

Field observations on the regeneration in *Synapta maculata* (Holothuroidea: Synaptidae)

Philippe Bourjon¹

Introduction

The order Apodida does not include fissiparous sea cucumber species but at least some species are known to exhibit autotomy and regeneration (Emson and Wilkie 1980). Such capacity has been experimentally studied in *Leptosynapta* Verrill, 1967 (Pearse 1909; Smith 1971a, b; Gibson and Burke 1983). Transversal section experiments reveal that anterior parts regenerate a smaller but functionally complete animal (Smith 1971a), whereas posterior parts never survive (Smith 1971a; Gibson and Burke 1983). Autotomy has been induced in *Synapta maculata* Chamisso and Eysenhardt, 1821 (Domanjay 1931), but field observations of the anterior part regenerating a posterior part are uncommon. This communication reports on observations made on a fringing reef at Reunion Island.

Material and methods

An anterior part of a *Synapta maculata* individual regenerating a posterior part was observed *in situ* on 10 September 2016 on the fringing reef of L'Ermitage at Reunion Island (21°07'S, 55°32'E). The specimen was found under a broken slab of concrete, 3 m from the beach and at a depth of 50 cm. The regeneration progress was monitored over seven weeks. Measurements were taken after moving the individual to a nearby sandy area without rubble. When the animal was crawling on a flat surface, its body was roughly straight, and there were very little contraction. After measurements were made, the individual *Synapta maculata* was placed back under its shelter. Photographs were taken during each monitoring session.

The specimen always stayed under the same shelter where it was first found. It was monitored until its appearance and length became similar to young individuals present at the site, and was indistinguishable from others like it.

Results

When the specimen of *Synapta maculata* was found, the loss of its posterior part seemed to have occurred rather recently because its posterior extremity showed petal-like pieces of tegument opening and closing regularly (Fig. 1 a, b, c). The body had the

same appearance as whole individuals on the reef, apart from its posterior part (Fig. 1c), whose coloration was semi-transparent, whitish to pale or yellowish grey with a low density of ochre heaps of spicules, and which exhibited a succession of prominent bulging warts. The anterior part was typically wrinkled, yellow-brown longitudinally, with

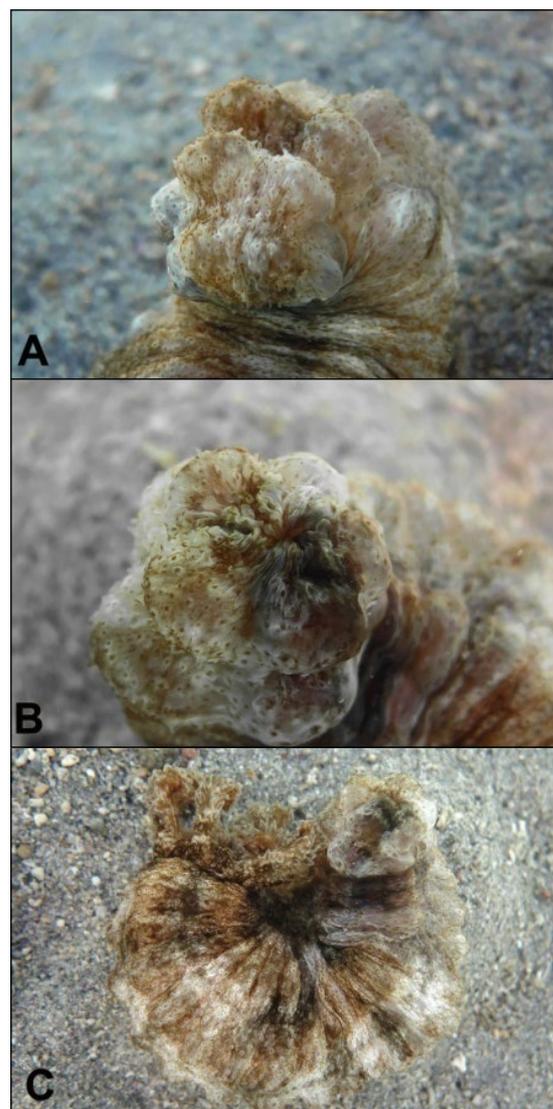


Figure 1. Anterior part of *Synapta maculata* regenerating a posterior part (observed on 10 September 2016). A: Petal-like pieces of tegument “opened” at the posterior extremity at 09.46 am. B: Posterior extremity closed at 09.47. C: Posterior extremity opened again a few seconds later.

