

A review of the enigmatic genus *Canalispira* Jousseume, 1875 (Gastropoda : Cystiscidae) with the description of three new species from the western Atlantic

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ABSTRACT. A literature review of the genus, and an inventory of currently recognised species of the genus *Canalispira* Jousseume, 1875 is presented. Photographs of the animal of *Canalispira* and its radula confirm its correct placement in the Cystiscidae, and morphologic comparisons are made between western Atlantic and other worldwide species. Three new species of *Canalispira* are described: *C. phantasia* n. sp. and *C. ornata* n. sp. from northern Honduras, and *C. fluctuata* n. sp. from Belize and northern Honduras. *Osvaldoginella* Espinosa & Ortéa, 1997 is considered as a new synonym.

INTRODUCTION

Historic review of the genus *Canalispira*

The confusion in the literature regarding the taxonomic status of the genus *Canalispira* has, since its inception by Jousseume (1875), been extensive and prolonged. This has been caused mainly by the lack of recent references in the popular conchological media, the misnaming of specimens in museum collections, and the general paucity of other specimens available for study. The group has, therefore, remained obscure. A brief chronology of the taxonomic history of this enigmatic genus helps to illustrate this fact.

In his 1875 monograph, Jousseume established the new genus *Canalispira* as one of thirteen genera in the Marginellidae, on the basis of the canaliculated suture of the type species, *C. olivellaeformis* Jousseume, 1875 (Figs 30, 31), and with great foresight drew comparisons with the Olividae, which he had also observed to bear this character. Subsequent marginellid general reviews such as Redfield (1870), Weinkauff (1878-1879) and Tryon (1882-1883) deliberately avoided attempts at taxonomic division in the Marginellidae. However, Weinkauff did propose a generic classification of sorts, including *Canalispira* in his 'division 2', which comprised those genera lacking a 'basal sinus'.

Early in the 20th Century, several Indian Ocean species were described under *Marginella* s.l. by E. A. Smith (1903), Preston (1906 & 1915), and Melvill (1912). Tomlin (1917) listed alphabetically all known

Marginella and assigned them to appropriate genera. However, even he failed to correctly place several species in *Canalispira*. Laseron (1957) named thirty new genera, including *Baroginella*, which was later considered by Covert (1995) to be a junior synonym of *Canalispira*.

The gradual accumulation of data on radula and animal characters allowed Coan (1965) to attempt a new classification, proposing three major divisions in the family Marginellidae: the subfamilies Marginellinae Fleming, 1828, Cystiscinae Stimpson, 1865 and Marginelloninae Coan, 1965, placing *Canalispira* in the Marginellinae.

The lack of any published information about the anatomy of the animal, combined with a shell morphology superficially resembling that of the genera *Volvarina* and *Prunum*, ensured that the historic placement of *Canalispira* in the Marginellidae persisted. As recently as 1991, a new Caribbean species, *Canalispira hoffi* (Moolenbeek & Faber, 1991), was described as a *Prunum*, with the authors themselves admitting that it did not quite fit its placement therein. In another case, Lipe & Sunderland (1991) presented a new *Canalispira* species from Florida, as a *Volvarina* species. This species still remains undescribed, but closely resembles *C. aurea* García, 2006, a species from the Bahía de Campeche, in the lower Gulf of Mexico. To compound the problem, the genus *Osvaldoginella* Espinosa & Ortéa, 1997, clearly synonymous with *Canalispira*, was erected for a single deep water Cuban species.

The presence of *Canalispira* in the fauna of southern Africa was recognised by Kilburn (1990), who

reviewed the South African *Canalispira* and named a new species, *C. umuhlwa* Kilburn, 1990. Later coverage of the South African *Canalispira* species was provided by Lussi & Smith (1998) in a review of the South African Cystiscidae, but by then the taxonomic situation had changed for the better with the publication of the important work of Covert & Covert (1995), who had divided marginelliform gastropods into two main families: Marginellidae Fleming, 1828 and Cystiscidae Stimpson, 1865. Crucially they placed *Canalispira* in the Cystiscidae, based upon a sketch of the animal of a Western Australian species, and on shell morphology and radula characters, which they had established as being diagnostic. They made the observation that the channelling of the suture is a species-level character in this genus, and appealed for more study of the living animals. They also demonstrated important ancestral relationships between the Olividae and the Cystiscidae, thereby confirming what Jousseume himself had suspected over a century earlier, and making the genus even more interesting to study as a special link between the two families.

