

A New Species of *Ophioglossolambis* Dekkers, 2012 from the Mascarene Islands (Mollusca: Gastropoda: Strombidae)

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ABSTRACT This paper describes a new species of *Ophioglossolambis* Dekkers, 2012 from the Mascarene Islands (Mauritius, Rodrigues, and Réunion) and Saint Brandon (also known as Cargados Carajos) Shoals in the western Indian Ocean as *Ophioglossolambis itsumiae*. It is separated from *Ophioglossolambis digitata* (Perry, 1811), its closest congener from the coastal waters of Madagascar and East Africa, by its typically larger and broader build, longer spines, lighter coloration, a more flared labral flange, and, most especially, very compact and short spire.

KEYWORDS Gastropoda, Strombidae, *Ophioglossolambis itsumiae*, *O. digitata*, *O. violacea*, Mascarene Islands, Mauritius, Rodrigues, Réunion, Saint Brandon (Cargados Carajos) Shoals, South Equatorial Current

INTRODUCTION

The Mascarene Islands and the Saint Brandon Shoals (henceforth referred to as the Mascarenes) comprise a highly geographically isolated archipelago located from 680 to 1460 kilometers east of Madagascar in the western Indian Ocean. This isolation has produced a high degree of endemism among marine species (Thébaud *et al.*, 2009) such as the well-known and unique violet spider conch *Ophioglossolambis violacea* (Swainson, 1821) and presents opportunities for the discovery of other endemics there, such as the subject of this paper. This paper will compare differentiating conchological morphometric characteristics and discuss possible environmental influences respective to colonization and evolution.

ABBREVIATIONS AND ACRONYMS

DL – David Lum

BPBM – Bernice Pauahi Bishop Museum

L, W, H – length, width & height

RC – Roger Clark

SR – Spire Ratio

MATERIAL AND METHODS

Eight fully mature specimens of *O. itsumiae* were compared to nine fully mature specimens of *O. digitata* from various populations found in the western Indian Ocean. Additionally, the author compared photographs of specimens of *O. itsumiae* not available for direct study with *O. digitata* to further validate the uniqueness of the new species.

All specimens exhibited in this paper were photographed with a monopod-mounted Nikon digital single-lens reflex camera. Lens focal length was set at 50mm or greater to minimize image distortion. White fluorescent desk lamps were used for lighting. In-camera white balance and Adobe Photoshop Elements 2020 were utilized for minor image adjustments to ensure realistic rendering of color.

Comparative dimensional measurements are enumerated in millimeters (mm). Weight is measured in grams (g).

SYSTEMATICS

Superfamily: Stromboidea Rafinesque, 1815

Epifamily: Neostromboidea Maxwell, Dekkers, Rymer & Congdon, 2019

Family: Strombidae Rafinesque, 1815

Genus: *Ophiglossolambis* Dekkers, 2012

Ophiglossolambis itsumiae Lum, new species
(Figures 1, 2, 4, Plate 1)

Description. Large (152.5 to 187.4 mm), broad, dorsally-compressed shell with a very short, compact spire; eight major dorsally-compressed, digit-like spines that extend to the right from the labrum; siphonal canal long and straight; smaller labral spines in between major spines in some specimens; posterior-most spine bifurcate and touches spire, with the smaller (left) branch forming a spoon-like structure; shoulder cord of the teleoconch (P1) has five prominent, rounded knobs located between left margin and beginning of the labral flange, with the largest knob at the top of the shell; two other closely spaced primary cords (P2-P3) with three to five smaller knobs on the left half of the shell starting from the left side up to the centerline of the dorsum; a series of thin, less distinct spiral cords found across the shell in between the P1 cord and tip of the siphon; rounded, spiny processes along edge of the labrum between the stromboid notch and start of the siphonal canal; spiny processes on the right edge of the siphon that are contiguous with cords spiraling along the siphon in very mature specimens (*e.g.*, Paratype 1, Plate 1); surface of body satiny to slightly glossy with light yellowish-tan background coloration; dorsal pattern indistinct; ventral surface of the body whorl with tan bands or wavy lines; aperture elongated with a thickened columellar plate; columellar plate and aperture lined with strongly-developed white lirae with orange and purple in the interstices

radiating roughly perpendicular to the aperture; the posterior-most lirae of very mature specimens transition into robust, white, cobble-like bumps that superficially resemble human teeth; internal surface of the shell creamy orange; periostracum thin, smooth, and yellowish brown; operculum smooth, brown, and crescent-shaped with smooth edges.

