

DESCRIPTION OF A NEW SPECIES OF *HYPSELODORIS* (GASTROPODA: NUDIBRANCHIA: CHROMODORIDIDAE) FROM VENEZUELA

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ABSTRACT

A new species of the gastropod genus *Hypselodoris* Stimpson, 1855 is described from the continental coasts of Venezuela. *Hypselodoris samueli* sp. nov. is characterized by the uniform dark blue colouration of the rhinophores, the rhinophoral sheath outlined by yellow pigment, not forming a ring on juveniles, the lack of mantle glands after the rhinophores, the jaws with two triangular smooth areas and small pin-shaped denticles on its ventral central region and by the evolve of mantle colour pattern with the size.

Key words: Mollusca, Gastropoda, *Hypselodoris samueli* sp. nov., species complex, Caribbean.

RESUMEN

Se describe una especie nueva del género *Hypselodoris* de las costas continentales de Venezuela. *Hypselodoris samueli* especie nueva se caracteriza por la coloración azul oscuro uniforme de los rinóforos, las vainas rinóforicas perfiladas con pigmento amarillo aunque sin formar un anillo en los juveniles, la ausencia de glándulas del manto después en la zona posterior a los rinóforos, las mandíbulas con dos áreas triangulares lisas y con denticulos en forma de chincheta en el centro de su región ventral y por la evolución del patrón de coloración en relación a la talla.

Palabras clave: Moluscos, Gasterópodos, *Hypselodoris samueli* especie nueva, complejos de especies, Caribe.

1. INTRODUCTION

The genus *Hypselodoris* Stimpson, 1855 consists of small to medium size unshelled gastropods with brightful colours on their bodies and chemical defenses on their mantle glands, predated on sponges, which have both, metamorphic and ametamorphic development. It is one of the most diverse genus in the Family Chromodorididae Bergh, 1891 (Ortea, Valdés & García-Gómez [12]) and comprises approximately 76 species (Johnson [8]; Caballer, Bouchet & Gofas [3]), of them, only 11 live in the Western Atlantic.

The first synthesis of the Family in the Atlantic is due to Ortea *et al.* [12], who consider 7 valid species of *Hypselodoris* in the Western side; 5 endemic to the Caribbean and 2 with a wider distribution that includes Brazil; *Hypselodoris picta* (Schultz, 1836) and *Hypselodoris marci* Marcus, 1971. These authors also established the characters useful to distinguish species.

Afterwards, Valdés *et al.* [14] recognize a total of 8 valid species in the Caribbean, plus 6 unnamed or doubtful.

From 1996 to the present, 3 species have been described in Western Atlantic: 2 in the Caribbean; *Hypselodoris lilyeveae* Alejandrino & Valdés, 2006 and *Hypselodoris olgae* Ortea & Bacallado, 2007 (in the species complex of *H. marci*) and one endemic to Brazil; *Hypselodoris juliae* Dacosta, Padula & Schrödl, 2010.

The intricate taxonomic history of the genus in Western Atlantic (summarized in Table 1) may be explained by the difficulties in distinguishing species and by the existence of several species complexes that share similar colour patterns (Alejandrino & Valdés [1]). Thus, the assumption that similar specimens from different localities are conspecific based only on external morphology may lead to misidentifications and taxonomic confusion (Dacosta, Padula & Schrödl [4]).

There is a group of species who share mantle edge with a wide white band with black spots, blue-green background and yellow-orange markings or lines in the dorsum. This group includes: *Hypselodoris bayeri* (Marcus & Marcus, 1967), *H. marci* and *H. olgae*. In the present work a big sized new species of *Hypselodoris* from Venezuela, close related to *H. bayeri*, is described.

2. MATERIALS AND METHODS

The specimens were collected by snorkeling in the National Park Morrocoy, Venezuela (march 2010). A Carl Zeiss stereomicroscope was used to take data on external anatomy and color patterns. The animals were photographed alive and then preserved in ethanol 96 %. To compare with other species of the genus, diagrams were made of the general internal anatomy, jaws, radula and genital apparatus using an Olympus SZ16 stereomicroscope. SEM images were taken at the Muséum national d'Histoire Naturelle (MNHN).

The specimens are deposited in MNHN and in the Marine Organisms Section of the Biological Collections of the Venezuelan Institute for Scientific Research (Register number 028), Miranda, Venezuela (SOM-IVIC).

3. SYSTEMATICS

Family CHROMODORIDIDAE Bergh, 1891

Genus *Hypselodoris* Stimpson, 1855

Type species: *Hypselodoris obscura* (Stimpson, 1855), by monotypy.

