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First confirmed record of *Tremoctopus violaceus* Delle Chiaje, 1830 (Cephalopoda: Tremoctopodidae) from Maltese waters (Central Mediterranean)

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ABSTRACT

The violet blanket octopus (*Tremoctopus violaceus*) is a rarely encountered argonautid cephalopod with few verified records from the Mediterranean. We report the first confirmed occurrence of *T. violaceus* in Maltese waters since an unverified mention in 1914. A female specimen was recovered from Mellieħa Bay (northern Malta) and identified on the basis of morphological features distinguishing it from the congeneric *Tremoctopus gracilis*. A second female *Tremoctopus* specimen was subsequently documented through photographs, although species-level identification was not possible as the specimen had been discarded. These findings expand knowledge of *Tremoctopus* distribution in the Central Mediterranean and underline the importance of collaboration with artisanal and recreational fishers in detecting rare taxa.

Keywords: Cephalopods, Argonautoidea, Blanket octopus, LEK, Malta

INTRODUCTION

The genus *Tremoctopus* Delle Chiaje, 1830 (family Tremoctopodidae) comprises four species: *T. violaceus* Delle Chiaje, 1830, *T. gracilis* (Souleyet, 1852), *T. gelatus* R.F. Thomas, 1977, and *T. robsonianus* T.W. Kirk, 1884 (WoRMS, 2025). These epipelagic cephalopods, collectively termed "blanket octopuses", exhibit extreme sexual dimorphism: females may reach up to 2 m in total length, while males rarely exceed 5 cm. Females possess an extensive membranous web connecting the dorsal arms, whereas males are characterised by a detachable hectocotylus (Famulari *et al*., 2022; Petrić *et al*., 2023).

Two species occur in the Mediterranean: *T. violaceus*, regarded as native, and *T. gracilis*, generally interpreted as an Indo-Pacific introduction (Relini *et al*., 2004; Agus *et al*., 2022). *T. violaceus* has a subtropical distribution in the Atlantic, Gulf of Mexico, and Caribbean, with sporadic reports from the Mediterranean (Thomas, 1977; Biagi & Bertozzi, 1992; Bello, 1993; Salman *et al*., 2002; Mereu *et al*., 2012; Agus *et al*., 2022; Ergüden & Ayas, 2022; Famulari *et al*., 2022; Battaglia *et al*., 2023; Petrić *et al*., 2023).

Reports from the Central Mediterranean are on the increase, although knowledge of the species' ecology remains limited since most records are based on strandings and a few incidentally collected specimens. This situation is complicated by the difficulty in distinguishing between *T. gracilis* and *T. violaceus* based on morphology, and since collected specimens are usually juvenile females, which tend to be near indistinguishable (Thomas, 1977). Moreover, the web, which includes key diagnostic characters, and the arm extremities, are very fragile and easily damaged. This said, the recent work of Agus *et al*. (2022) and Petrić *et al*. (2023), combining morphological assessment and DNA barcoding of *T. violaceus* specimens, provides valuable taxonomic and morphological reference.

The only previous mention of *T. violaceus* from Malta dates back to Gulia (1914), who, in a general review of the Maltese fauna, just listed this species and others as observed by him; therefore this record is regarded as unverified (Schembri & Schembri, 1997). We here provide the first verified documentation of *T. violaceus* in Maltese waters and also report a second undetermined *Tremoctopus* specimen.

MATERIAL AND METHODS

On 03 July 2025, a recreational freediver recovered a dead female *T. violaceus* from a sandy seabed at 15 m depth in Mellieħa Bay (35.9678 N, 14.3675 E). The partially damaged specimen was fixed in 10% seawater formalin and later examined morphologically and identified following the descriptions by Portmann (1952), Thomas (1977), Jereb *et al*. (2016) and Famulari *et al*. (2022). After blotting dry the specimen, its body weight was taken to the nearest 0.001 g and the beak was carefully extracted. The maturity status of the female was determined using the MEDITS maturity table (MEDITS Working Group, 2017) by dissecting the specimen and examining the gonads under a stereomicroscope. Morphometric measurements were taken from photographs of the preserved specimen using ImageJ (Rasband, 2018), and the same approach was applied for the beak measurements (Table 1), as the specimen was extremely fragile and additional handling risked causing further damage. Shortly after recovery of this specimen, photographs of another *Tremoctopus* individual were posted on social media. We traced the origin of these images but unfortunately, the specimen had been disposed of.