Diagnosis of *Canalispira*

The species assigned to *Canalispira* have tiny to small-sized, robust, porcelainous shells (approx. L = 2.5- 10.0 mm). The shape is cylindrical-biconic to narrowly ob-ovate, usually with a very weak shoulder. The colour is commonly opaque white, creamy or golden-tan, but some western Atlantic species, including the ones described herein, have light to dark brown irregular, wavy axial markings, or zig-zag markings, some forming a tented pattern. The channel at the suture (Figs 26-28, 30, 31) can be deep, weakly recessed or callused over. The spire is medium to tall, and the aperture narrow posteriorly but widening anteriorly. The lip is thickened, especially anteriorly, either smooth and not lirated within aperture, or denticulate and lirated. The external varix is absent. There is no siphonal notch, except in the west African species *Gibberula cucullata* Gofas & Fernandez, 1998, discussed below. However, there is always a deep, narrow posterior notch (Figs 23, 26, 27, 30), even in species with no channelled suture. The columella bears 3-6 plications and parietal lirae, and the internal whorls are reduced in thickness by resorption.

Geographic and Bathymetric Distribution

The genus has a worldwide distribution and has strongholds in the Gulf of Mexico, the northern Caribbean and the western Indian Ocean. A further possible member of the genus has been found in the Gulf of Guinea, in west Africa. The Indian Ocean harbours a number of species from the east coast of South Africa, the Gulf of Oman, and Western Australia, and several species are present in

northeastern Australia. As yet, species of *Canalispira* have not been found in most of the Pacific, including tropical west America. Species are found from intertidal depths to 540 m, and it is evident that, in the western Atlantic at least, endemism is high.

Species assigned to *Canalispira*

Covert & Covert (1995) noted that there were thirteen species of *Canalispira*: one from South Australia, seven from the Indo-Pacific, three from the western Atlantic, and two from South Africa, without being more specific.

We consider the taxa that can be assigned to *Canalispira* as follows. These are in chronological order, with their original generic designation retained:

Described species

Canalispira olivellaeformis, Jousseume 1875. Type species. Locality unknown (Figs 30, 31).

Marginella fallax E. Smith, 1903 from False Bay to Ramsgate, Natal.

Marginella shackelfordi Preston, 1915 from Sri Lanka (*nom. nov.* for *M. eburnea*, Preston, 1906), (Fig. 26).

Marginella replicata Melvill, 1912 from the Gulf of Oman (Figs 27, 28)

Canalispira minor Dall, 1927 from Georgia / northeast Florida.

Baroginella infirma Laseron, 1957 from Northern Queensland.

Baroginella attentia Laseron, 1957 from Northwestern Australia and Queensland.

Canalispira umuhlwa Kilburn, 1990 from Natal.

Prunum hoffi Moolenbeek & Faber, 1991 from Saba, Netherlands Antilles.

Osvaldoginella gomezi Espinosa & Ortéa, 1997 from Cuba.

Canalispira aurea García, 2006 from Bahía de Campeche, Gulf of Mexico.

New species described in this paper

Canalispira phantasia n. sp. from Roatán (Bay Islands), Honduras.

Canalispira ornata n. sp. from Roatán and Guanaja (Bay Islands), Honduras.

Canalispira fluctuata n. sp. from Belize and Roatán (Bay Islands), Honduras.

Doubtful assignment

Baroginella volunta Laseron, 1957 from Queensland.

Tentative assignment

Gibberula cucullata Gofas & Fernandez, 1988 from São Tomé, Gulf of Guinea (see comments below).

Undescribed species

Marginella sp. no. 29 in Lipe 1991, pl. 17 no. 4 and pl. 18 no. 32, Two Peoples Bay, Albany, Western Australia.

Marginella sp. no. 80 in Lipe 1991, pl. 7, fig 4, screened off Tryall, Jamaica, 80 ft.

Marginella sp. no. 83 in Lipe 1991, pl. 7, figs 8, 9, dredged in 50 Fathoms off Florida = *Volvarina* sp. in Lipe & Sunderland, 1991.

Habitats of *Canalispira*

Canalispira appear to be very widespread and diverse in the Bay of Honduras. They can be encountered on nearly every dive when collecting in settled muddy rubble at depths from 2 m down to approximately 15 m. Populations have also been encountered in the mud, amongst the roots of mangroves, where they form an important part of the gastropod fauna. They do not appear to favour flat sandy substrates in shallow areas where wave action occurs.

Our first sample of *Canalispira*, however, were found in dredgings performed in May 2006 from s/y Marina Em, in 56 m, off northeastern Honduras (off Cayos Vivarillos, dredged 56m, 16°04.9N 83°56.1W). They were initially catalogued by us as *Volvarina*. All eight shells were dead, and most were faded, and whilst transportation of shells to this depth cannot be entirely ruled out, it is more likely that live specimens are found here, as it is a small location on a large, flat, off-shore bank with little opportunity for transportation to have taken place. The shells were of poor quality and unsuitable for descriptive purposes. It is possible that they are conspecific with *C. fluctuata* n. sp., and a sample, labelled *C. cf. C. fluctuata* has therefore been lodged as voucher material in BMNH.