Hypselodoris samueli sp. nov.

(Figures 1-4)

Type material: Holotype: adult, 85 mm long alive, dissected, jaw and radula mounted for SEM, rest preserved in 96 % ethanol. (type locality: Mouth of El Ocho lagoon, Morrocoy, State Falcón, west coast of Venezuela [OLV], coordinates: 10°52'05"N 68°13'27"W; water depth: 1.5 m) [MNHN]; coll. M. Caballer, 23 march 2010. Paratype 1: adult, 50 mm long alive, dissected, jaw and radula mounted for optical microscopy, rest preserved in 96 % ethanol. (OLV; coordinates: 10°52'05"N 68°13'27"W; water depth: 2 m) [SOM-IVIC-IVICCMT010]; coll. S. Narciso, 23 march 2010. Paratype 2: juvenile, 10 mm long alive, dissected, jaw and radula mounted for SEM, rest preserved in 96 % ethanol. (OLV; coordinates: 10°52'05"N 68°13'27"W; water depth: 1 m) [SOM-IVIC-IVICCMT011]; coll. M. Malaquias, 23 march 2010.

Diagnosis: Rhinophores uniform dark blue. Rhinophoral sheaths outlined by yellow pigment in the outer side, not forming a ring in juveniles. Mantle edge with a wide white-green to white band, with black spots only on the sides. Longitudinal yellow lines in the mantle reach the gill opening. Their number proportional to the size: central one continuous, plus 2 to 5 discontinuous laterals. Mantle glands all around the mantle edge, except on a portion after the rhinophores. Gill leaves bifurcated or trifurcated in the upper half in adults. Jaws with two triangular smooth areas flanking the dorsal anterior middle zone. Small pin-shaped denticles with one to four cusps present in the central region. Lateral teeth of the radula bicuspid. Both cusps equal or similar size. Up to 6 denticles at the base of the lower cusp, the first of them always towards the half of its length.

Description:

External anatomy and colouration (Figure 1): body elongate, wider than high, blue-green, which becomes clear and turns to green-gray in bigger specimens. On these, a big bluish-black blotch, as wide as the body, is present in the center of the mantle. Foot bright blue in juveniles. Anterior foot margin bilabiate, upper lip with yellow spots. Oral tentacles digitiform with some yellow spots. Mantle edge wide and rippled in big specimens, always bounded by a narrow reddish orange band except in the back. This band broken longitudinally by a thin white line. Toward inwards another white-green band with 9 parallel black spots each side in juvenile. Wider and gray to bright white in Holotype and Paratype 1, with double number of black spots distributed in two alternate bands. Black spots same size as in juvenile, not bigger.

Several longitudinal yellow lines in the mantle. The design varies with the size:

Paratype 2 (10 mm long): 3 yellow lines, the central one continuous, interrupted only by the gill opening, not reaching the edge of the mantle. Lateral lines discontinuous, skirting the rhinophoral opening on its outer side, not forming a ring. Reaching to the gill opening on the back.

Paratype 1 (50 mm long): 2 additional external lateral lines, reaching further than the branchial opening. Yellow spots between the lines.

Holotype (85 mm long): a total of 10 yellow lines, the central line continuous, the remaining fragmented or composed by aligned spots.

Rhinophores uniform dark blue, with 15 to more than 30 lamellae (10 and 85 mm specimens respectively). Rhinophoral sheaths in juvenile outlined by yellow pigment in the outer side, not forming a ring. They join to form a yellow bridge in the holotype (Figure 1D). Gill grayish-blue, composed of 10 unipinnate branchial leaves (even in juvenile specimen), base translucent blue. Gill rachis black, with orange to orange-red border. Inner rachis red at the base and white in the rest in the holotype. Gill leaves bifurcate and ramify in the upper half in adults. Gill sheath not outlined in yellow. Hiponotum green-blue to gray, with one continuous yellow line on each side, joining in the tail (Figure 1A); one to six fragmented lines below, up to two above. Discontinuous lines do not merge with the continuous one in the tail. Posterior end of the foot lacking black spots. Mantle glands: 7-8 regular ones anteriorly, from the nose to the rhinophores; 10 along the posterior edge of the mantle, the last three very bulky. Mantle glands absent in a portion after the rhinophores. Gonopore lack distinct colouration, yellow lines thickened around it.

