Biodiversity in holothurians at Reunion Island: Two previously undescribed sea cucumbers species

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Abstract

We present two sea cucumber species discovered at Reunion Island between 2014 and 2016: *Stichopus* sp. and *Holothuria* (*Stauropora*) sp. Because the discoveries occurred within a marine protected area, no specimens were collected. *Stichopus* sp. Specimens were confirmed by DNA sequencing from non-lethal authorised tissue samples; *Holothuria* sp. specimens were determined from photographs with the usual reservations about photograph-based identifications. One adult and two juveniles of *Stichopus* sp. were found, along with two specimens of *Holothuria* (*Stauropora*) sp. Awaiting for type specimens that will allow a conventional description, this communication presents their main morphological characteristics in the field and from photographs, and observations on habitats and behaviour. Photographs of these specimens illustrate some aspects of the descriptions.

Introduction

Two undescribed sea cucumber species were discovered by the authors on the west coast of Reunion Island between 2014 and 2016: *Stichopus* sp. and *Holothuria* (*Stauropora*) sp. No specimens were collected, however, because the discoveries occurred within the perimeter of the marine protected area "Réserve Naturelle Marine de La Réunion (GIP-RNMR)". Nevertheless, authorised non-lethal tissue sampling allowed DNA sequencing for *Stichopus* sp., while the identification of *Holothuria* (*Stauropora*) sp. was based on photographs. The most recent inventory of holothurians of Reunion Island includes 44 species (Conand et al. 2016), an important increase since the previous one, which included 37 species (Conand et al. 2010). The holothurians at Reunion belong to 5 families, the Stichopodidae with 5 species, and Holothuriidae with 30 species, including the two undescribed species presented here.

Awaiting the collection of type specimens, the present article provides information on the main external morphological characteristics of these two species in the field and from photographs, and on their habitat and some patterns of behaviour. Photographs of these specimens illustrate some aspects of this information.

Material and methods

Observations were made on the Saint Gilles–La Saline Reef (also known as L'Ermitage Reef), on the west coast of Reunion Island (21°07'S and 55°32'E). Saint Gilles–La Saline Reef is 7.6 km long, its maximum width is 500 m, and its maximum depth is less than 2 m at high tide. It is divided in two parts (northern and southern) by L'Ermitage Pass. This reef is included within the perimeter of the marine protected area Réserve Naturelle Marine de La Réunion (GIP-RNMR). One of the observers holds a non-lethal tissue sampling authorisation approved by the Scientific Council of the RNMR.

Observations were made by snorkelling near the surf zone. For underwater exploration, each observer had underwater photography equipment, a ruler, magnifying glass, and a small container for tissue samples that could be made in situ. Tissue sampling equipment was left on shore.

Two specimens of *Holothuria* (*Stauropora*) sp. were observed, the first in the southern part of the reef on 20 July 2014, the second in its northern part on 2 March 2016. No tissue sampling was done because the tegument of the individuals seemed too thin to withstand a cut, but many pictures of the second individual were taken. Three specimens of *Stichopus* sp. were found in the same area in the northern part of L'Ermitage Pass, the first one on 26 September 2015, the second one on 25 November 2015, and the third on 10 January 2016. The first one bore two wounds with white tegument strips trailing out from the body, one on the left side, and the second on the trivium (visible in Fig. 1 a, b). These strips were collected *in situ* with a dive knife because the manual transportation to the shore of a Stichopodidae would have been hazardous for the specimen, considering how easily the tissue of some species in this family can disintegrate. The sample was immediately brought to shore and preserved in 90%

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ethanol. The two other individuals were identified from photographs. All specimens were observed in the morning.

Identifications were made by F. Michonneau (Division of Invertebrate Zoology, Florida Museum of Natural History, FLMNH). The status of undescribed species of *Stichopus* sp., established from DNA sequencing, was confirmed by G. Paulay (Curator of the Division of Invertebrate Zoology, FLMNH). Identification of *Holothuria* (*Stauropora*) sp. was based on photographs with the usual reservations regarding photograph-based determinations.

Information on the external morphology of two specimens is developed from field observations and photographs.

Results

Holothuria (Stauropora) sp.

