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# A New Species of *Bornella* from Tropical West-America

(Mollusca, Opisthobranchia)

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## 1. Abstract

The nudibranch, *Bornella sarape* Bertsch, sp. nov., occurs in the extreme southern portion of the Gulf of California. This new species is the first representative of Bornellidae reported from the western coast of the Americas. Its morphology and distribution separate it from the 4 known Indo-Pacific species of *Bornella* and the Caribbean *Bornella calcarata*.

## 2. Introduction

Between the years 1850 and 1949, 12 species were assigned to the genus *Bornella*. Five of these are currently recognized as valid species:

- Bornella adamsii* J. E. Gray in M. E. GRAY, 1850, type locality Borneo
- = *Bornella digitata* Adams & Reeve, 1850, Straits of Sunda
- = *Bornella hancockana* Kelaart, 1859, Pearl Banks of Aripo, Ceylon
- = *Bornella hermanni* Angas, 1864, Watson Bay, Port Jackson, Australia
- = *Bornella arborescens* Pease, 1871, Tahiti
- = *Bornella caledonica* Crosse, 1875 a, Noumea, New Caledonia
- = *Bornella semperi* Crosse, 1875 b, Luzon, Philippines
- = *Bornella marmorata* Collingwood, 1881, Aden, Saudi Arabia
- Bornella calcarata* Mörch, 1863, St. Thomas, Caribbean
- Bornella excepta* Bergh, 1884, Arafura Sea, East Indies
- Bornella simplex* Eliot, 1904, Chuaka, east coast of Zanzibar
- Bornella japonica* Baba, 1949, Sagami Bay, Japan

In ODHNER's review of this genus (1936), the 8 synonymous species are considered to be *Bornella digitata* Gray in ADAMS & REEVE, 1848. Recent usage has continued to use *B. digitata* as the species name, correcting the authorship but retaining the date: *B. digitata* ADAMS & REEVE, 1848 (BABA, 1949: 88; BURN, 1964: 89; ER. MARCUS, 1965: 279; THOMPSON, 1972: 76). However, recent bibliographic work has shown that the ADAMS and REEVE volume was published in separate parts, spanning the years 1848-1850, and that Part 3 (in which *B. digitata* was named) was published in August, 1850 (cf. KEEN, 1971: 971, and RUSSELL, 1971: 1). In addition, the title page for Part 3 gives the date 1850. This is the same publication year of *B. adamsii*. Internal evidence allows a correct decision to be made regarding which species name has priority. ADAMS & REEVE (1850: 66-67) refer to *B. adamsii* (citing the exact page in Mrs. GRAY's "Figures of Molluscous Animals" where *B. adamsii* is named), and state they had intended to establish a new ge-

nus for these mollusks, "but were anticipated by Mr. GRAY." ADAMS & REEVE admitted the priority of GRAY's publication. GRAY named the genus *Bornella* on the same page he named *B. adamsii*. Therefore *B. digitata* is the junior synonym of *B. adamsii*.

To the 4 Indo-Pacific species and one Caribbean species (*B. calcarata*) is now added a new species of *Bornella* from the eastern Pacific.

Mollusca, Gastropoda, Opisthobranchia, Nudibranchia, Dendronotacea, Bornellidae  
Fischer, 1883

*Bornella* Gray, 1850

*Bornella sarape* Bertsch, sp. nov.

### 3. Material examined and distribution

1) Six specimens, collected on the underside of rocks in 2–2.5 meters of water while snorkeling, by Thomas S. Cooke, Gary Stellern, and Hans Bertsch, on 26 July 1972, at Bahía Carisalito, 4 km north of Las Cruces (24°13' N; 110°05' W), Baja California del Sur, Mexico (see WILLIAMS & GOSLINER, 1973: 113, and BERTSCH, 1973: 105, for maps of the locality). These specimens were originally reported simply as *Bornella* sp. (BERTSCH, 1973: 109).

2) Two specimens, collected intertidally by Gary McDonald and James Lance on 24 and 27 January 1975, at Sayulita, Nayarit, Mexico (approximately 21°20' N; 105°15' W).

