

First record of an adult *Taningia danae* (Cephalopoda: Octopoteuthidae) in the Canary Islands (central-east Atlantic)

ALEJANDRO ESCÁNEZ & CATALINA PERALES-RAYA



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Remains of an adult specimen of the poorly known oceanic cephalopod, *Taningia danae* Joubin, 1931 were found floating in the south-western waters of Tenerife. Here we report for the first time an adult stage of the species in the Canary Islands. The remains, with a total weight of 21.169 kg, presumably belonged to a large adult female given the presence of spermatangia implanted intramuscularly in the ventral side of the mantle. This study confirms the presence of all life stages of the species in the Canary Islands.

Key words: Hooked squid, *Taningia danae*, Canary Islands, Atlantic Ocean

Alejandro Escánez^{1,2}(e-mail: aescanez@msn.com) ¹BioCepahALab. Department of Ecology and Animal Biology, Lagoas-Marcosende Campus, University of Vigo, ES-36310 Vigo. Spain. ²Department of Animal Biology, Edaphology and Geology, Faculty of Biology, University of La Laguna Avenida Astrofísico Francisco Sánchez S/N. Anchieta Camous, ES-38206 San Cristobal de La Laguna, Spain; C. Perales-Raya, Spanish Institute of Oceanography (Centro Oceanográfico de Canarias), Canary Islands Oceanographic Centre Vía Espaldón, Dársena Pesquera PCL 8, ES-38180, Santa Cruz de Tenerife, Spain.

INTRODUCTION

The deep-sea hooked squid, *Taningia danae* Joubin, 1931 (Octopoteuthidae) is one of the largest oceanic squids, reaching dorsal mantle lengths (DML) of 1700 mm (Nesis 1982; 1987), and has been reported to weigh up to at least 161.4 kg (Roper & Vecchione 1993). This species is characterised by a conical mantle with large triangular fins that occupy almost the entire mantle length and its width exceeds up to 130% of the DML. This species has eight short robust arms, with two series of hooks on each arm, and arm pair II with two large oval terminal photophores, which are covered by black eyelid-like skin folds that allow for the controlled flashing of each photophore. Another pair of photophores is embedded on each side of the ink sac. Tentacles are robust on paralarvae but are

lost at a dorsal mantle length of 40 to 45 mm (Jereb & Roper 2010).

This species has a cosmopolitan distribution, being more abundant in tropical and temperate waters, but has also been observed in boreal areas, e.g. 57° N in the NE Atlantic. Paralarval and juvenile individuals of *T. danae* have been caught within Scottish waters (Santos et al. 2001), the North Atlantic Ocean (Clarke & Lu 1974; Okutani 1974; Lu & Clarke 1975), and off Bermuda, Cape Verde and the Madeira Islands (Roper & Vecchione 1993). In the Pacific Ocean the species has been reported from the Hawaiian Islands and New Zealand (Roper & Vecchione 1993) and in the Mediterranean Sea from Algerian waters (Quetglas et al. 2006). Santos et al. (2001) reported an incomplete adult female caught at 400 m depth by a commercial trawler in Galician waters. Posteriorly, González et al.

(2003) recorded three specimens (two females and a mature male), in the Carrandi fishing ground (Cantabrian sea). A further large specimen (1600 mm ML) was captured at Georges Bank (USA) in the NW Atlantic (Roper & Vecchione 1993). Three living specimens have been video-recorded: two in the Ogasawara Islands' waters (Japan), in the western North Pacific at 240 and 900 m depth (Kubodera et al. 2007) and in the northeast atlantic Lusitanian seamounts southwest of Portugal (Seine Seamount) at 2717 m depth (Gomes-Pereira & Tojeira 2014). Despite the small number of catches of large individuals of *T. danae*, several hundred large beaks have been recorded from sperm whale (*Physeter macrocephalus*) stomach contents, suggesting that it is not a rare deep-sea squid species in tropical and subtropical oceans (e.g. Clarke et al. 1993; Smith & Witehead 2000; Evans & Hindell 2004; Clarke 2006).

In the Canary Islands, previous records of *T. danae* come from beaks found in the stomach contents of three Cuvier's beaked whales (*Ziphius cavirostris*) stranded in Lanzarote and Fuerteventura in 2002 (Santos et al. 2007) and from the stomach contents of a sperm whale stranded in Fuerteventura in 2005 (Fernández et al. 2009). Later, Bordes et al. (2009) reported three juvenile individuals of 30-100 mm ML caught in mesopelagic trawling nets around Gran Canaria and on the south-eastern side of Fuerteventura in 2000 and 2002.

This study reports the occurrence of the first adult deep-sea hooked squid in the Canarian archipelago. The studied specimen was collected off SW Tenerife, confirming the presence of all life stages of this species in Canary waters.

MATERIAL AND METHODS

Fresh remains of a *Taningia danae* specimen were found floating by the whale-watching vessel *Bonadea-II* in the south-western waters of Tenerife on 2 July 2012. The remains were landed in Puerto Colon and transported to the Spanish Oceanographic Institute in Tenerife, where the specimen was kept frozen until later analysis in the laboratory. Wet weights and measurements were recorded before freezing.