Live *C. ornata* n. sp. was subsequently collected in the northeastern lagoon of Guanaja, Bay Islands, Honduras, in the muddy sand under piles of dead coral rubble inside vital reef. From animal studies of these specimens it became clear that the shells previously dredged off Cayos Vivarillos were *Canalispira* and not *Volvarina*.

In June 2006, live specimens of *C. fluctuata* n. sp. were discovered at several locations in Belize, and also in Roatán, Bay Islands, Honduras. The discovery of the stunningly patterned *C. phantasia* n. sp. in a mangrove habitat in Roatán followed a short time later. The mangrove area is often avoided, presumably because collecting shells here is dirty work. It is, however, a place rich in beautiful, darkly coloured species, and the biotope is thus worthy of description; Along the edge of the mangroves at the waterline, there is often a steep bank ranging from 0.2 m to 1 m in height. At the base of this is the mud of the bay and this gently slopes away into deeper water. There is generally little algal coverage immediately beneath the mangroves as this area is shaded from the sun, but the weed and other algal growth starts outside the edge of

the leaf canopy. It is in the shaded area below the mangrove roots and in the soft mud at the foot of the bank where *C. phantasia* n. sp. are to be found. It is interesting to note that another of our new species, *C. fluctuata* n. sp., was found 300 metres from the colony of *C. phantasia* n. sp. albeit in an entirely different habitat. In addition, mangroves at Mud Hole Swash, Roatán, (16° 21.4'N 86° 31.0'W), close to the type locality of *C. ornata* n. sp., were checked but results were negative for *C. phantasia* n. sp.

General anatomical observations

The anatomy of *Canalispira* is essentially that of a type 4 animal (Covert & Covert, 1995) with a modification in the form of greatly reduced anterior lobes on the head, and the presence of parapodia – ‘wing-like’ lateral extensions of the foot which curl upwards to surround the sides of the anterior half of the shell and project forwards to form two lobes. So extensive are these that in *C. phantasia* n. sp. the yellowish foot has been observed to partially envelop the shell in a mantle-like fashion. During movement, the animal always holds these foot extensions as described, and it may be that this anatomical feature is put to use when the animal buries itself in the substrate. Such behaviour is commonly observed in the animals of the related family Olividae, which use movements of their expansive foot to soften the substrate to facilitate rapid burial.

Gofas & Fernandez (1988) recorded lateral edge curling of the foot in *Gibberula gruweli* Bavay in Dautzenberg, 1913 but this simple edge curling is not as dramatic as that seen in *Canalispira*. On the other hand, *Gibberula cucullata* Gofas & Fernandez, 1988 from São Tomé, was described as having strongly developed ‘parapodia’ and a highly modified head. The authors illustrated the animal (plate 2, fig. b), which shows a remarkable anatomical resemblance to all of our new species in that the split head has no anterior lobes and the foot is translucent with small, blurred, opaque-white spots, and completely unlike other sympatrically occurring *Gibberula* species, which are spotted in red, green, yellow and brown. The shell of *Gibberula cucullata* is similar in size to the tiny western Atlantic *Canalispira* species, and the authors mention the deep channel at the posterior insertion of the lip. However, unlike typical *Canalispira*, the shell appears to have an anterior notch, and strong labial denticles run the whole length of the lip. The shell is not thick and porcelainous, is coloured uniformly tan, lacks axial markings, and its profile is closer to that of *Gibberula* than any other *Canalispira*. Indeed, Covert & Covert (1995) provisionally considered it to be *Gibberula*. Without live animals for study to hand, we cannot make any definitive statement as to its generic status. However, there is a distinct possibility that this species may be the single known species from west Africa belonging to *Canalispira*.

At the suture, an impressed or callused-over channel is found encircling the spire of *Canalispira*. Tursch & Greifeneder (2001) described, in some detail, what appears to be an analogous structure in the Olividae and Olivellidae and called it the 'filament channel' since it is occupied by a long filamentous organ. They demonstrated that in these families the channel has no relationship with the suture, and is found remote from it. Our examinations of deeply channelled Indo-Pacific *Canalispira* show that, unlike in the olives, it is closely associated with the suture. It was also noted that in all of the Atlantic species known to date, the channel is modified by being callused over. We have not observed a soft tissue filament in these Atlantic *Canalispira*, and in our opinion the channelled suture may simply be a product of the way the spire of the shell is formed.

Materials and methods

Specimens were collected by the use of dredging, or substrate suction during snorkelling and SCUBA diving, followed by screening the sediment of large particles, and then allowing time for the animals to crawl out.