The known distribution of this species in the tropical west American province (KEEN, 1971, and VALENTINE, 1973) is on both sides of the southern mouth of the Gulf of California, a range of about 350 miles (570 km). It is the first representative species of Bornellidae reported to occur in the eastern Pacific and along the western American coast.

Bahia Carisalito, Baja California del Sur, is the type locality of this species.

### 4. Type deposition

Holotype: Mounted radula and alcohol-preserved specimen (HB 22; collected 26 July 1972) deposited in the type collection of the San Diego Natural History Museum, Department of Marine Invertebrates (Type Series No. 501). This radula is illustrated by the scanning electron micrographs.

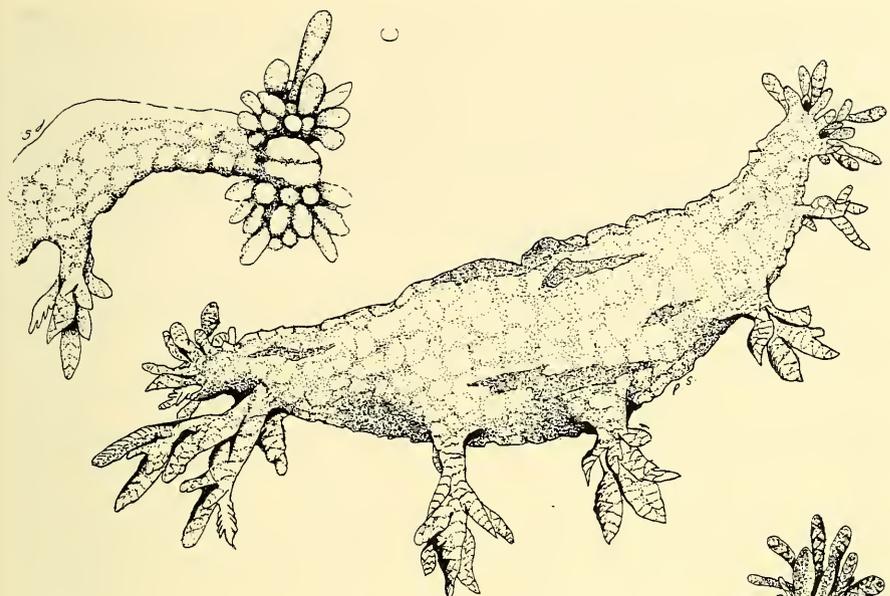
Paratypes: Three undissected specimens (HB 20, 24, and 25; collected 26 July 1972), deposited in the type collection of the San Diego Natural History Museum, Department of Marine Invertebrates (Type Series No. 502).