Type Material.

Types: LxWxH (maximum dimensions), weight / location of origin / repository

Holotype. 172.4x84.8x48.1, 132 g / Mascarenes / coll. BPBM (accession # 2021.010, catalog # 288445)

Paratype 1. 187.4x84.5x51.9, 139 g / La Réunion Island / coll. DL

Paratype 2. 178.2x77.9x47.1, 123 g / Saint Brandon Shoals, Territory of Mauritius / coll. DL

Paratype 3. 160.3x62.7x37.9, 70 g / Mauritius Island / coll. DL

Paratype 4. 170.7x75.8x47.2, 130 g / Mascarenes / coll. DL

Paratype 5. 152.5x69.0x41.0, 90 g / Mascarenes / coll. DL

Paratype 6. 156.0x71.6x41.73 / Saint Brandon Shoals, Territory of Mauritius / coll. RC

Paratype 7. 167.5x81.2x50.7, 135 g / Mascarenes / coll. DL (incomplete siphonal canal due to filing)

Type Locality. The holotype (Figure 1) was collected in the Mascarenes but specific island location for it is not available. The paratypes are from various locations in the Mascarenes.



Figure 1. *Ophioglossolambis itsumiae* n. sp., Mascarene Islands, 172.4 mm, holotype. Photos by D. Lum.



Figure 2. *O. itsumiae* holotype (center) compared with a 149.6 mm specimen of *O. digitata* closely resembling the illustration in Perry's 1811 description of *Strombus digitatus*. To scale, the images show their distinct differences. Photos by D. Lum.

Animal Characteristics. No live animal of *O. itsumiae* was available for study, but it is likely very similar to the animal of *O. digitata*.

Habitat and Distribution. The various Mascarene Islands (Figure 3) were formed at different times over the last 15 million years by oceanic volcanic activity. Deep water exists off their coasts. The Mascarene Plateau is the major undersea feature that connects the archipelago together, but they have never been connected to any other land masses by land bridges or a shallow continental shelf. The dominating current passing through the Mascarenes is the powerful westward flowing South Equatorial Current (SEC) (Pous *et al.*, 2013). Coral reef development is extensive but discontinuous around most of Mauritius, nearly continuous around Rodrigues, and very restricted at Réunion. Saint Brandon Shoals has a well-developed coral-reef arc and sand cays (J. Turner & R. Klaus, 2005).

The collection depth of the type specimens varies from 5 to 55 meters. Mollusks of the family Strombidae are typically shallow water species that are highly dependent on soft-leaved sea grasses and algae for food. As such, it is not likely that *O. itsumiae* is found much deeper than 55 meters due to low light levels beyond this depth limiting the growth of much of its food source. According to Dr. Maurice Jay, a collector from Réunion Island, *O. digitata* is found on dead corals on the outer slope of the barrier reef from 10 to 40 m on rocky bottoms with algae (Réunion Island Mollusks website, 2021).

Etymology. *Ophioglossolambis itsumiae* is named in honor of Itsumi Kanamori Lum, the author's wife, for her grace and infinite patience with her husband's esoteric interests.

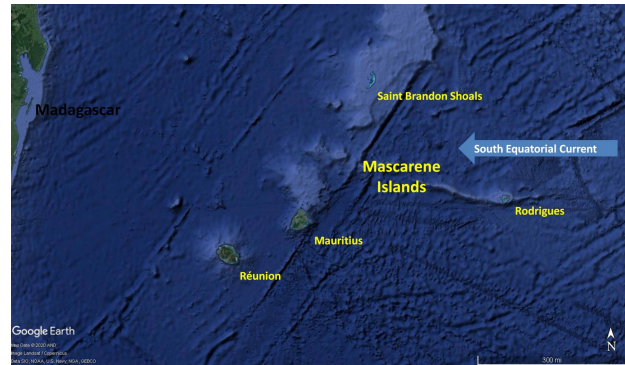


Figure 3. The Mascarene Islands is the type locality of *O. itsumiae*. The westward flow of the powerful South Equatorial Current enhances biological isolation of these islands from the rest of Africa. (Source: Google Earth Pro.)