Digital images of the shells were made using a Kodak PSLR/n camera mounted on an Olympus SZX12 microscope. A radula was extracted from a single juvenile specimen of *C. ornata* n. sp. The shell was crushed and the radula was cleaned in a 10% KOH solution before mounting in a gelatine and glycerine medium. Images of the radula were taken using the same camera mounted on an Olympus CX41 microscope.

Abbreviations

MNHN: Muséum national d'Histoire naturelle, Paris, France.

BMNH: Natural History Museum, London, England.

AWC: Andrew Wakefield Collection.

TMC: Tony McClery Collection.

ad.: adult specimen.

juv.: juvenile specimen.

lv.: live taken specimen.

dd.: dead dredged shell.

L: Length of shell.

W: maximum width of shell.

SYSTEMATICS

Family **CYSTISCIDAE** Stimpson, 1865

Subfamily **PERSICULINAE** Coovert & Coovert, 1995

Genus *Canalispira* Jousseaume, 1875

Type species *C. olivellaeformis* Jousseaume 1875

= *Baroginella* Laseron, 1957

Type species *B. infirma* Laseron, 1957

= *Osvaldoginella* Espinosa & Ortéa, 1997 (new synonymy)

Type species *O. gomezi* Espinosa & Ortéa, 1997

Canalispira phantasia n. sp.

Figs 1-6, 19

Type material. Northern Honduras (Bay Islands), Roatán Island, Fantasy Island lagoon, French Harbour area, 16° 21.6'N 86° 26.4'W, 1m in mud at edge of mangroves, 1 ad. lv., holotype (3.38 x 1.64 mm), (Figs 1-3), Reg. no. BMNH 20060787.

1 ad. lv., paratype 1 (3.18 x 1.57 mm), (Figs 4-6), Reg. no. BMNH 20060788; 1 ad. lv., paratype 2 (2.95 x 1.47 mm), (Fig. 32), AWC; 1 ad. lv., paratype 3 (3.38 x 1.58 mm), AWC; 1 ad. lv., paratype 4 (3.05 x 1.49 mm), AWC; 1 ad. lv., paratype 5 (3.20 x 1.62 mm), TMC; 1 ad. lv., paratype 6 (3.14 x 1.57 mm), TMC; 1 ad. lv., paratype 7 (2.79 x 1.40 mm), TMC.

Other material examined. Approximately 50 ad., lv., from the type locality.

Type locality. Fantasy Island lagoon, French Harbour area, south-central Roatán Island, northern Honduras (Bay Islands).

Figures 1-22

1-6. *Canalispira phantasia* n. sp. Fantasy Island lagoon mangroves, Roatán, Honduras, 1 m;

1-3. holotype, 3.38 x 1.64 mm, BMNH 20060787; 4-6. paratype 1, 3.18 x 1.57 mm, BMNH 20060788.

7-12. *Canalispira fluctuata* n. sp. 7-9. Pelican Cays, Belize, 15 m, holotype, 2.99 x 1.49 mm, BMNH 20060789;

10-12. Fantasy Island lagoon reef, Roatán, Honduras, 5 m, paratype 1, 3.16 x 1.63 mm, BMNH 20060790.

13-18. *Canalispira ornata* n. sp. 13-15. Mud Hole Swash, Roatán, Honduras, 2 m, holotype, 2.81 x 1.40 mm, BMNH 20060792. 16-18. Northeast Lagoon, Guanaja, Honduras, 2 m. Voucher specimen, 2.6 x 1.26 mm, BMNH 20060794.

19-22. *Canalispira* live animals.

19. *C. phantasia* n. sp., paratype 2, head detail; 20. *C. ornata* n. sp. head detail; 21. *C. ornata* n. sp., holotype;

22. *C. ornata* n. sp., unpigmented specimen.



Description. Shell tiny (L: 2.79 to 3.38 mm), cylindrical-biconic (W:L ratio 47 to 50 %); surface smooth, glossy. Spire slightly convex, of medium height, of 3½ whorls including the moderately wide, milky white protoconch. Shoulder very weak; suture indistinct. Colour creamy yellow, with regular to slightly irregular dark brown, densely tented pattern; pattern arranged in such a way as to produce a reticulated effect throughout the surface of the shell; three spiral rows of darker markings at shoulder mid-body and anterior end. Suture marked with fine brown line; line extending onto protoconch. Aperture moderately wide anteriorly, narrowing posteriorly, ending in a narrow, sharply defined posterior notch. Labial denticles absent. External labial varix absent; lip thickened, narrowing to a sharp edge posteriorly. Parietal wall concave posteriorly, convex in region of the four columella plications. Parietal callus wash running full length of aperture, with weak, shallow fasciolar edge. Columella with four rounded, oblique, closely spaced plications occupying just less than half of apertural length; first plication strong, increasing in width anteriorly, sweeping around the base of the shell to join lip; second and third plications strong, emergent; fourth plication weaker, confined to aperture.

