

Contribution to the knowledge of holothurian biodiversity at Reunion Island: Two previously unrecorded dendrochirotid sea cucumbers species (Echinodermata: Holothuroidea)

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Introduction

A comprehensive knowledge of biodiversity at the local scale is needed to design management and conservation strategies, and to adapt regional management plans to population connectivity as well as to formulate biogeographic hypotheses. This information is all the more important when the biology and distribution of species are poorly known, as is the case with many sea cucumbers. Consequently, reliable field observations accompanied by photographic evidences and information on location and habitat can allow experts to better understand spatial patterns, and infer distributions using ecological niche modelling (Michonneau and Paulay 2015). Moreover, these data, even if not enabling precise identification of previously unrecorded species, allow the inclusion of these species in the research programme of future inventory missions. This article is written with that in mind.

The most recent inventory of holothurians at Reunion Island includes 39 species (Conand et al. 2018) belonging to four orders (Holothuriida, Synallactida, Apodida, Dendrochirotida) and five families (Holothuriidae, Stichopodidae, Chiridotidae, Synaptidae, Sclerodactylidae). The order Dendrochirotida is represented by two species belonging to the family Sclerodactylidae (*Afrocucumis africana*, *Ohshimella ehrenbergii*).

Two clearly different species of dendrochirotid holothurian were observed in the island's waters between 2014 and 2018. Several individuals of one species, probably belonging to the Cucumariidae family, were observed at various locations on Saint Gilles-La Saline reef between 2014 and 2017. An individual of the second species, probably belonging to the Phyllophoridae family, was observed on the same reef in 2016, and another was found in 2018 in a pond on the supralittoral zone of the rocky southeastern coast of the island, near the town of Sainte Rose. These observations add two species, and probably two families, to the biodiversity of holothurians on Reunion Island. This article provides information on the main external morphological characteristics of these two species, and some aspects of their ecology.

Methodology

Observations were carried out on Saint Gilles-La Saline reef, located on the western coast of Reunion Island (21°07'S, 55°32'E), and in ponds scattered along the supralittoral zone of the rocky western, southern and southeastern coasts of the island. Saint Gilles-La Saline reef is less than 8 km long; its maximum width is about 500 m, and the mean depth is 1.2 m. Ponds are located on basaltic platforms and connect to the ocean only under swell effect. Their surface ranges from a few tens of square centimetres to over 100 square metres; their depth ranges from a few centimetres to 5 meters.

Observations by the authors were made by snorkelling. For exploration, each observer held an underwater camera and a ruler.

Results

Individuals probably belonging to the family Cucumariidae

Physical description

The description is based on the first observed individual. Length slightly contracted 2.9 cm, mid-body width 0.9 cm; non-contracted body elongated,

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tapering slightly at the posterior end, with prominent dorsolateral edges; sub-quadrangular in cross-section with interradii of the bivium slightly concave when body not contracted; contracted body barrel-shaped with five deep longitudinal grooves (Fig. 1A); body wall rough to the touch, probably thick; bivium bright red-orange with greenish yellow anterior end and yellowish posterior end (Fig. 1B), trivium yellowish (Fig. 1C); interradii and anterior part with thin longitudinal black lines, also present on the stem of tentacles; no apparent interradiial papillae; mouth terminal, tentacles apparently branched, yellowish (Fig. 1D); number of tentacles not determined; anus terminal, rounded, dorsal during excretion; presence or absence of anal teeth not determined; tube feet extending from mouth to anus, relatively short and thick, restricted to the ambulacra and arranged in two irregular rows, far fewer on the dorsal ambulacra; same colour as the body with distal white ring and dark red brown endplate; tube feet apparently not fully retractile.

The other individuals had the same overall characteristics. The non-contracted size range was 2.6 cm to 3.8 cm (Fig. 1E); a pear-shaped individual (Fig. 1F) was also observed.

Ecology

All individuals were found on a reef flat at a depth of less than 1 m, approximately 50–70 m from the reef front, in strong hydrodynamic areas characterised by a sandy-detrital substrate. All individuals adhered to the underside of slab-shaped coral debris. Two were observed within a few metres of each other at two different sites. Other individuals

were isolated, with no individuals found within 50 m on either side of their position. None of the individuals eviscerated while being handled.