Comparison. *O. itsumiae* can be readily distinguished from the other two described extant species of the genus *Ophioglossolambis*. The differences to *O. violacea* are stark and will not be underscored in writing here, but several specimens are illustrated in Plate 3 for clarity.

A key diagnostic characteristic to separate *O. itsumiae* from *O. digitata* is the shape of the spire, which can be expressed as a Spire Ratio (SR) defined here as the length of the spire (as measured along the top of the shell) divided by the width of the spire (as measured from the dorsal to basal sides) (Figure 4). The spire of *O. itsumiae* is consistently short and compact, while that of *O. digitata* tends to be significantly more prominent and variable in shape, as can be seen when comparing the standard deviation (Std Dev) of the SRs of the two species. The author chose this ratio because the spires of all examined specimens of both species were intact, while the spines and siphons could be severely damaged and not as supportive of objective comparison, even though clear differences do exist between length/width and length/height ratios. Table 1 summarizes the important differences between *O. itsumiae* and *O. digitata*.

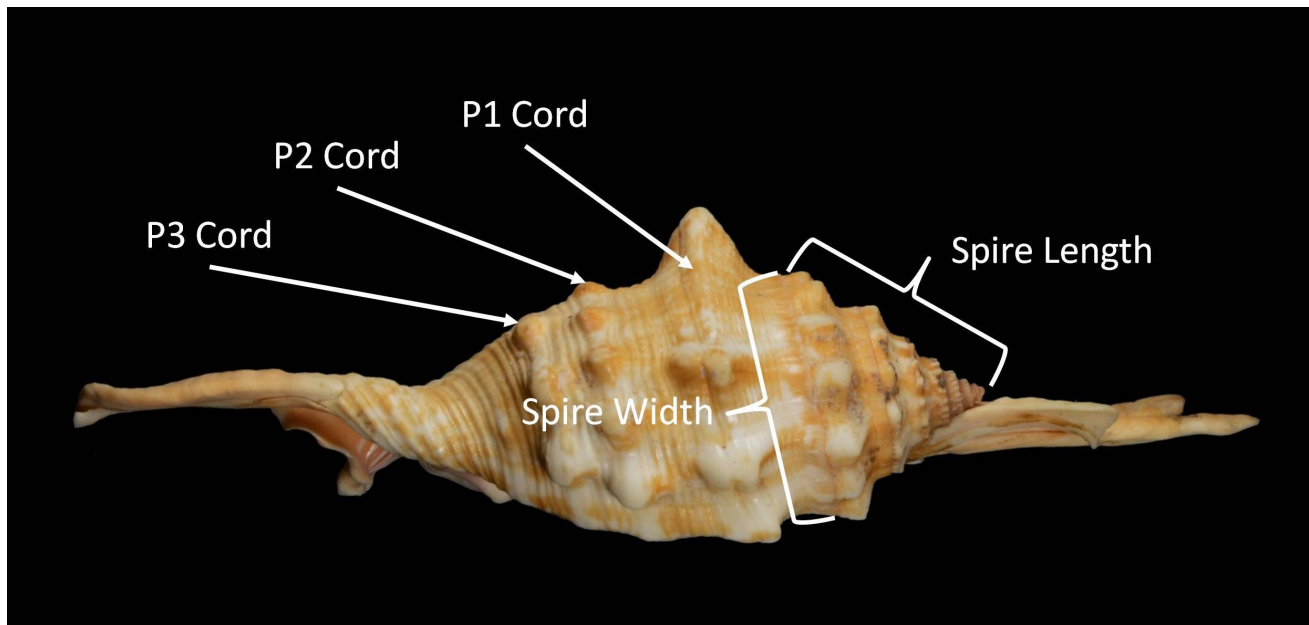


Figure 4. Image of Paratype 7 defining measurement points for spire length and width and locations of primary cords. Cord numbering modeled after the nomenclature for Muricidae (Merle, 2005). Photo by D. Lum.