Animal: Modified type 4 animal (Fig. 19). Foot narrow, dimensionally similar to shell, rarely extending beyond it, extending anteriorly to form parapodia; parapodia curling up around the sides of the anterior half of the shell, extending forward as bilateral lobes. Foot translucent yellow, with clusters of 4 to 8 tiny, opaque, blurred white spots, more numerous anteriorly. Eyes black, situated centrally within each half of the split head, distal to the base of short, blunt tentacles which are generally held in a vertical position. Head lobes anterior to tentacles greatly reduced in size.

Radula unknown (not extracted).

Distribution. Found at the type locality only.

Habitat. *C. phantasia* n. sp. has so far been found only in the mud at the edge of mangroves.

Remarks. The overall slightly larger size, reticulated pattern, and specialized habitat sets this beautiful species apart from its congeners. Other comparative comments are presented in Table 1.

Etymology. From the Greek word *phantasia*: fantasy. Alluding to the type locality of Fantasy Island.

Canalispira fluctuata n. sp.

Figs 7-12, 23, 25

Type material. Belize, Pelican Cays, grid ref., 1 ad. lv., in 15 m, holotype (2.99 x 1.49 mm), (Figs 7-9), Reg. no. BMNH 20060789; Fantasy lagoon reef,

Roatán, northern Honduras, Bay Islands (16° 21.4'N 86° 26.3'W), 1 ad. lv., in 5-15 m, paratype 1 (3.16 x 1.63 mm), (Figs 10-12), Reg. no. BMNH 20060790; 2 ad lv., paratypes 2, 3 (2.96 x 1.51 mm, 2.67 x 1.43 mm), AWC; Long Cocos Cay, Belize, 1 ad. lv., paratype 4 (2.38 x 1.19 mm), AWC; Long Cocos Cay, Belize, 1 ad. lv., paratype 5 (2.40 x 1.40 mm), TMC.

Other material examined. Belize: Pelican Cays (16° 39.5'N 88° 11.3'W), 10 ad. lv. and 4 juv. lv.; Long Cocos Cay (16° 29.6'N 88° 12.8'W), 1 ad. lv. and 1 juv. lv.

Honduras: Fantasy Island lagoon reef, Roatán Island, northern Honduras (Bay Islands), approx. 60 ad. lv., and 10 juv. lv.; Off Cayos Vivarillos (16° 04.9'N 83° 56.1'W), 5 ad. dd. and 3 juv. dd., dredged in 56 m, (Size range approx. 2.38 – 3.16 mm in length. W:L of 50-54%).

One ad. dd. (2.72 x 1.38 mm), lodged as voucher material, Reg. no. BMNH 20060791, as *C. cf. C. fluctuata*.

Type locality. South-central Belize, Pelican Cays.

Description. Shell tiny (L = 2.38 – 3.1 mm), cylindrical-biconic (W:L ratio 50 – 54%); surface smooth, glossy. Spire of medium height, of 3½ whorls including the moderately wide, milky white protoconch. Shoulder very weak; suture indistinct. Colour creamy-white, with irregular to regular brown wavy axial pattern, or zig-zag pattern; pattern extending onto spire and anterior labial margin; darker brown blotch showing adjacent to labial margin, at mid-body, and on shoulder. Aperture moderately wide anteriorly, narrowing posteriorly, ending in a narrow, sharply defined posterior notch. Labial denticles absent. External labial varix absent, lip thickened, narrowing to a sharp edge posteriorly. Parietal wall concave posteriorly, convex in region of the four columella plications. Parietal callus wash running full length of aperture, with distinct, shallow fasciolar edge. Columella with four rounded, oblique plications occupying just over half of apertural length; first plication strong, increasing in width anteriorly, sweeping around the base of the shell to join lip; second and third plications strong, emergent; fourth plication weaker and confined to aperture.

Animal: Modified type 4 animal. Foot narrow, dimensionally similar to shell, rarely extending beyond it; extending anteriorly to form parapodia; parapodia curling up around the sides of the anterior half of the shell, extending forwards as bilateral lobes. Foot translucent, with clusters of 4-8 tiny opaque, blurred white spots, more numerous anteriorly. Eyes black, situated centrally within each half of the split head, distal to the base of short tentacles which are generally held in a vertical position. Head lobes anterior to tentacles greatly reduced in size. Radula unknown (not extracted).

Distribution. Belize: Long Cocas and Pelican Cays. Northern Honduras: Roatán Island, and tentatively recorded off Cayos Vivarillos (16° 04.9'N 83° 56.1'W).