Internal anatomy (Figure 2A-C, 3 & 4): blood gland very big, compressed in front, pointed behind. Salivary glands white, long and tubular. Oesophagus long, with a fold. Intestine two and a half times the length of the oesophagus. Jaws (Figure 3E-F) composed of both: conic, unicuspid rodlets, tightly and regularly arranged (Figure 3G), and, small pin-shaped rodlets with one to four cusps in the ventral central region (Figure 3H). Dorsal anterior middle zone of jaw flanked by two triangular smooth areas, without denticles, one each side (Figure 3E-F). Radular formula 49 x 51.0.51. (Paratype 2), 80 x 145.0.145 (Paratype 1) and 98 x 170.0.170 (Holotype). Teeth bicuspid, both cusps equal or similar in size. Innermost lateral teeth with a single denticle at the base of the lower cusp, up to 6 in the middle laterals, the first always towards the half of the cusp (Figure 3A-D). Middle lateral teeth with a thick denticle at the base of the lower cusp (Figure 4C). Size of the teeth increases in the row, from the innermost teeth, to the last middle laterals, which are more blunt and irregular, then decreases. Outermost teeth short and pectinate (Figure 4D), cusps reduced, with 3-5 denticles under the lower one, sometimes fused.

Reproductive system (Figure 2D): ampulla long, oval and narrow. Prostate very long, organized in two areas of tight folds; one attached to the back and the other to the inner side of the bursa copulatrix, which is covered almost completely. Bursa copulatrix globose, fairly large and tinged of a characteristic pale orange. Vagina dark blue. Seminal receptacle saccular, elongated, white, with same diameter as the vagina and inserted on its base, at the same point that the vagina duct. Hermaphroditic gland cream-orange, similar diameter than the seminal receptacle, equal length than the bursa. Vestibular gland very apparent. Holotype and paratype 1 fully mature.

Biology: The holotype was collected in the channels caused by turistic boats on the bottom of the entrance of El Ocho lagoon. The bottom there is sandy-muddy with *Thalassia testudinum* and *Halimeda* spp. (Figure 1B).

When disturbed, the animal retracts the gills and secretes a white substance around the edge of the mantle which also seems to spring from the edge of the foot in the tail (Figure 1E). Afterwards, it swells and shows areas that seem to be full of water throughout the body.

Geographical and bathymetrical distribution: Known only to the type locality, up to 2 m deep.

Etymology: *Hypselodoris samueli* sp. nov. is named in honor of our friend and colleague Samuel Narciso who collected one of the paratypes and gave logistical support in Morocco.

4. DISCUSSION

Several similarly coloured species occur in the Caribbean. The colouration pattern of the adult specimens of *Hypselodoris samueli* sp. nov., is similar to that present in three other species listed in the Caribbean: *Hypselodoris bayeri*, *Hypselodoris marci* and *Hypselodoris olgae*, however, *H. samueli* sp. nov. has uniform navy-blue rhinophores, character that clearly distinguishes it from *H. marci* and *H. olgae*. On the other hand this character is shared by a large group of western Atlantic *Hypselodoris*: *Hypselodoris picta webbi* (d'Orbigny, 1839), *Hypselodoris picta lajensis*, *H. bayeri*, *Hypselodoris zebra* and *Hypselodoris juliae*, although the juveniles of these five species/subspecies are quite different, so as the adults (except *H. bayeri*).

Within the set of distinctive characters of *H. samueli*, there are two that distinguish it from the rest of *Hypselodoris* in the Caribbean with whom it could be compared:

- The triangular smooth areas flanking the dorsal anterior middle zone of the jaw. This character is only present in other two species, both from east Atlantic, both with a reduced geographical distribution; *Hypselodoris bilineata* (Pruvot-Fol, 1953) (south of Spain to Senegal and Canary islands) and *Hypselodoris malacitana* Luque, 1986 (from the south of Spain).

- The small pin-shaped denticles in the ventral central region of the jaw. This character is only present in *Hypselodoris ruthae* Marcus & Hughes, 1974 from the Caribbean, quite different from *H. samueli* sp. nov., and in *Hypselodoris pinna* Ortea, 1988, from Cape Verde.

Other typical characters of *H. samueli* sp. nov. are:

- The bridge between the rhinophoral sheaths seen in the holotype (Figure 1 D), quite similar to that present in the Indo-Pacific species *Glossodoris atromarginata* (Cuvier, 1804). This character hasn't been observed in any Atlantic species before.

- The thick denticle below second cusp of the middle lateral teeth similar to that illustrated by García *et al.* [7: figure C, p.129] for *H. marci* without comments on its significance.