¹ Les Sentinelles du Récif, réseau d’observateurs volontaires de la Réserve Naturelle Marine de La Réunion (GIP-RNMR). Sentinels of the Reef is a network of volunteer observers of Reunion Marine Park. Email: seizhavel@wanadoo.fr

white and brown stripes and transversal dark grey blotches, and exhibited dense patches of spicules. No measurement of the non-contracted body could be done that day, as the individual kept a C-shape posture and did not attempt to crawl. Its length in this contracted posture was about 9.5 cm and its diameter was 3.5 cm; the posterior part was around a quarter of the length of the body (Fig. 1c).

During the following weeks, the specimen was identically characterised by a warty and greyish posterior part while the anterior part was wrinkled and yellowish (Figs. 2 and 3a). The posterior part remained more or less warty even when its colouration became the same as the anterior part. This feature was no longer obvious on 5 November 2016 and, therefore, monitoring ceased on that day (Fig. 3b).

On 17 September 2016, its length of the *Synapta maculata* individual when it was crawling was about 20 cm (Fig. 3a). From 17 September to 5 November, it increased in length regularly by an average of 0.42 cm by day, with the specimen reaching 41.00 cm when the observations ceased (Fig. 3b). An increase in the daily average length was noticed during this period: increasing from 0.30 cm day⁻¹ between 17 September and 12 October (26 days), to 0.54 cm day⁻¹ between 12 October and 5 November (24 days).

Discussion

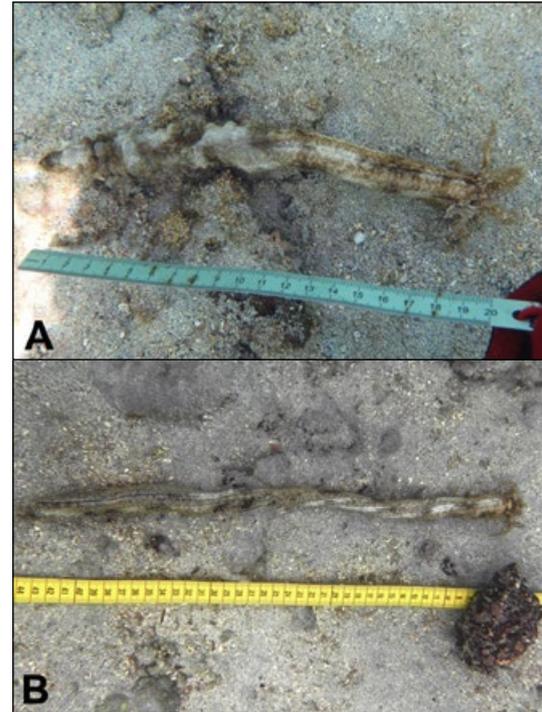
The quantitative data provided here are solely for informational purposes, as the high stretching capacity of this species prevented an accurate estimation of length in the field. Therefore, the change in the ratio of the anterior and posterior parts of the body length based on their characteristic appearances could no longer be estimated. Moreover, the cut on the body seemed to have occurred recently when the specimen was found. The posterior part of the body, close to the wound and equivalent to about 25% of the total body length, was covered with warts. This suggests that this feature could be a post-traumatic response that was rapidly exhibited by the tegument tissues of the anterior part bordering on the wound, as the warts can appear in stressful conditions in this species (Domantay 1953). Inasmuch as this response was also exhibited by the regenerating part during seven weeks, the warty appearance cannot be considered as a reliable characteristic to estimate the growth of this part because it seems impossible to perceive the precise localisation of the transection.

The almost unchanging warty morphology of the posterior part during the observation period suggests that the regenerating part exhibited a long post-traumatic stress period. This may be a way to recognise a regenerating individual in the field.

Figure 2. *Synapta maculata*: warty and greyish posterior part, and an anterior part that is wrinkled and yellowish (observed on 17 September 2016).



Figure 3. Regeneration of *Synapta maculata*. A - 24 Sept. 2016: The specimen was about 20-cm long. The posterior part was still greyish and warty. B - 5 Nov. 2016: The specimen measured about 41 cm. The posterior part was, henceforth, approximately similar to the anterior part.



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