Habitat. 5 to 15 m; on slopes with muddy rubble.

Remarks. *C. fluctuata* n. sp. is most likely to be confused with *C. ornata* n. sp. Their differences are presented in Table 1.

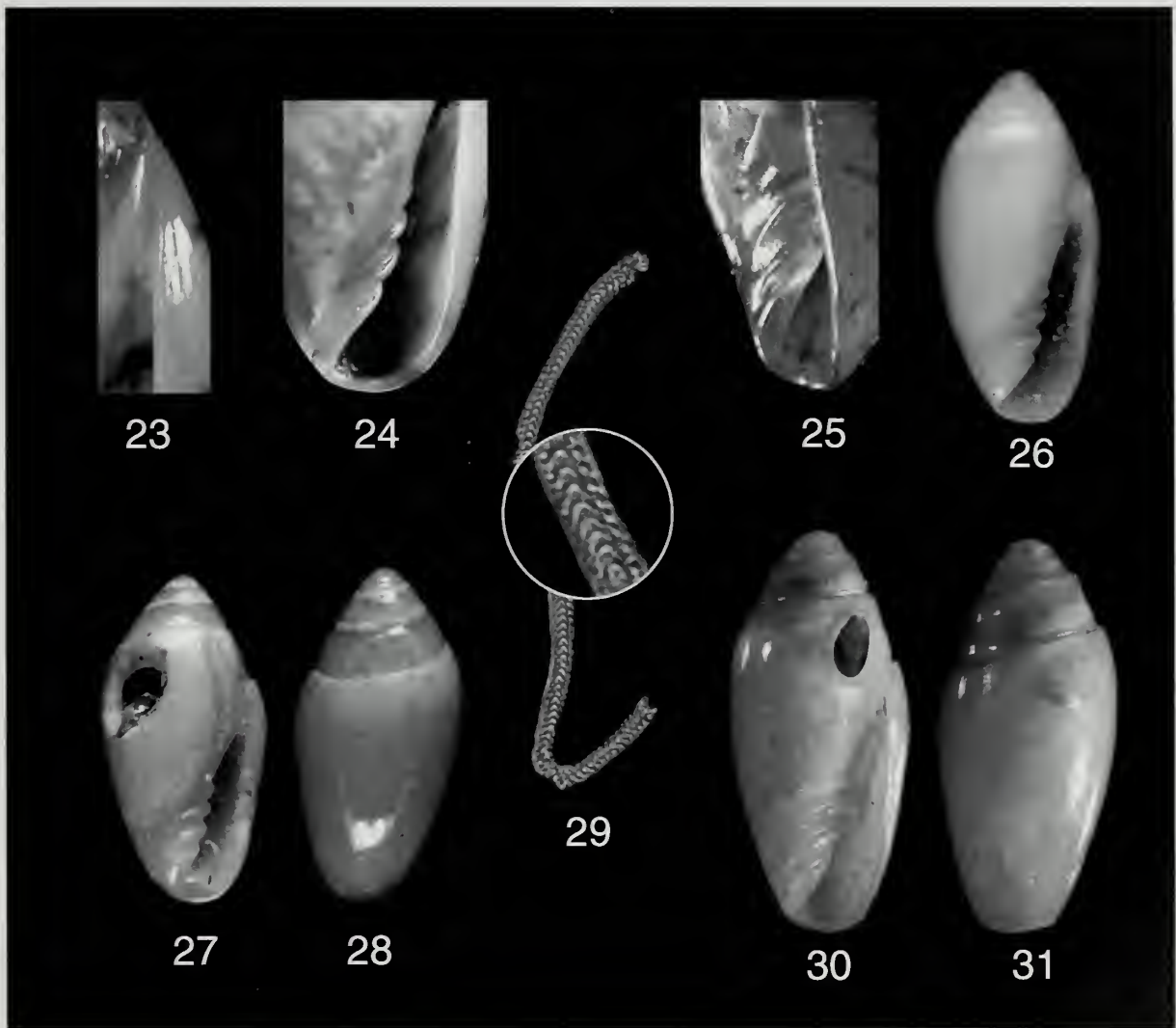
Etymology. From the Latin *fluctuata* (= wavy).

Named for the design of the pattern in the surface of the shell.

***Canalispira ornata* n. sp.**

Figs 13-18, 20-22, 24

Type material. Northern Honduras (Bay Islands), Roatán Island, Mud Hole Swash (16° 21.7'N 86° 31.3'W), 2m in muddy rubble, holotype (2.81 x 1.40 mm), (Figs 13-15), Reg. no. BMNH 20060792 ; 1 ad. lv., paratype 1 (2.81 x 1.38 mm), Reg. no. BMNH 20060793 ; 1 ad. lv., paratype 2 (2.81 x 1.38mm), AWC.