### 5. Description

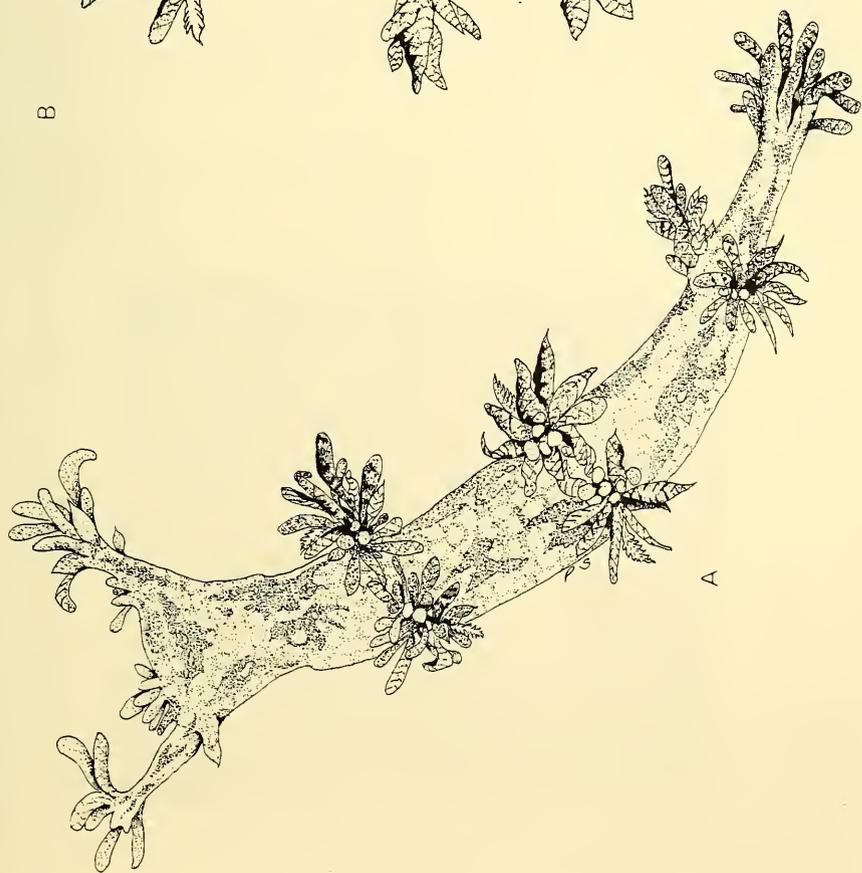
Total lengths of the 8 living animals were 47, 45, 30, 29, 23, 19, 18 and 13 mm ( $\bar{x}$  = 28 mm). The thin laterally compressed body (Fig. 1–A) is yellow-brown, co-

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Fig. 1: Line drawings of living *Bornella sarape*. 1–A. Dorsal view of whole animal. 1–B. Lateral view. 1–C. Antero-ventral view of mouth and oral lobes.



B



vered with irregular black markings. Dorsal processes and rhinophore sheaths have the same coloration. Mouth opening is surrounded laterally with oral lobes, each consisting of 2 rows of papillae, 4 smaller papillae at the base of 6 larger ones (Fig. 1-C).

A dorsal ridge (partly visible in Fig. 1-B) extends lengthwise down the animal's body. The ridge begins as two separate ridges coming from the rhinophoral sheaths, fusing medially, and then terminating. This anterior dorsal ridge is then replaced by 2 new paired ridges proceeding posteriorly from the first pair of dorsal processes. These second ridges also fuse medially, and then a single slightly raised ridge extends down the entire length of the body.

Each rhinophore is nestled in a large, flattened rhinophoral sheath. The sheath branches distally (at one-half to two-thirds its length) into a round portion enclosing the rhinophore stalk, and a flat, palmate-shaped flap.

The whitish-colored dorsal anal opening is immediately anterior to the second pair of dorsal processes, and opens just to the right of the dorsal ridge.

The genitalia open on the right side of the body, below and posterior to the rhinophore sheath.

There are 3 to 4 pairs of branching dorsal processes. These are followed by a median row of 2-4 small, unpaired, simple papillae. Gills are positioned at the junction of the main stalk and the branchings. The gills are uni- or bi-pinnate, and are a translucent whitish color; they are not prominent, but can be seen fairly easily with a dissecting microscope.

The radula (Fig. 7) consists of a series of rows, each with a prominent median tooth flanked by smooth, claw-shaped laterals. The holotype specimen (HB 22) has a radular formula of 32 (13.1.13). Two other specimens (HB 21 and 23) have formulae of 33 (12.1.12) and 39 (11-14.1.11-14) respectively. This is similar to the intraspecific range

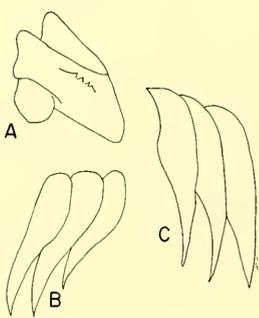


Fig. 2

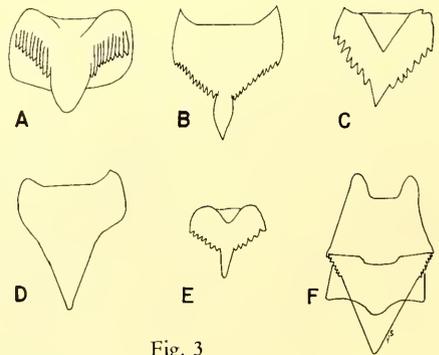


Fig. 3

Fig. 2: Radular teeth of *Bornella sarape*. 2-A. Lateral view of central tooth. 2-B and C. Claw-like lateral teeth.