Characteristic	<i>O. itsumiae</i> (n=8)	<i>O. digitata</i> (n=9)	n = number of specimens
Shell shape	Broad, flattened	Narrower	
Shell length average (range)	168.2 (152.5-187.4) mm*	151.0 (123.2-173.8) mm	
Spire shape	Short and compact	Long, pronounced, and more variable	
Spire Length / Spire Width Ratio	0.97 (Std Dev 0.04)	1.24 (Std Dev 0.20)	
Knobs on primary cords	Strong	Weaker	
Siphon	Long, straight	Short, bending or curling more to right	
Labral spines	Long	Short, particularly along right margin	
Dorsal background color	Yellowish tan	Tan to brown	
Dorsal pattern	Indistinct	Clear wavy lines of varying width	
Distribution	Mascarene Islands	Continental East Africa and Madagascar	

*Average shell length calculation does not include length of paratype 7 (167.7 mm) due to its broken and filed siphon.

Table 1. Comparison of *O. Itsumiae* to *O. digitata*.

DISCUSSION

O. itsumiae is introduced at the species level consistent with the precedence established with the splitting of other similar spider conch species, in particular *Lambis pilsbryi* Abbott, 1961 from *Lambis crocata* (Link, 1807) and *Lambis montorum* Cossignani & Lorenz, 2020 from *Lambis scorpius* (Linnaeus, 1758). *O. itsumiae* differs from *O. digitata* to a close degree to that of the other sets of taxa.

Prior to this description, only two *Ophioglossolambis* (“snake tongue *Lambis*”) species were recognized, namely *O. digitata* and *O. violacea*. The differences between these two taxa are unmistakable, while those between *O. digitata* and *O. itsumiae* require more explanation. The combining of *O. digitata* with *O. itsumiae* under one name in the past may be due to the comparatively few *O. itsumiae* specimens available for examination. It has taken the author over seven years of concerted effort to acquire the type specimens used in this

study, and these constitute over half of all specimens known to him. This paper should prove useful towards others finding specimens “hiding in plain sight” in their collections, such as the specimen in the collection of Roger Clark.

O. digitata was originally described as *Strombus digitatus* by Perry, 1811, Plate XIII: "No. 1 *Strombus digitatus*. Shell brown, striped with white; the cheek very much expanded, and divided into ten segments, pointed, rounded, and arcuated; the mouth and columella richly striped with white and red veins, running the whole length of the shell; the beak short. A native of the Eastern Ocean." The associated color engraving in Perry's plate is reproduced here in Figure 5. While Perry's description does not specify the locality of the specimen he depicted, its form is consistent with typical *O. digitata* shells from the East African mainland (Somalia, Kenya, Tanzania, South Africa, and various nearby island groups) and Madagascar [Plate 2 shows various *O. digitata* specimens]. Very clearly shown are the shell's very long spire and relatively short labral spines. Given that this is Perry's concept for *Strombus digitatus*, it is well within reason, based on the description of *O. itsumiae* and its comparison to *O. digitata* above, that *O. itsumiae* should be accepted as a valid taxon.

In 1842, Reeve described *Pterocera crocea* as a species. Upon examination of the illustration he used to introduce *P. crocea* (also reproduced in Figure 5), which is only accompanied by general text on the genus *Pterocera* not specific to *crocea*, it is quite apparent that it is just a variation of *O. digitata* that resembles the largest *O. digitata* shown in Plate 2. No locality data was provided in this description. Specimens of *O. itsumiae* have occasionally been traded as *Lambis digitata* form *crocea*, making loose usage of Reeve's moniker, but it

is clear from physical comparison that *O. itsumiae* and *P. crocea* cannot be synonymized.