Figures. 23-31

23. *C. fluctuata* n. sp. posterior lip showing deep narrow posterior notch; 24. *C. ornata* n. sp. columella plications; 25. *C. fluctuata* n. sp. columella plications; 26. *C. eburnea* Preston, 1906, syntype, BMNH; 27-28. *C. replicata* Melvill, 1912. Gulf of Oman, syntype, L=4.5mm, BMNH Ref. no. 1912.9.17.1/4-5; 29. Radula of *C. ornata* n. sp.; 30-31. *C. olivellaeformis* Jousseaume, 1875. Lectotype, L=4.2 mm, locality unknown, MNHN.

Type locality. Mud Hole Swash, Roatán Island, Bay Islands, northern Honduras, 16° 21.7'N 86° 31.3'W.

Other material examined. Guanaja, northern Honduras (Bay Islands), North East Lagoon, 16° 28.5'N 85° 49.4'W, in 2 m, 1 ad. lv. (2.60 x 1.26 mm), (Figs 16-18), and 1 ad. lv. (2.88 x 1.39 mm), both deposited as voucher specimens, Reg. no. BMNH 20060794. Also 4 ad. lv. from the same locality as above, and 10 ad. lv. from reef in centre of lagoon 300 m distant, in 3 to 15 m.

Description. Shell tiny (L = 2.6– 3.05 mm), cylindrical-biconic (W:L ratio 48 %); surface smooth, glossy. Spire moderately tall, straight to slightly concave, of 3½ whorls including the moderately wide, milky white protoconch. Shoulder weak; suture weakly distinct. Colour creamy white, with very fine, irregular, brown axially-oriented, zig-zag pattern, or tented pattern; pattern extending onto spire and anterior labial margin; dark brown markings showing in two distinct rows: above shoulder and at mid-body. Aperture moderately wide anteriorly, narrowing posteriorly ending in a narrow, sharply defined posterior notch. Labial denticles absent. External labial varix absent; lip thickened, narrowing to a sharp edge posteriorly. Parietal wall concave posteriorly, convex in region of the four columella plications. Parietal callus wash running full length of aperture, with distinct shallow fasciolar edge. Columella with four rounded, oblique, closely spaced plications; plications occupying just less than half of apertural length; first plication strong, increasing in width anteriorly, sweeping round the base of the shell to join lip; second and third plications strong, converging at their distal ends; fourth plication weaker, confined to aperture.

Animal: Modified type 4 animal. Foot narrow, dimensionally similar to shell, rarely extending beyond it; extending anteriorly to form parapodia; parapodia curling up around the sides of the anterior half of the shell, extending forward as bilateral pedal lobes. Foot translucent, with clusters of 4-8 tiny, opaque, blurred white spots; spots more numerous anteriorly. Eyes black, situated centrally within each half of the split head, distal to the base of short, blunt tentacles which are generally held in a vertical position. Head lobes anterior to tentacles greatly reduced in size.

Radula: Radula of juv. from Guanaja. (L = 2.20mm); Cystiscid type 3, long (113 narrow arched plates, measuring 4.84 µm from centre to centre of consecutive plates), narrow (13.9 µm wide), and each bearing 7 pointed cusps, with the central cusp being the strongest (Fig. 29).

Distribution. This species has been found at two locations in the Bay Islands, northern Honduras; Mud Hole Swash, Roatán Island (16° 21.7'N 86° 31.3'W),

and in the Northeast lagoon, Guanaja, (16° 28.5'N 85°49.4'W).

Habitat. In muddy sand, under piles of dead coral rubble. Inside living reef, in 2 to 5 m. (At the Roatán locality it was found in 2 m inside vital reef. At the Guanaja locality it was also found there, but in addition at 3 to 5 m in the centre of the lagoon. In all these places it was found in muddy sand under piles of dead coral rubble.)

Remarks. *C. ornata* n. sp. is most likely to be confused with *C. fluctuata* n. sp. Their differences are given in Table 1.

The intensity of the colour pattern is variable in this species, as demonstrated by Figs 13-18. One of the Roatán specimens of *C. ornata* n. sp. found was white, completely devoid of pattern (Fig. 22). As this specimen had black eyes, it cannot be considered a true albino, and it is the only example of mutation noticed in the genus so far.

Etymology. *ornata* – decorated (Latin). Named for its intricate pattern.

DISCUSSION

The differences between our three new species are presented in Table 1.

Regional species which require comparison with our three new species are *Canalispira minor* Dall, 1927 from Georgia / northeast Florida, *Prunum hoffi* Moolenbeek & Faber, 1991 from Saba, Netherlands Antilles, *Osvaldoginella gomezi* Espinosa & Ortéa, 1997 from Cuba, *Marginella* sp. no's 29, 80 & 83 in Lipe (1991), and *Canalispira aurea* García, 2006 from Bahía de Campeche, Gulf of Mexico.