Fig. 3: Comparative outline sketches of the central radular teeth of the 6 species of *Bornella*. 3-A. *Bornella japonica*; after BABA, 1949: 89. 3-B. *Bornella excepta*; after ELIOT, 1904: plt. IV, fig. 5-b. 3-C. *Bornella simplex*; after ELIOT, 1904: plt. IV, fig. 5-c. 3-D. *Bornella calcarata* 1 after BERGH, 1874: plt. 36, fig. 18. 3-E. *Bornella adamsii*; after ELIOT, 1904: plt. IV, fig. 5-a. 3-F. *Bornella sarape*.

Table 1: Lengths (in mm) of entire animal, rhinophores, and dorsal processes of 3 living specimens of *Bornella sarape* from Bahia Carisalito.

Specimen	A	B	C
Total length	23	29	23
Rhinophores	4.5	8	6
Dorsal processes:			
First pair	4	6	4.5
Second pair	3.5	5	4
Third pair	2.5	4	3.5
Simple papillae			
First	0.75	3	2
Second	0.75	—	1.5

of variation known for other species of *Bornella* (ODHNER, 1936: 1111–1112) and the related genus *Dendronotus* Alder & Hancock, 1845 (ROBILLIARD, 1970). BERTSCH (1976) has discussed the use of radular characteristics in opisthobranch systematics.

The central tooth has a large, chevron-shaped cusp (Fig. 8) with a depression behind it (see Fig. 10) into which the convex undersurface of the adjacent tooth fits (Figs. 8 and 9). The sides of the cusp (Fig. 9) are grooved, resulting in a series of small basal denticles. Underneath the cusp is a solid, box-like supporting structure (Figs. 2–A, 3–F, and 8) that serves to attach the tooth to the radular membrane. The lateral teeth are uniformly clawlike in appearance (Figs. 2–B, 2–C, and 7). The jaw (Fig. 11) has the rounded shape characteristic of most dendronotids.

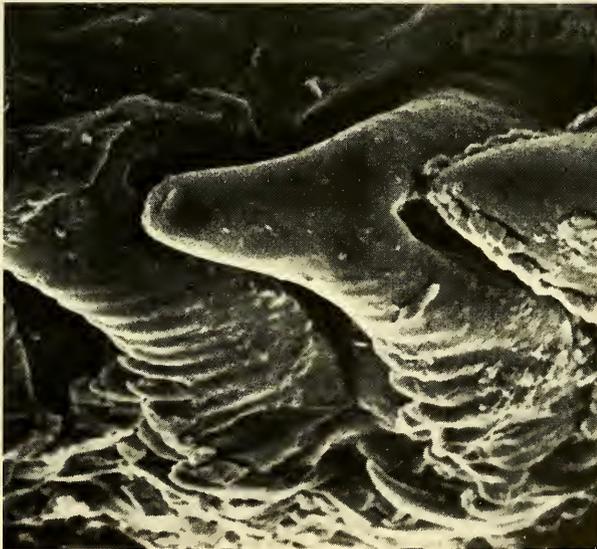
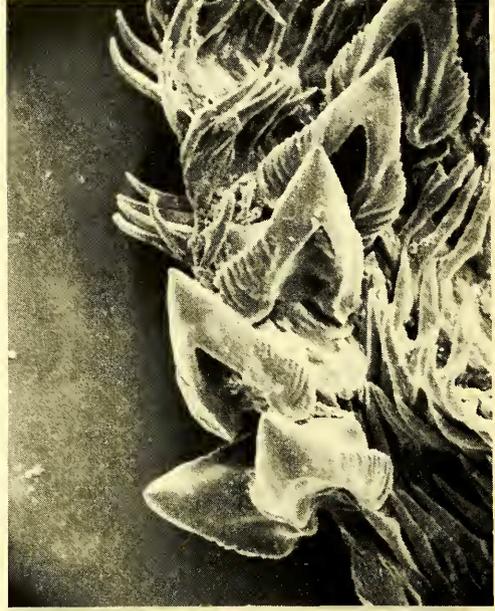