Individuals probably belonging to the family Phyllophoridae

Physical description

The description is based on the first observed individual. Length slightly contracted 3.2 cm, mid-body width 1.2 cm; body wall wrinkled, soft to the touch, probably thin; colour light brown with yellowish, white and greyish areas and small blackish smears scattered all over the body (Fig. 2A); both ends blackish, posterior end with a distal white ring (Fig. 2B); body arched, slightly U-shaped when contracted, with blunt anterior end and tapering posterior end; mouth terminal; colour and number of tentacles not determined; anus terminal surrounded by small thin yellowish tube feet, presence or absence of anal teeth not determined; tube feet relatively long, tubular, abundant, more or less uniformly scattered over the whole body without any arrangement; same colour as the body parts where they are located, with clearer irregular transverse lines on the stem and white endplate; tube feet apparently not fully retractile.

The second individual (Fig. 2C) had the same overall characteristics, except for the following features: semi-contracted length 2.9 cm; half-body width 1 cm; dominant colour dark brown with whitish areas limited to the trivium and lateral sides of the bivium; posterior end with a whitish protrusion disappearing when the body was fully contracted.

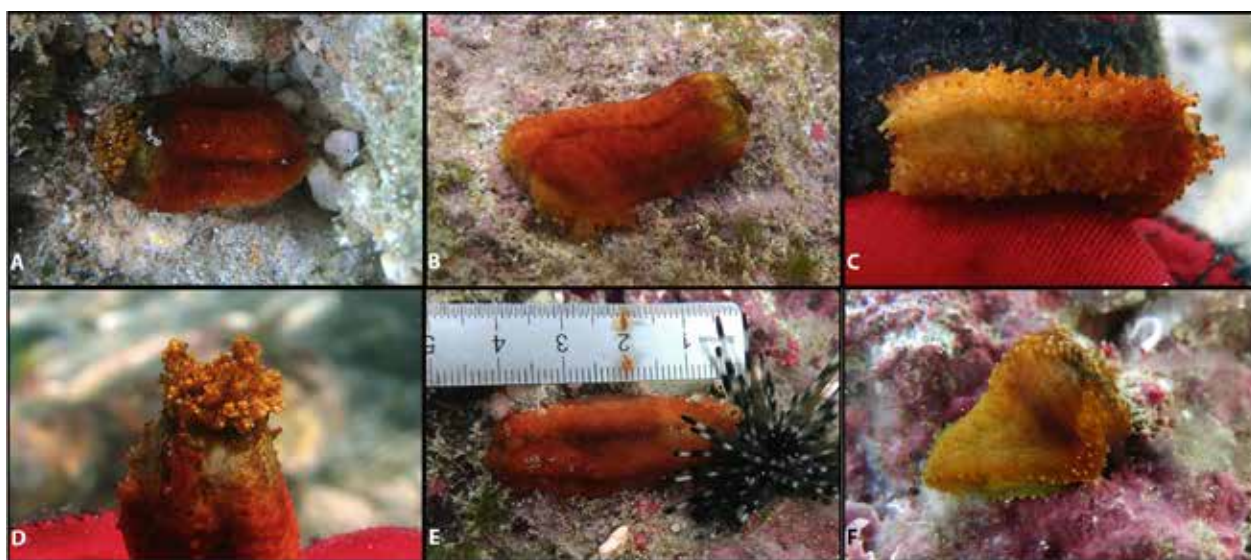


Figure 1. Individuals probably belonging to the family Cucumariidae. A) The contracted body is barrel-shaped, with five longitudinal grooves. B) The bivium is bright orange-red with yellowish ends. C) The trivium is yellowish, tube feet are present only on radii. D) Tentacles appear branched. E) This individual measuring 3.8 cm is the largest of those observed. F) Pear-shaped individual. (photos by P. Bourjon)

Ecology

The first individual was found at a depth of 1 m on the reef flat, 200 m from the reef front, in a moderately hydrodynamic area occupied by a layer of coral debris colonised by algal turf. The individual was hidden under some debris on the surface of the layer. The second individual was in a pond about 150 m² and 40 cm deep on a basaltic platform a few metres from the surf zone, in a site where the swell is regularly strong. These two extremely different habitats show that this species is able to adapt to various biotopes. Neither of the two individuals eviscerated while being handled.