The most similar of these species is *Osvaldoginella gomezi* Espinosa & Ortéa, 1997 (Cossignani, 2006: 175). Its shell is more darkly marked, is more cylindrical and is restricted to 25-55 metres off Cienfuegos, North Havana Province, Cuba.

Prunum hoffi Moolenbeek & Faber, 1991, which should be renamed *Canalispira hoffi* Moolenbeek & Faber, 1991, is also similar to our new species. Its profile is similar to *C. fluctuata* n. sp. (it has a W:L ratio of 51% to 53%). However, it has eight labial denticles on the lower half of the lip, whereas none of our new species are denticulate, even when fully mature. It has a heavily pigmented axial lined pattern with superimposed tenting comparable to *C. phantasia* n. sp. in intensity, but the regularity of the reticulated pattern of the latter sets it apart from the more haphazard tenting of *C. hoffi*. *C. hoffi* is also significantly larger at 3.7 to 3.8 mm (the lengths of the two adult paratypes in the Dayton Museum, Ohio, U.S.A.). *C. fluctuata* n. sp. and *C. ornata* n. sp. are almost 1 mm shorter – a significant difference when comparing such tiny shells.

C. minor Dall, 1927 is 6 mm in length, and is a whitish, deep water species and has a taller spire than *C. ornata* n. sp. *C. aurea* García, 2006 from 77-81 m, Bahía de Campeche, Gulf of Mexico, is also much larger at 5.2 mm. It too lacks an axial pattern. Instead, it is banded in orange and white.

An axial pattern of tent-like markings is present on the shell depicted as *Volvarina* sp. (in Lipe & Sunderland, 1991) and sp. no. 29 (in Lipe 1991, pl. 17 no. 4 and pl. 18 no. 32). This relatively large pale orange and white species from deep water off Florida's Gulf coast is allied to the species from Bahía de Campeche noted above. Neither is otherwise similar to any of our new species.

Looking at the western Atlantic species as a whole, it is evident that they differ significantly from *Canalispira* species from other parts of the world. The deeply channelled suture commonly observed in Indo-Pacific species (see *C. replicata* Figs 27, 28) is, in western Atlantic species, partially or completely callused over. Western Atlantic *Canalispira* are also

weakly to strongly axially patterned, and are often orange-coloured. Indo-Pacific species are predominantly white with no decorative pattern. For all these reasons, the type species, which has no given type locality, is likely to have an Indo-Pacific origin.

Another regional variation in *Canalispira* shell morphology could be evident in West Africa, as seen in the taxon *Gibberula cucullata*, but further research is required on this species. However, all *Canalispira* possess the characteristic unifying features of a sharply defined, narrow, deeply channelled posterior notch, and, where known, unique modified cystiscid type 4 animal anatomy.

In view of the fact that we have identified three species within a short period of time and over a relatively small geographical area, it seems likely that endemism and diversity is high in the western Atlantic *Canalispira*, and that with further fieldwork, particularly in the intertidal mangrove biotope, more new species are likely to be discovered.

Species	Size (mm)	W:L	Protoconch and spire	Colour Pattern	Columella	Habitat
<i>C. phantasia</i> n. sp. (Figs 1-6)	2.79- 3.38	47-50%	Wide and rounded apex, smooth slightly convex spire. Suture and labial shoulder indistinct.	Always dark and heavily reticulated.	Plications are strong.	Mangroves 1m in mud.
<i>C. fluctuata</i> n. sp. (Figs 7-12)	2.38- 3.10	50-54%	Wide and rounded apex, short, smooth, convex spire. Suture indistinct. Labial shoulder distinct.	Open pattern of fine wavy axial lines. Often a distinct dorso-labial brown blotch. Pattern varies from distinct to faint.	Plications further apart than <i>C. ornata</i> and plications do not converge.	Muddy sand with rubble 2-5 m.
<i>C. ornata</i> n. sp. (Figs 13-18)	2.60- 3.05	48-49%	Smaller, more pointed apex, proportionally taller spire. Spire straight or slightly concave. Suture and labial shoulder weakly distinct.	Very fine zig-zags forming Pointed tents. Two faint bands of darker brown on body whorl. No obvious large blotch. Pattern varies from distinct to faint.	Plications spaced closer together than in <i>C. fluctuata</i> , and 2 nd and 3 rd often converge.	Muddy slopes with rubble 5-15 m.

Table 1. Comparison of *C. phantasia* n. sp., *C. fluctuata* n. sp., and *C. ornata* n. sp.

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