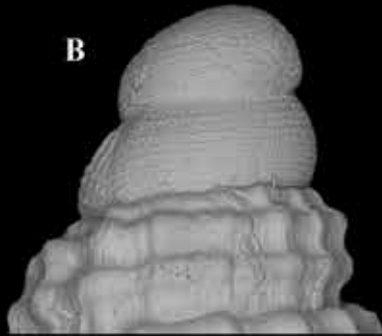
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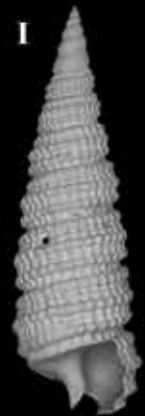
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Plate 1



Cerithiopsidella cornea
Cecalupo & Perugia, 2017
2.90 mm
Mirbat, Oman

Cerithiopsidella cornea
Cecalupo & Perugia, 2017
protoconch, 0.31 x 0.25 mm
Mirbat, Oman



Clathropsis multispirae
Cecalupo & Perugia, 2012
3.10 mm
Mirbat, Oman

Clathropsis multispirae
Cecalupo & Perugia, 2012
2.80 mm
Mirbat, Oman



Clathropsis omanensis n. sp. 3.60 mm
Holotype Mirbat, Oman

Clathropsis omanensis n. sp.
3.01 mm Paratype 1 Mirbat, Oman

Plate 2



A



B

Clathropsis charlesi
Cecalupo & Perugia, 2014
3.30 mm
Mirbat, Oman



D

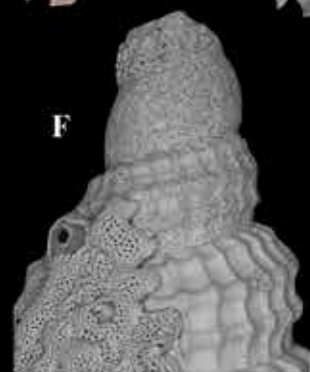


E

C



F



Clathropsis sp.
6.85 mm
Mirbat, Oman

G



Clathropsis fosterae
(Melvill & Standen, 1896)
5.6 mm
Mirbat, Oman

K



Horologica gwenellae
Cecalupo & Perugia, 2013
3.01 mm Mirbat, Oman

H



I

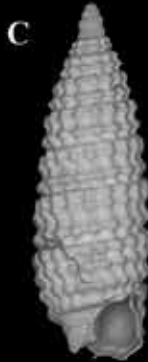
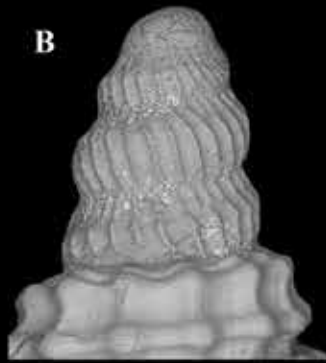


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Prolixodens lutea (Cecalupo & Perugia, 2012)
3.20 mm Mirbat, Oman

Plate 3



Prolixodens gorii n. sp. 3.56 mm
Holotype Mirbat, Oman

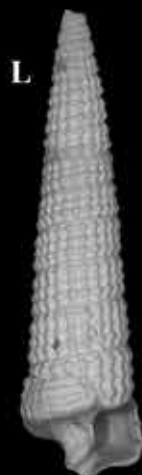
Prolixodens gorii n. sp.
Paratype 1 3.02 mm
Mirbat, Oman



Seila maxima
Cecalupo & Perugia 2014
15.04 mm Mirbat, Oman



Seila sp.
3.00 mm, Mirbat Oman



Tubercliopsis sp.
7.51 mm
Mirbat, Oman



Metaxia bacillum
M-N 3.30 mm
O 2.40 mm, Mirbat, Oman

**DESCRIPTION OF *ODOSTOMIA WIDMERI* SPEC. NOV. (MOLLUSCA, GASTROPODA, PYRAMIDELLIDAE)
FROM THE EASTERN MEDITERRANEAN SEA**

Thanasis MANOUSIS
Email: athanasiosmanousis@gmail.com
PO Box 48 K, 57500 Epanomi, Greece

Morena TISSELLI
Email: morena.tisselli@yahoo.com
Via Novara 19A, 48125 San Zaccaria, Italy

Sofia GALINO-MITSOU
Corresponding author
Email: galimits@otenet.gr
International Hellenic University (IHU)
Department of Environmental Engineering
P.O BOX 141, 574 00 Thessaloniki, Greece

Keywords

Gastropoda, Greece, Mediterranean Sea, new species, Pyramidellidae, taxonomy, *Odostomia*

Abstract

Odostomia widmeri n. sp. (Pyramidelloidea, Pyramidellidae) is described from two locations in eastern Thermaikos Gulf (North Aegean Sea, Greece) at depths of 0.2 m and 5 m, as well as beached in Yumurtalik (Adana, Turkey), based on 12 specimens. The new species is yellowish-white to pinkish-white in colour and has the unique for the genus character of two narrow reddish-brown spiral bands on the teleoconch.