Aspects of the living animal. Length slightly contracted: around 9.0 cm; mid-body width: 2.5 cm. Bivium blue-grey locally smoky (Fig.1a). Trivium uniformly pale grey. A multitude of minute dark red-brown dots irregularly distributed on the bivium (not visible on photographs). Trivium flattened. Body wall flexible, thin and wrinkled. Two kinds of papillae on the bivium. The first ones high, conical, with a broad whitish base; distal extremities translucent and sprinkled with minute white dots. The second ones smaller; their base brown marked with black dots up to two-thirds of the cone, the tip being whitish. The two kinds of papillae irregularly distributed. Ventral podia long and thin. Stems translucent pale grey with minute white dots, topped by a white disc. Interambulacral areas narrow, without podia. Oral tentacles apparently peltate; colour yellowish-white. Mouth surrounded by two collars of papillae. Cloacal orifice terminal and circular, surrounded by a collar of short whitish papillae. Cuvieran tubules few but with large diameter, rather quickly expelled; colour translucent bluish (Fig. 1b).

The 8.5-cm long second specimen exhibited the same characteristics with two exceptions: a broad white blotch on the bivium slightly behind the first half of the body, and a thin white anterior extremity (Fig. 2a). This extremity, whose diameter was distinctly smaller than that of the preceding body part, suggests a regeneration process. This hypothesis is strengthened by the nipple-like aspect of this part when the body was fully contracted (Fig. 2b). This species could, therefore, reproduce asexually.

Habitat. The two specimens were found in areas of strong hydrodynamic conditions near the surf zone. The habitat of the first one is characterised by a sandy-detritus substrate, including mainly dead coral rubble. The habitat of the second one includes necrotic hard corals. The sandy areas between these corals are cluttered with dead coral rubble, and the two specimens observed were hidden under this rubble. The first one was lying on the substrate whereas the second one was fixed on the underside of slab-shaped debris.

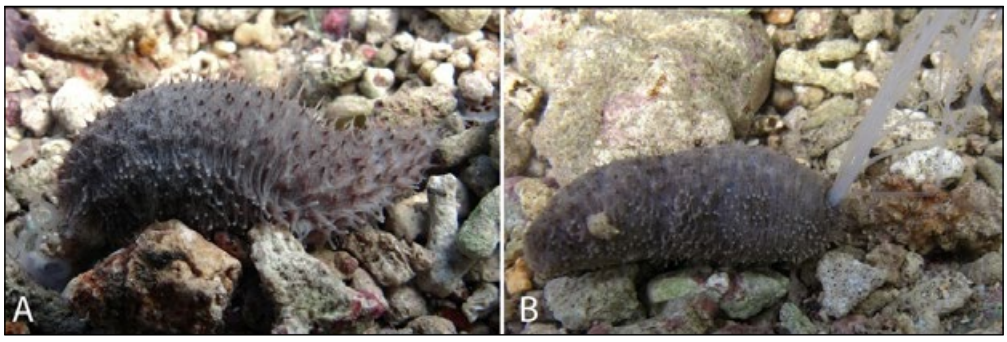

Figure 1. First discovered individual of *Holothuria* (*Stauropora*) sp.
A. Bivium; B. Trivium and Cuvieran tubules.

Figure 2. Second individual of *Holothuria* (*Stauropora*) sp. A. Bivium; B. Nipple-like protrusion on the anterior part, suggesting a regeneration process; C. Cryptic behaviour: attempting to hide within a little arch on the underside of a piece of coral rubble.

Behaviour. The second specimen was observed for one hour, which allowed the sighting of a particular cryptic behaviour. When discovered it immediately tried to hide into one of the holes present on the underside of the rubble. Unsuccessful in its attempt, it painfully got through a little arch, grazing its tegument after one try to move backwards. It was then placed by the observer on one side of the rubble and it got away into another arch (Fig. 2c). When placed on the sandy substrate, it began burying itself. Cuvieran tubules were not expelled by this individual.

Remarks. Except for short papillae and a dorsally arched body, this specimen corresponds to the subgenus *Holothuria* (*Stauropora*) as described by Rowe (1969), considering what can be observed in the field (tentacles could not be counted):

> "Tentacles 18–30, pedicels in three distinct rows on the ventral flattened surface, papillae small, irregularly arranged dorsally, a 'collar' of papillae sometimes present around the base of the tentacles; body wall soft, not very thick, usually about 1 (1–2) mm; body with flattened 'sole'-like ventral side, arched dorsally; size small, up to 100 (rarely 125) mm long..." (Rowe 1969).