Hypselodoris bayeri is the closest species to *H. samueli* sp. nov. in the colour pattern. It was described as the type of the genus *Felimare* Marcus & Marcus, 1967, due to the presence in the holotype of a rachidian teeth, character that hasn't been observed ever again in any other specimen attributed to the species, not even in the paratype. Thus, the holotype has been considered anomalous and *Felimare* synonymous with *Hypselodoris* (Ortea *et al.* [12]). Some of the posterior records to this species doesn't fit in the original description very well (Rudman [13]) or do not give much data on the anatomy (Meyer [10]) and there seem to be a complex of species with similar colour pattern under the name *H. bayeri*, so, the taxonomy should be revised. *Hypselodoris samueli* sp. nov. is one of this species misidentified with *H. bayeri* in Venezuela. A synthesis of the characters to distinguish both species can be seen in Table 2. Despite what Ortea *et al.* [12] established about the colouration of the rhinophores in *H. bayeri*, as it can be seen in the illustrations given by Marcus and Marcus [9: plate 1, figure 2], Ortea *et al.* [12: p. 15, figure 11B] and Valdés *et al.* [14], the rhinophores of *H. bayeri* are not uniform blue as in *H. samueli* sp. nov. They show a longitudinal clearer line in the back and/or a clearer base of the lamellae.

The specimens illustrated by Ardila & Rachello [2] could be conspecific with *H. samueli* sp. nov.

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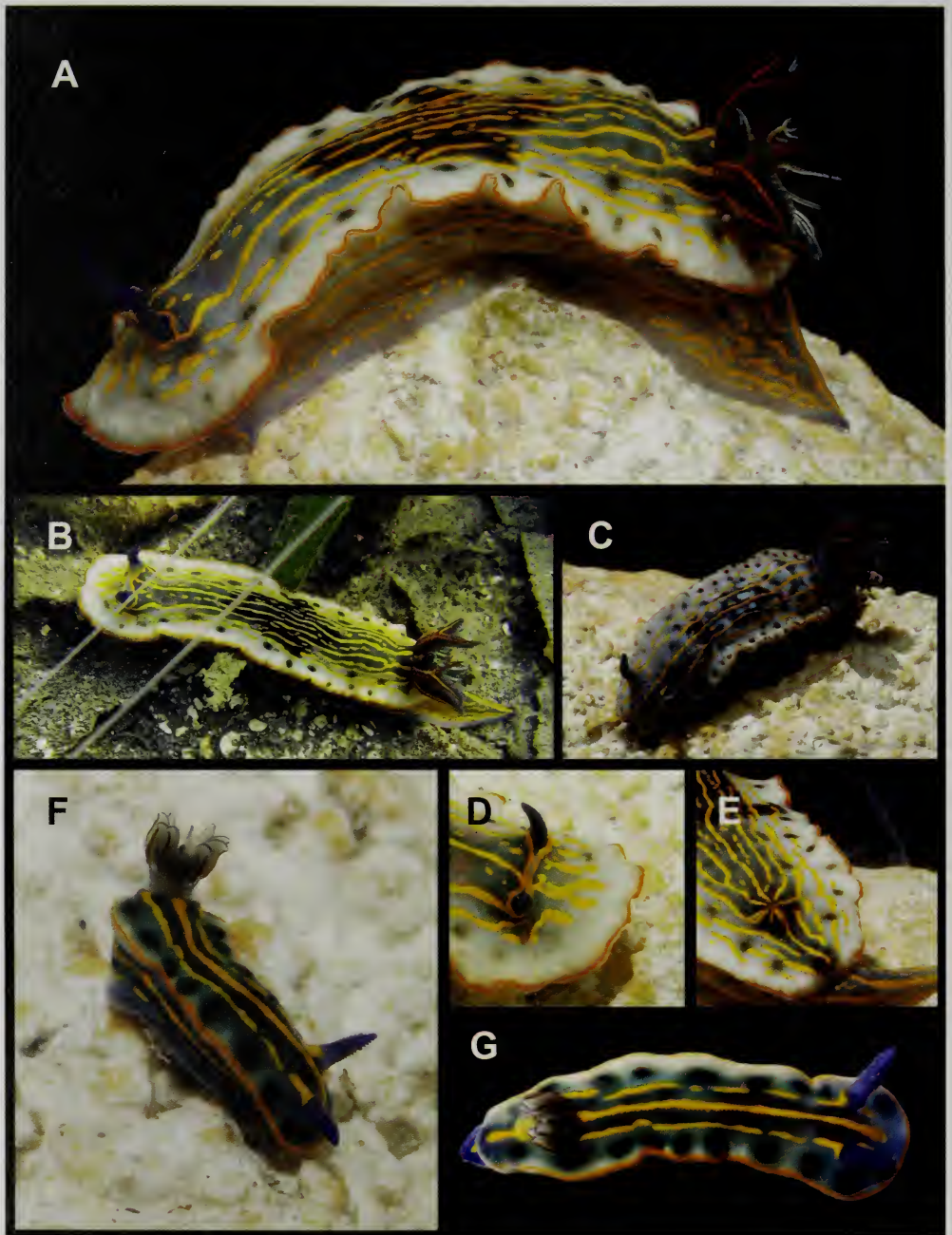