Introduction

The numerous family of Pyramidellidae Gray, 1840 within the superfamily of Pyramidelloidea Gray, 1840 includes minute gastropods of all depths around the globe. They are epibionts and carnivore ectoparasites on preys without mobility of diverse groups of invertebrates. They belong to the Subclass of Heterobranchia; though their taxonomic affinities are much argued as they simultaneously bear characteristics of both prosobranchia and opisthobranchia (Gofas *et al.*, 2011, Høisæter, 2014). The generic taxonomy of the family is chaotic and there is general consensus that the generic subdivision is greatly artificial and in need of a profound revision.

The genus *Odostomia* J. Fleming, 1813, in particular, harbours some 520 species, most of which with white and smooth shells, some few with a spiral microsculpture over the entire surface or a subsutural groove. Protoconch of type A2, B or C. A more or less evident columellar fold is almost always present. The operculum is plane, rarely coloured, thin and translucent, with a small and eccentric spire (Gofas *et al.*, 2011; Giannuzzi-Savelli *et al.*, 2014; Høisæter, 2014). Some 12 species have been included by authors in the genus *Brachystomia* Monterosato, 1884, but as the distinctive characters of *Brachystomia* are not so discriminative, the taxon is considered by other authors as synonymous with *Odostomia* (van Aartsen, 1987). Mediterranean members of the genus are rather extensively presented by Bogi and Cuneo (1999), Gofas *et al.* (2011) and Giannuzzi-Savelli *et al.* (2014) while those of the Hellenic Seas by Manousis *et al.* (2020) and Manousis (2021). This work presents a new species of *Odostomia* taking into account our specimens and relevant ones from the literature.

Materials and Methods

Sampling and handling of the specimens from Greece were conducted according to Manousis *et al.* (2019) in February 2022 in the eastern Thermaikos Gulf. Specimens from Turkey were taken manually at the beach by Soleyman Dede Oztekin[†], a local collector. The species recognition was based on atlases and faunistic and articles on the molluscan fauna of the Hellenic seas and the East Mediterranean. Information from specific web sites was also taken into account, more specifically, the World Register of Marine Species (WoRMS) (Accessed, March 2022). Specimens are deposited in the premises of Dr. T. Manousis and those of M. Tisselli. Scientists are welcome to have access to the biological material for inspection by appointment.

Results

Systematics:

Superfamily **Pyramidelloidea** Gray, 1840

Family **Pyramidellidae** Gray, 1840

Genus ***Odostomia*** J. Fleming, 1813

Type species: *Turbo plicatus* Montagu, 1803 accepted as *Odostomia plicata* (Montagu, 1803) (type by subsequent designation).

Odostomia widmeri n. sp.

Odostomia sp., Giunchi *et al.* (2001), page 48, Fig. 3.

Odostomia sp., Bogi and Galil (2006), page 17, Fig. 1c.

Odostomia sp., Giannuzzi-Savelli *et al.* (2014), page 49, Fig. 81.

Odostomia (s.l.) sp. 2, Albano *et al.* (2021), page 44, Fig. 24.

Odostomia sp., Natural History Museum Rotterdam visible in WoRMS image (<http://www.marinespecies.org/aphia.php?p=image&tid=138413&pic=68061>).

Etymology: The species is named after the deceased colleague Luigi Widmer Giunchi.

Abbreviations:

CB - *Cymodocea nodosa* Bed,

CTM - Collection Thanasis Manousis,

MB - Mixed Bottom,

CTMT-LG - Collection Morena Tisselli - Luigi Widmer Giunchi,

MNHN - Muséum National d'Histoire Naturelle.

Description of holotype: Shell small for the genus, 1.5 mm high, 0.75 mm wide, ((h/w = 2), hyaline, semi-transparent, fragile and pupoid. Protoconch smooth and pinkish, of type C, larval shell of 149 µm maximum diameter (mean ± sd: 154 ±

5.57 µm from 3 specimens). Teleoconch with 3 convex whorls and deep suture. Aperture oval, columella oblique, inner lip overlapping, umbilicus absent, inconspicuous inner columellar tooth and prosocline and conspicuous incremental lines. The outer lip of the aperture is clearly prosocline, simple and very fragile. Teleoconch colour yellowish-white with 2 characteristic narrow spiral chestnut-brown bands, one at the suture and one over it at the middle of the whorl, the lower one less intense. Animal pure white, semitransparent, with conspicuous black eye spots. Operculum yellowish-white (Fig. 1a) and hyaline (personal observation on live individuals).