This subgenus presently comprises 13 accepted species (Paulay 2015).

Stichopus sp.

Aspects of the living animal. Length slightly contracted: 21 cm (Fig. 3a); mid-body width: 7 cm. Background colour of the bivium more or less pale or yellowish creamy white with numerous small ochre-coloured spots and diffuse areas mixing pink and dark grey on top and sides of the body. Trivium uniformly pale grey (Fig. 3b). Body quadrangular in cross-section, tapering at the two extremities. Trivium flattened. Body wall thick. Transversal folds present on the dorsal side. Big prominent papillae on dorso-lateral and ventro-lateral edges; colour of papillae mostly pinkish with short red lines forming concentric circles from base to summit. Numerous shorter pinkish papillae between edges. All papillae with white bases and translucent distal tips. Papillae irregularly distributed, even on edges. Tube feet long, rather thick and irregularly scattered only along ambulacral areas. Stems pale grey with minute black and white dots and white distal disk. Interambulacral areas relatively wide. Mouth apparently subterminal. Tentacles greyish and apparently peltate. Anus terminal. Cloacal orifice surrounded by a collar of very short bumplike papillae.

The first specimen is probably an adult. The two juveniles found in the same area are, respectively, 10.5 cm and 7.2 cm long (Fig. 4a and b), both slightly contracted. Because the first specimen was observed on 25 November 2015 and the second one, clearly smaller, on 10 January 2016, they cannot be the same individual. The adult's colours are paler in the juveniles. The background creamy white colour becomes pure white, with pinkish areas. Small ochre-coloured spots of the adult are grey in the smallest juvenile, and grey or pink in the bigger juvenile. The trivium is pinkish white (Fig. 4c). Prominent papillae are fewer than in the adult, and principally distributed on the four edges. The cloacal orifice was observed successively in terminal and dorsal positions in the bigger juvenile.

Figure 3. First discovered individual of *Stichopus* sp. A. Bivium; B. Trivium; C. Fully contracted body.

Figure 4. Two juveniles of *Stichopus* sp. A. First individual; B. Second individual; C. Trivium of the first individual.

Habitat. The three specimens were found in an area of strong hydrodynamic conditions near the surf zone. Their habitat is characterised by a sandy-detritus substrate that includes dead coral rubble.

Behaviour. The two juveniles displayed cryptic behaviour, and were hidden under dead coral blocks, while the adult specimen was fully exposed on the substrate among the blocks. None of the three specimens reacted to brief handling by altering their superficial tissues. Nevertheless, the two pieces of tegument removed from the adult specimen quickly became a translucent viscous substance.

Remarks. External morphology features of species of the genus *Stichopus* Brandt, 1835 make accurate identifications difficult in the field because they can be similar interspecifically and variable intraspecifically (Massin et al. 2002). Compared with stichopodid species recorded from La Reunion, these three specimens looked like individuals of the *Stichopus monotuberculatus* complex at first glance, particularly because they exhibited prominent papillae with coloured rings. *S. monotuberculatus* displays highly variable colour patterns (Byrne et al. 2010). One of them is creamy white with red and grey or black patches on the bivium, which make it relatively similar to that of *Stichopus* sp. specimens from La Reunion, but the trivium of *S. monotuberculatus* is longitudinally blotched with grey to black markings while it is uniformly whitish to pale grey in our specimens. Regarding the general shape of the body, *S. monotuberculatus* does not taper at the posterior extremity; the quasi-spherical shape of *Stichopus* sp. when fully contracted (Fig. 3c) is not typical in *S. monotuberculatus*, suggesting a thinner body wall. Moreover, *S. monotuberculatus* is active at night (Byrne et al. 2010) and hidden under rubble during the day, whereas the adult specimen of *Stichopus* sp. was exposed on the substrate at 10:30.

This species is genetically close to an undescribed *Stichopus* sp. from Hawaii (Godwin & Bolick, 2006) and could be the same (F. Michonneau pers. comm.). The genus *Stichopus* presently comprises 14 accepted species (Paulay and Hanson 2013).

The fact that sea cucumbers are not commercially exploited in Reunion Island (Conand and Frouin, *in* Conand and Muthiga 2007) probably facilitated the preservation of these species. However, their shallow coastal habitat is likely to make them vulnerable to anthropogenic pressures, particularly in a place as densely populated as Reunion's western coast.

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