Figure 1.- *Hypselodoris samueli* sp. nov. (A-B, D-E) Holotype (85 mm alive); (A) lateral view; (B) underwater photograph of the living animal; (C) Paratype 1 (50 mm alive), dorso-frontal view; (D) detail of the rhinophoral sheath; (E) detail of the tail and the mantle edge secreting a white substance; (F-G), Paratype 2 (10 mm alive); (F) dorso-lateral view; (G) dorsal view.

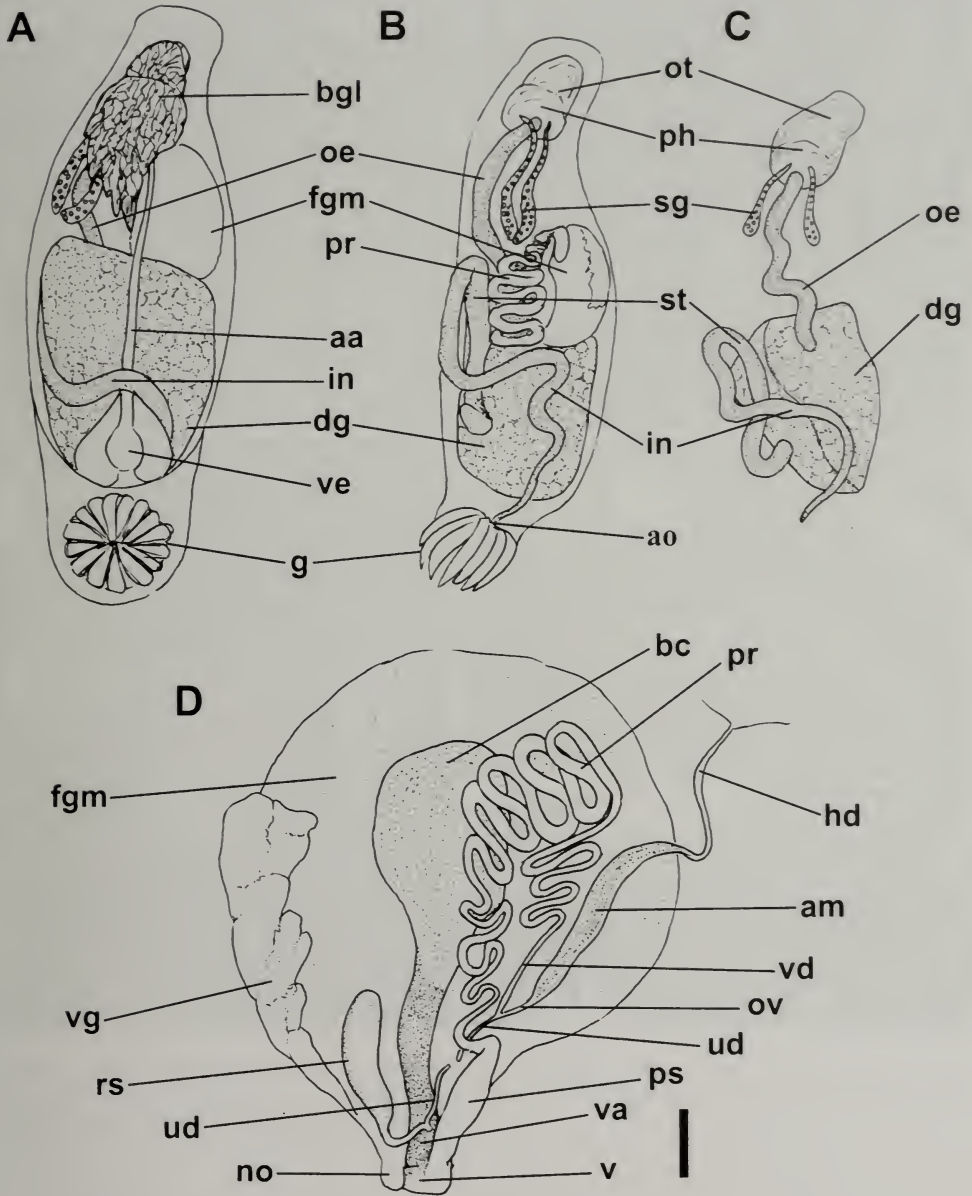


Figure 2.- *Hypselodoris samueli* sp. nov. Paratype 1 (50 mm alive). (A-C) Successive schemes for the general organization of internal organs; (A) outermost; (B) medium; (C) innermost; (D) scheme of the reproductive system. Scale bar = 1 mm.