Type Material:

Holotype: (Fig. 1a), live, CTM, Greece, CB, -5 m, Paralia, Epanomi, Thermaikos Gulf, 40°24'N - 22°53'E, (wet storage, 96% EtOH), *Odostomia widmeri* Tisselli & Manousis, 2022, deposited at MNHN-IM-2000-37912.

Paratypes: 1 to 4 (Fig. 1b-e) shells, and paratypes 5 and 6 (Fig. 1f, g) live individuals (wet storage, 96% EtOH), CTM, Greece, CB, -0.2 m, Paralia, Epanomi, Thermaikos Gulf, 40°23'N - 22°53'E. Paratypes 7 to 9, Yumurtalik, Adana, Turkey, in shell grit, beached, sand/gravel bottom, CTM-GL.

Type Locality: Paralia, Epanomi, Thermaikos Gulf, 40°24'N - 22°53'E and Cape, Epanomi, 40°23'N - 22°53'E.

Distribution: Known originally from five shells found at Yumurtalik, Adana, Turkey (Giunchi *et al.* 2001), then from another shell found at Neve Yam, northern Israel (Bogi and Galil 2006), subsequently from a living individual collected at the Soreq desalination plant, southern Israel Albano *et al.* (2021), and now from Thermaikos Gulf, northern Aegean Sea.

Habitat: Our specimens were collected from CB bottom material at 0.2 m and 5 m depth, and a sand/gravel bottom and in the beach (Turkey).

Remarks: *Odostomia widmeri* Tisselli and Manousis n. sp. shells exhibit all morphological features diagnostic for the genus including an inconspicuous columellar plica plus the unique for the genus character of two distinct spiral colour bands. Live individual was first reported and image documented from Greece (Manousis *et al.*, 2020) and subsequently from Israel (Albano *et al.*, 2021). That later finding was among two more similar looking species, i.e. *O. cf. dalli* (Hornung & Mermoud, 1925) from which it differs as *O. cf. dalli* is pure white, smooth and porcelaneous and with a proportionally higher aperture, and *O. (s.l.) sp. 1* which, unlike *O. widmeri* n. sp., is pure white, with a higher aperture and bears a fine spiral microsculpture (Albano *et al.*, 2021). *O. widmeri* n. sp. does not resemble any known Mediterranean pyramidellid; considering the great number of confirmed introductions of Indo-Pacific microgastropods to the eastern Mediterranean Sea (Giunchi *et al.*, 2001, Bogi and Galil, 2006, Giannuzzi-Savelli *et al.*, 2014, Manousis *et al.*, 2020, Albano *et al.*, 2021).

Discussion

The history of *Odostomia widmeri* n. sp. dates back to 1995 when it was first encountered. Since then and before our 9 findings, at least 7 specimens have been collected (Albano *et al.*, 2021) but the species was not officially described and deposited. Perhaps the reason lies, on one hand, with its two spiral colour bands which make it differ from all known Mediterranean congeners and predispose towards a non indigenous species and, on the other hand, on the fact that we all colleagues being unaware of any Indo-Pacific pyramidellid resembling the taxon, in spite the extensive search of the literature aiming at finding similar *Odostomia* species worth of a

comparison, especially those of the E. Mediterranean (Öztürk *et al.*, 2013). The case is reminiscent of another minute species, that of *Murchisonella mediterranea* Peñas & Rolán, 2013 which was initially considered as a Lessepsian migrant to be eventually accepted as a not described indigenous species. It is also reminiscent of the collection of a specimen of *Teretia cf. neocaledonica* Morassi & Bonfitto, 2015 from the North Aegean Sea (Manousis *et al.*, 2018). Apparently, *T. neocaledonica* had been recently reported and described as new species from New Caledonia, thus making the finding more improbable if its origin should be attributed to Lessepsian migration. The resemblance, though, between the recent Indo-Pacific species described in Morassi & Bonfitto (2010) and members of *Teretia* from the Tertiary of Europe suggested a Tethyan origin for the genus, thus leading to the hypothesis that an isolated subpopulation of the species might have survived the geological eras till now in some Mediterranean depths. Similarly, all our findings of *O. widmeri* n. sp. may represent an indigenous Mediterranean subpopulation of the species expected to be found eventually in the Indo-Pacific - not to exclude a reverse migration, e.g. from the Mediterranean to the Indo-Pacific. Nevertheless, the finding of shells and live individuals from two different localities of Thermaikos Gulf is indicative of both, a thriving population and an autochthonous identity. We would add that finding of minute new species is attributed to laborious, diverse and meticulous efforts made. We intentionally avoid using the term "cryptogenic" as we think that behind this word lies our inability as researchers to study biodiversity diligently both because of the limited means available and the limited number of people involved in its study (Albano *et al.*, 2020). Finally, there is a discrepancy between the observed size of the larval shell between our specimens and that of Albano *et al.* (2021). More specifically, our specimens exhibit a size of some 154 µm (mean) of the exposed part of the larval shell, while that of Albano *et al.*, (2021) of some 100 µm. The case is in need of further study, perhaps by finding some more specimens and looking for the presence of two distinct protoconch sizes within the same population.