Discussion

The taxonomy of dendrochirotidids is currently based mainly on differences between calcareous ring morphologies and ossicle assemblages (Panning 1949; Heding and Panning 1954), and on the shape of the tentacles rather than on their number (Pawson and Fell 1965). However, many species remain in an uncertain position, and some families or sub-families are not clearly distinguishable (Byrne and O'Hara 2017). This makes photo-based determinations most often impossible with this order, unlike what remains possible in others (e.g. Kim et al. 2013; Kerr 2013). However, more or less precise assumptions based on external morphology or geographical distribution can be made in the dendrochirotid group.

The body shape, conspicuous colour and tube feet restricted to the ambulacra, and observable in individuals of the first group that was observed on Reunion Island suggests that they could belong to the family Cucumariidae. Nevertheless, it is impossible to be more precise in determining these individuals in the context of photo-based identification, due to the difficulties associated with the taxonomy of dendrochirotid holothurians.

Some aspects of the external morphology of the second group individuals make them close to the

genus *Phyrella* (Heding and Panning 1954) (Phyllophoridae). This genus, revised by Michonneau and Paulay in 2014, and based on morphological and molecular analyses, includes eight species (*P. trapeza* (Clark 1932), *P. drozdovi* (Levin and Stepanov 1999), *P. fragilis* (Mitsukuri and Ohshima in Ohshima 1912), *P. mookiei* (Michonneau and Paulay 2014), *P. thyonoides* (Clark 1938), *Phyrella? ambigua* (Cherbonnier 1988), *Phyrella? bedoti* (Koehler 1895); *Phyrella? tenera* (Ludwig 1875)). The last three species were putatively assigned to this genus due to a lack of sufficiently numerous and accurate data. Among these species, only *Phyrella? ambigua* can be found in the southwest Indian Ocean (Madagascar, Mauritius and Rodrigues). Our individuals have external characteristics (small size, body shape and colour, blackening of both extremities, tube feet shape and distribution) similar to those of *Thyonidiella cherbonnieri* (Rowe and Richmond, 2004), as re-described by the authors of the revision of the genus, and considered by them a synonym of *Phyrella? ambigua*. The individuals observed on Reunion Island could, therefore, belong to *Phyrella? ambigua*. Samyn and Tallon (2005) consider that dendrochirotid holothurians have a low dispersal capacity due to their larval development pattern (lecithotrophic doliolaria and direct development, without auricularia stage). However, the record of *Phyrella? ambigua* in Mauritius, located 170 km east-northeast of Reunion Island, as well as a local current pattern favourable to larval transport from Mauritius to Reunion Island (Pous et al. 2014), may reinforce this hypothesis. Nevertheless, only the examination of preserved specimens and molecular analyses can confirm that *Phyrella? ambigua* is indeed present on Reunion Island.

The present observations confirm the assumption of Conand and colleagues (2010) that the group of dendrochirotida could be more diversified on Reunion Island than what the inventory of holothurians has shown so far. Other species in this group are likely to remain undiscovered in the island's waters, particularly those with cryptic behaviour.



Figure 2. Individuals probably belonging to the family Phyllophoridae. (A and B: individual found on the Saint Gilles-La Saline reef, C: individual found on the southeast coast of the island). A) The colour pattern is a mix of light brown, yellowish, white and grey zones, and has irregularly scattered blackish traces on the body. B) Both ends are blackish, the anterior end is rounded and the posterior end is tapered (photos by P. Bourjon). C) The dominant colour is dark brown in this individual. The anus is surrounded by thin yellowish tube feet and is located at the tip of a whitish protrusion. (photo by J.-P. Quod)

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