Abbreviations: aa, anterior aorta; am, ampulla; ao, anus opening; bc, bursa copulatrix; bgl, blood gland; dg, digestive gland; fgm, female gland mass; g, gills; hd, hermaphrodite duct; in, intestine; no, nidamental duct opening; oe, esophagus; ot, oral tube; ov, oviduct; ph, pharynx; pr, prostate; ps, penial duct; rs, seminal receptacle; sg, salivary gland; st, stomach; ud, uterine duct; v, vestibulum; va, vagina; ve, ventricle; vd, vas deferens; vg, vestibular gland.

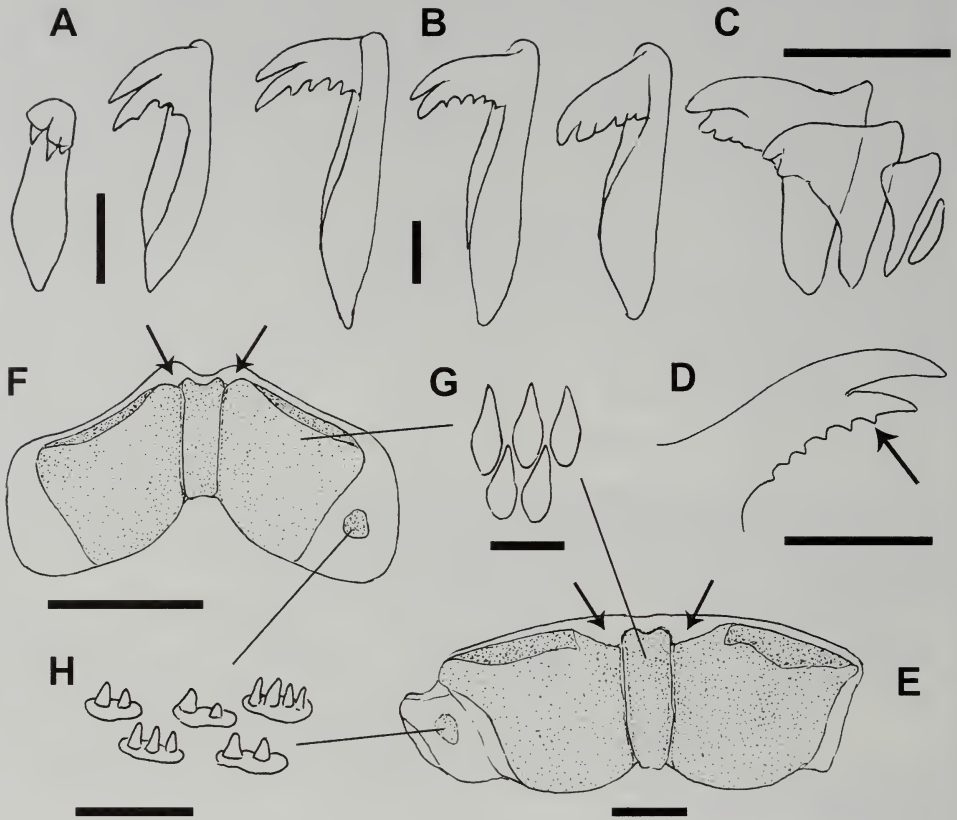


Figure 3.- *Hypselodoris samueli* sp. nov. Schemes of jaw and radula. (A-C, F) Paratype 2; (D-E) Paratype 1; (A) innermost lateral teeth (number 1 and 18 of row 50); (B) mid-lateral teeth (25, 43 and 51 of row 50); (C) outermost lateral teeth (row 50); (D) external side of mid-lateral teeth, detail of the thick lateral denticle at the base of the lower cusp; (E) Jaw, scale bar = 1 mm; (F) Jaw, scale bar = 0,5 mm; (G) jaw rodlets; (H) pin-shaped rodlets. Scale bar = 10 μ m.