Acknowledgements

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Plate 1

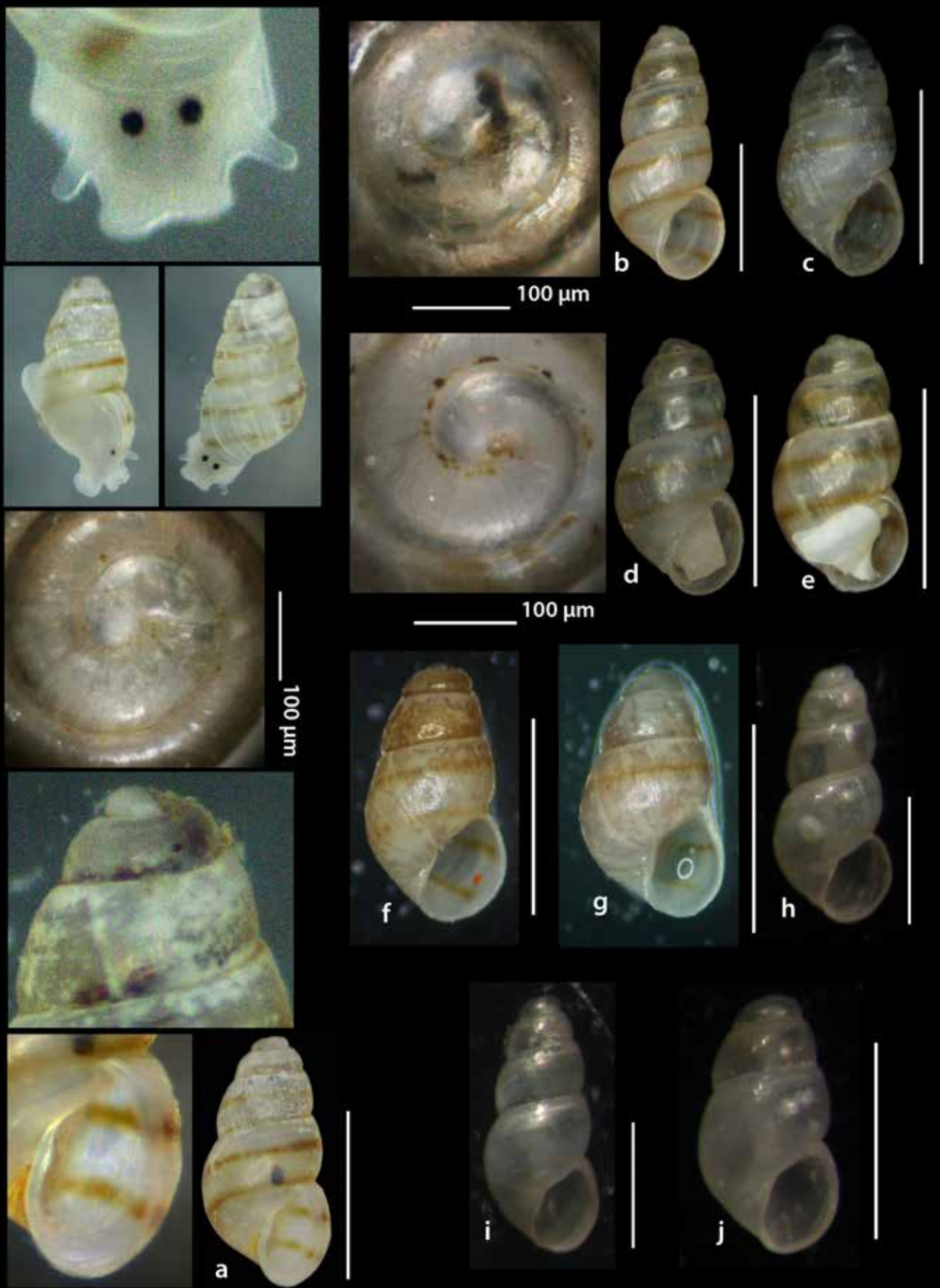


Figure: a. *Odostomia widmeri* Holotype MNHN-IM-2000-37912, live specimen, b-e. *O. widmeri* paratypes 1 to 4, shells, f and g. *O. widmeri* paratypes 5 and 6, live specimens stored in 96% ethanol, h-j. *O. widmeri* paratypes 7 to 9, shells.

Bar = 1 mm, unless otherwise indicated.