Fig. 4: Scanning electron micrograph of central radular teeth of *Bornella adamsii*. 1375 × (magnifications of SEMs are approximate, ±3). All scanning electron microscopy by H. BERTSCH.



7 (top)



5





10



11



8



9

Fig. 5: *Bornella calcarata*, SEM of radular teeth. The lateral teeth of all species of *Bornella* have the same basic shape. 525 ×

Fig. 6: *Bornella calcarata*, SEM of radular teeth. Compare the solid shape of these central teeth (merely a slight depression basal to the cusp's triangular cutting edge; there is not the distinct, chevron-shaped cusp) with the shape of the central teeth of *B. adamsii* and *B. sarape*. 535 ×

Fig. 7: *Bornella sarape*, stereo pair SEM of the radula of the holotype (525 ×). This stereo pair is published vertically rather than side-by-side. Resolution into a three-dimensional image can be easily accomplished by using a prism or the System Nesh (Klosterstraße 4-5, D-4400 Münster, West Germany), as described by HAYES (1973: 203-205). The vertical presentation of stereo pairs results in less eye strain while viewing than if the pairs were mounted laterally.

Fig. 8: *Bornella sarape*; magnification of Figure 7. Detail of anterior and posterior surfaces of the central radular teeth. 1075 ×

Fig. 9: Overlapping median teeth of *Bornella sarape*. 1620 ×

Fig. 10: Single median tooth of *Bornella sarape*. Note the strong chevron-shape and the prominent groove into which the adjacent tooth fits. 1500 ×

Figure 11: Jaw of *Bornella sarape*. 55 ×

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## 6. Natural history

Very little is known about the biology of this species since only a few specimens have been collected. Based on radular morphology (BERTSCH, 1974) and known habits of related genera (McDONALD & NYBAKKEN, 1978, and MARCUS & MARCUS, 1967: 106) it can be presumed that this species feeds on cnidarians (probably sessile hydrozoans).

*Bornella sarape* swims by lateral bending of its body. This behavior is common among a great diversity of dendronotacean species (FARMER, 1970). I have also seen *Tritionia hawaiiensis* Pease, 1860, and *Bornella calcarata* swim in this fashion, with all their appendages waving and flapping through the water.

## 7. Etymology

The specific name chosen is the Spanish word for a brightly-colored blanket with tasseled edges that is worn around the shoulders. Often the sarapes are woven with highly ornamental designs. This traditional item of Mexican clothing seems an appropriate name for this exotic new species.

## 8. Discussion

This new species can be distinguished from the other species of *Bornella* on the basis of general body shape, external coloration, and radular morphology. The Indo-Pacific species have a more delicate appearance, with more elongate rhinophore sheaths and dorsal processes. The other 5 species of *Bornella* have a white or yellowish-white background color, with orange or red reticulations or rings. These colors are distinctly different from the yellow-brown with black markings seen on *Bornella sarape*.

The comparative morphology of the central radular tooth of each of the 6 species of *Bornella* clearly delineates *B. sarape* (Fig. 3). *Bornella calcarata* has no denticles (Figs. 3-D, 5 and 6). *Bornella adamsii*, *B. excepta*, *B. simplex*, and *B. japonica* all have denticles (Figs. 3-A, B, C, E, and 4) that are more prominent than those seen on the central tooth of *Bornella sarape*. Moreover, the size of the main cusp is wider, much more solid, and generally more prominent in *Bornella sarape* than in the other forms with accessory denticles.

## 9. Acknowledgements

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