RESULTS

The remains consisted of two pieces, one of them with a total weight of 5.470 kg corresponding to the brachial crown with eight arms (Fig. 1a).

External characteristics such as its large size, the lack of tentacles, generalised maroon colour, the presence of two rows of hooks on the arms and the presence of terminal oval photophores on arm pair II, allowed the species to be positively identified.

Left arm I was completely severed at its proximal extreme. Arm pairs II-III and IV were complete.

Tips of both arms II were modified with a broad light organ (Fig. 1b). All arms possessed two rows of strong hooks. The buccal membrane and connectives were complete, with formula DDVV. Two well-developed pockets were found between arm pairs III and IV (Fig. 1c). These symmetrical pockets could be a remnant of the tentacle, which is lost during the juvenile stage.

On the other hand, these pockets could be remnants of healed injuries. Neither head, buccal mass nor beak remained. All arm measurements are shown in Table 1.

The second piece comprised approximately one third of the total mantle with a length of 66.5 cm and weight of 15.699 kg. This piece corresponded to the anterior part of the mantle, containing the funnel on its ventral side. Some remains of the internal organs such as gills, stomach, and oesophagus were found in the mantle cavity. The posterior part had a large semi-circular laceration with a diameter of 20 cm, presumably a shark bite. A tubular olfactory organ (1.2 cm in length) was observed close to the left side of the funnel but was absent on the right side. The funnel cartilage of the locking-apparatus was complete (Fig. 1d). The funnel organ had an inverted V-shaped dorsal pad and oval-shaped ventral pads.

The funnel valve was present and well developed. Shape of a hook removed from arm pair IV is shown in Figure 2.

All biometric measurements are shown in Table 1. Some intramuscularly embedded spermatangia were observed on the edge of the ventral side of the mantle, in proximity to the funnel (Fig. 3),



Fig. 1. a) Brachial crown of *Taningia danae*. b) Light organ on arm tip II. c) Pore between arm pairs III and IV. d) Funnel cartilage.

All biometric measurements are shown in Table 1. Some intramuscularly embedded spermatangia were observed on the edge of the ventral side of the mantle, in proximity to the funnel (Fig. 3), indicating that the specimen was probably a mature female. Implanted spermatangia in the mantle and other body surfaces of *T. danae* have often been reported associated with male-inflicted wounds, probably made by males using their beak or arm hooks (Hoving et al. 2010). We also observed incisions close to the area of embedded spermatangia, supporting this hypothesis.

DISCUSSION

The Canary Islands host a great variety of large cephalopod species, the individuals of which may exceed 1000 mm mantle length such as the giant squid (*Architeuthis dux*), the large cranchid squid (*Megalocranchia oceanica*), the diamond squid (*Thysanoteuthis rhombus*), the neon flying squid hunting strategy appears to be related to large and fast moving prey such as squids (Aguilar-Soto et al. 2008). Unfortunately, the diet of the resident

Table 1. Biometric measurements of *Taningia danae* remains. * severed.

Measures (cm)	
Right arms length	
I	33
II	38.5
III	37.5
IV	35
Mantle length remain	66.5
Funnel length	34
Funnel width	18
Right funnel cartilage length	17
Left funnel cartilage length	17
Weights (kg)	
Mantle remain weight	15.699
Brachial crown weight	5.47
Total remain weight	21.169



Fig. 2. Shape of a hook removed from arms pair IV. Bar scale correspond to 1 cm.

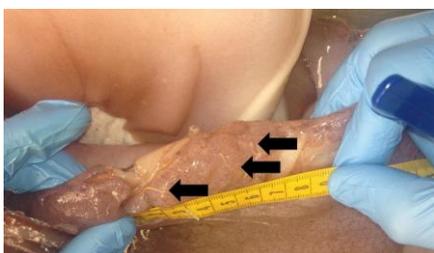


Fig. 3. Spermatangia implanted in the ventral edge of the mantle.

DISCUSSION

(*Ommastrephes bartramii*) and the scaled squid (*Lepidoteuthis grimaldii*) (Bordes et al. 2009; Escanéz et al. 2012; 2017). Adult stages of all of these species have been reported, and mature or maturing females have been recorded. Moreover, remains of *Architeuthis* and *Taningia* specimens have usually been found associated with cetacean frequented areas in the Canarian archipelago.

Whale watching boat skippers that operate off the south-western Tenerife coast have recorded numerous sightings of “giant squid” carcasses, unfortunately the majority of these encounters remain unpublished. The south-western coast of Tenerife Island is a feeding ground for a resident short-finned pilot whale (*Globicephala macrohynchus*) population that inhabits this area throughout the year (Carrillo et al. 2010). Its short-finned pilot whale population of the Canary

archipelago is poorly known, with only three stomachs contents analysed (Hernández-García & Martín 1994; Fernández et al. 2009). The south-western coast of Tenerife is dominated topographically by a deep channel (>3000 m on the southern side and >400 m on the northern side), that separates Tenerife and La Gomera (Guerra et al. 2011) which suggests that some bottom features like submarine channels or canyons provide a suitable habitat for large squids. More research into the frequency and identity of such floating carcasses is needed to verify the unusual importance of large squids in these waters.

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