The geographic isolation of the Mascarenes from the continent of Africa and Madagascar, locations where *O. digitata* is prevalent, supports the evolution of unique marine species around these remote islands. In addition to physical distance, the powerful east to west flow of the South Equatorial Current and associated current/gyre systems result in further oceanographic isolation of these islands (Obura 2012). Clear evidence of this is the existence in the Mascarenean Molluscan Subprovince of such well-known endemic mollusks as *Harpa costata* (Linnaeus, 1758), *Conus julii* Liénard, 1870, *Cribrarula esontropia* (Duclos, 1833), *Bistolida owenii* (Sowerby I, 1837), and *Cribrarula cribellum* (Gaskoin, 1849) (see Petuch & Berschauer, 2020, at pp. 226-227). The existence of *O. digitata*'s congener *O. violacea* as an endemic to the Mascarenes gives particularly strong support to the idea that another endemic strombid, namely *O. itsumiae*, could have evolved in the Mascarenes.

It is not yet known whether *O. digitata* is the progenitor of *O. itsumiae* or vice versa, but it is reasonable to hypothesize that the former is more likely the case, since *O. digitata* is much more widespread and may even today occasionally reach the Mascarenes based on an image of a typical *O. digitata* in Dekkers, 2012 labeled as originating from Mauritius. Exceptionally hardy veligers of *O. digitata* may have made a very circuitous route via ocean eddies and the meandering of today's major Indian Ocean currents (Perpetual Ocean website) to arrive at the Mascarenes sometime in the past to give eventual rise to both *O. violacea* and *O. itsumiae*. That *O. violacea* and *O. itsumiae* do not have well-established populations west of the Mascarenes may speak to the existence of harsher oceanic conditions today than when

Ophioglossolambis first reached the Mascarenes. Evidence that more benign, warmer conditions likely existed for the migration of *Lambis*-like species in the past is the late Pleistocene fossil record of Hawaiian Islands, another very isolated archipelago, which contains an extinct form of *Harpago chiragra* (Linnaeus, 1758) found above today's sea level (D. R. Muhs *et al.*, 2002).

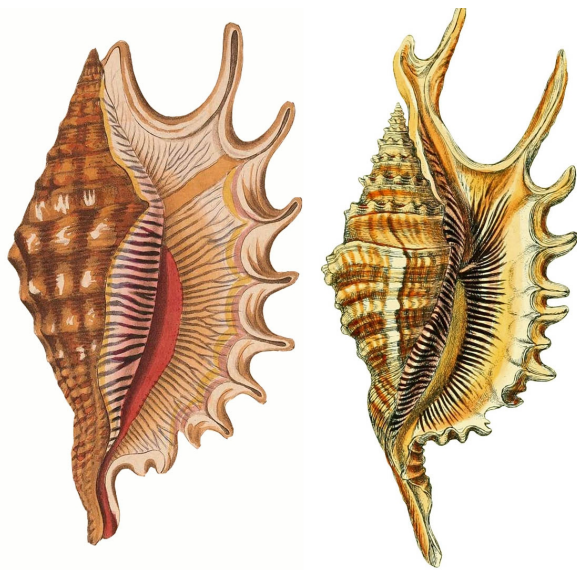


Figure 5. Original illustrations of *Strombus digitatus* Perry, 1811 (left) and *Pterocera crocea* Reeve, 1842 (right).

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Plate 1. *Ophioglossolambis itsumiae* n. sp. Left to right: Paratype 1 (La Réunion Island 187.4 mm), Paratype 2 (Saint Brandon Shoals 178.2 mm), and Paratype 3 (Mauritius Island 160.3 mm). To scale. Photos by D. Lum.



Plate 2. *Ophioglossolambis digitata* from Madagascar (left to right 173.8 mm, 162.6 mm and 123.2 mm) showing variability in spire development (typical in larger shells and particularly long and steep in smallest shell. The largest shell closely resembles the specimen of *Pteroceras crocea* illustrated in Reeve, 1842. To scale. Photos by D. Lum.



Plate 3. *Ophioglossolambis violacea* from the Mascarene Islands (left to right: Mauritius 122.6 mm, Saint Brandon Shoals 124.8 mm, and Saint Brandon Shoals 125.0 mm) showing variability. Note the ribs on the columellar shield of the specimen from Mauritius (collected over 40 years ago) that the recent Saint Brandon Shoals specimens lack. The left and middle specimens display typical spine formation, while the right specimen has an abnormally high number of digits. To scale. Photos by D. Lum.