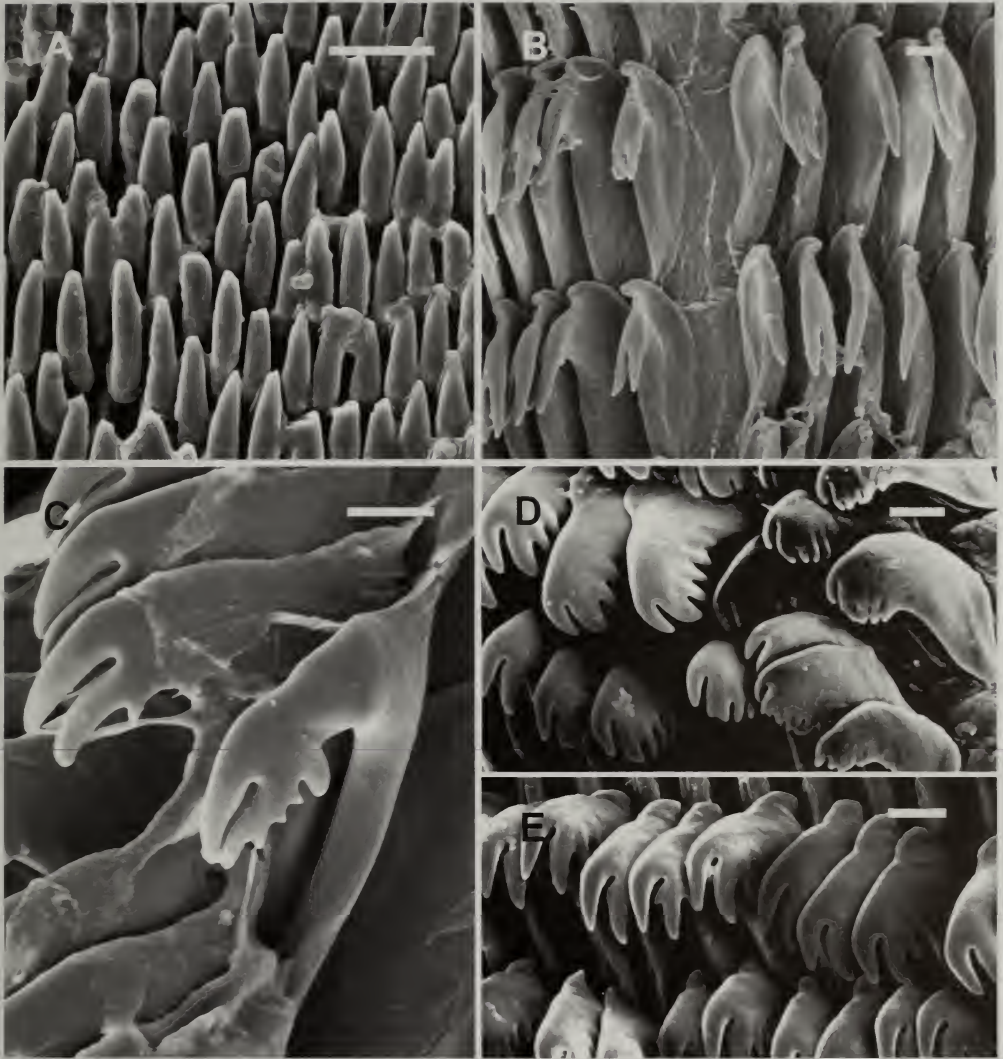


Figure 4.- *Hyselodoris samueli* sp. nov. Scanning electron micrographs of radula and jaws. (A-C) Holotype; (A) jaw rodlets; (B) innermost lateral teeth; (C) mid-lateral teeth, detail of the thick lateral denticle; (D-E) Paratype 2; (D) outermost lateral teeth; (E) mid-lateral teeth. Scale bar = 10 μ m.

Table 1.- Synthesis of the recent taxonomic history of the species/subspecies of the genus *Hypselodoris* in Caribbean-Brazilian regions, including distributions.

	Ortea <i>et al.</i> [12]	Alejandro and Valdés [1]	Valdés <i>et al.</i> [14]	Domínguez <i>et al.</i> [5]	Ortea and Bacallado [11]	García and Berst [6]	Da Costa <i>et al.</i> (2010)
<i>H. picta</i>	Florida	–	Florida, Brazil	–	–	Caribbean	–
<i>H. picta webbi</i>	–	Caribbean	–	–	–	–	–
<i>H. picta lajensis</i>	–	Western Atlantic	–	= <i>H. lajensis</i>	–	–	Brazil
<i>H. lajensis</i>	–	–	–	Brazil	–	Brazil	Invalid rank = <i>H. picta lajensis</i>
<i>H. sycilla</i>	Uncertain. Not in northern Brazil.	–	Possible synonymous with <i>H. zebra</i> ?	–	–	Caribbean, Brazil	Taxonomy unresolved Mexico Not in northern Brazil
<i>H. acriba</i>	Mexico and Venezuela	–	Mexico, Costa Rica, St. Lucia, Guadeloupe, St. Martin, Puerto Rico	–	–	Caribbean	–
<i>H. cf. acriba</i>	–	Caribbean	St. Martin, Puerto Rico	–	–	–	–
<i>H. bayeri</i>	South Florida and northern Cuba	Caribbean	Florida, Panama, Cuba, Mexico, Belize	–	–	Caribbean	–
<i>H. zebra</i>	Bermuda	Bermuda	Bermuda	–	–	–	–
<i>H. ruthae</i>	Barbados, Panama, Jamaica, Mexico, Cuba	Caribbean	Mexico to Venezuela	–	–	Caribbean	–

<i>H. marci</i>	Venezuela, Northern Brazil, Jamaica, Caiman Is., Belize, Bay Is., Mexico	Caribbean	Belize, Honduras, Venezuela, Brazil	Southern Brazil, Venezuela, Jamaica, Belize, Caiman Is. and Bay Is., Mexico	Venezuela Not Brazil (misidentification = undescribed species) Not Mexico (misidentification = <i>H. olgae</i>)	Caribbean, Brazil	? Caribbean Brazil
<i>H. espinosai</i>	Mexico	Caribbean	Mexico, St. Martin, St. Vincent & the Grenadines	—	—	Caribbean	—
<i>H. illyeveae</i>	—	British Virgin Islands	Puerto Rico, Virgin Islands, Bahamas	—	Caribbean, Cuba	—	—
<i>H. olgae</i>	Misidentification = <i>H. marci</i> from Mexico	—	—	—	Mexico, Cuba, Florida	—	—
<i>H. juliae</i>	—	—	—	—	—	—	Brazil ?Florida, ?Grenada
<i>Hypselodoris</i> sp. 1	—	—	Florida, Grenada	—	—	—	? = <i>H. juliae</i>
<i>Hypselodoris</i> sp. 2	—	—	St. Vincent & the Grenadines	—	—	—	—
<i>Hypselodoris</i> sp. 3	—	—	Venezuela, Puerto Rico, Virgin Is., Curaçao	—	—	—	—
<i>Hypselodoris</i> sp. 4	—	—	Florida	—	= <i>H. olgae</i>	—	—

Table 2.- Comparison between *H. samuelli* sp. nov. and *H. bayeri*.

	<i>H. samuelli</i> sp. nov.	<i>H. bayeri</i>
Size	Up to 85 mm	Up to 60 mm
Rhinophores	Uniform navy-blue	Blue with a clearer area at the back or at the base of the lamellae
Rhinophoral sheath in juveniles and young specimens	Outlined by yellow pigment only in the outer side. Not forming a ring	Edged by yellow pigment, forming a ring
White band in the mantle margin	Interrupted in the back With black spots of the same size only on the laterals	Continuous With black spots of different sizes all along the margin
Lines in the dorsum	Yellow, not anastomosed, not edged by black pigment. One central and 1 to 5 discontinuous laterals	Anastomosed, orange yellow, edged with black pigment. Not central line observed
Branchial sheath	Not edged by yellow pigment. Yellow dorsal lines reach directly	Edged by yellow pigment
Branchial leaves	10 unipinnate (even in juvenile) Blue to whitish-blue. Rachis black with orange to orange-red border. Inner rachis dark to red at the base and white in the rest	8 unipinnate Opaque white with dark rachises. Inner rachis with yellow and black spots.
Mantle glands	All around the mantle margin, except in a portion after the rhinophores	All around the mantle margin
Hiponotum and tail	Blue with yellow lines. Without black spots	Blue with a net of yellow stripes. With black spots
Jaws	Two smooth areas flanking the anterior middle zone	No smooth areas
Jaw rodlets	Unicuspid. Pin-shaped denticles with one to four cusps	Unicuspids
Radular formula	49-98 × 51-170.0.51-170	74-90 × 106-148.0.106-148
Radular teeth	Bicuspid Mid-lateral teeth with lower cusp about the same size than the higher, with a thick denticle in the base Up to 6 denticles at the base of the lower cusp from the first tooth	Bicuspid Mid-lateral teeth with lower cusp smaller than the higher, at least half of the size or less. No thick denticle No denticles at the base of the lower cusp until tooth number 90
Reproductive system	Bursa copulatrix globose, pale orange. Vagina blue	Bursa copulatrix elongated
Distribution	Venezuela	Florida, Cuba, Mexico, Belize, Panama, Colombia
Data origin	This paper	Marcus and Marcus [9]; Ortea <i>et al.</i> [12]; Valdés <i>et al.</i> [14]