RESULTS AND DISCUSSION

The Mellieħa specimen (Fig. 1a-b) weighed 12.699 g and displayed faded but recognizable coloration, with a light-purple dorsum and a silvery ventral surface. The mantle was muscular, broader than the head. A thin maroon web, which was partly damaged, connected the dorsal and dorsolateral arms and bore a single row of ocelli (Fig. 1c-d), consistent with *T. violaceus* (Portmann, 1952) and distinguishing it from *T. gracilis*, which bears double rows (Relini *et al*., 2004). The ocelli increased in size distally, although one enlarged proximal spot was also present, a feature recently noted in a specimen from the Strait of Messina reported by Famulari *et al*. (2022). Arm length followed the typical sequence of II > I > IV > III (Table 1). Two pairs of oval water pores were present, one pair dorsal and the other ventral at the base of the dorsal arms (Fig. 1a-b). The radula had seven teeth in each transverse row with tricuspid rachidian teeth (A2 seriation) and long, slender

marginal teeth (Fig. 1e). The specimen was determined to be immature (Stage 1) with a semi-transparent, stringy ovary lacking granular structure, absence of eggs, and small, translucid nidamental glands. This is in agreement with Thomas (1977) who states that females with mantle length from 25 to 80 mm are considered juvenile, having attained adult proportions, but are still sexually immature.

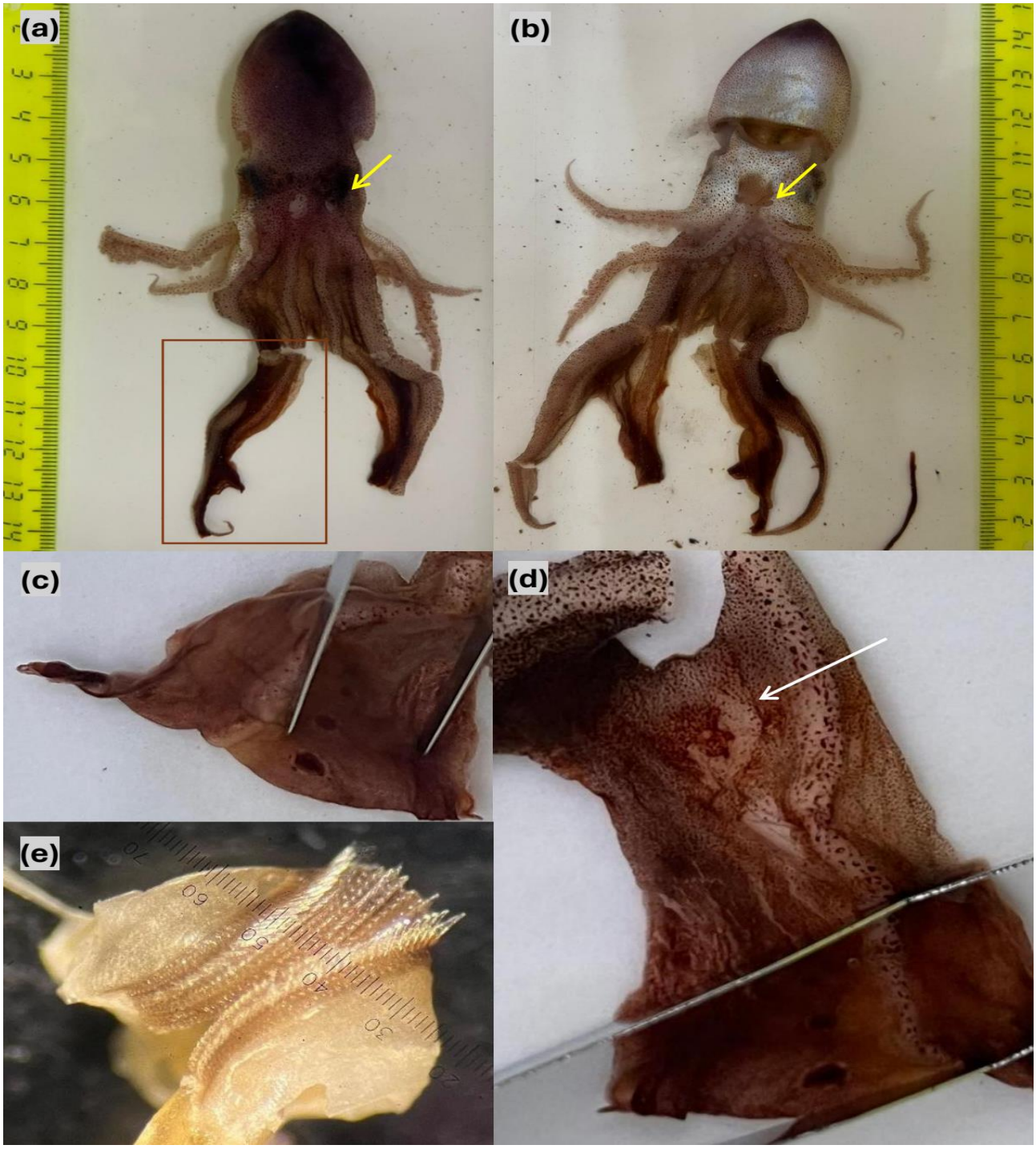

Figure 1. (a) dorsal and (b) ventral view of the female *T. violaceus* specimen. The yellow arrows indicate the two pairs of dorsal and ventral water pores. The red box shows the area of the dorsal web photographed in (c) and (d), which show the ocelli. The white arrow in (d) shows the enlarged proximal spot. (e) radula. (scale: 10 units = 1 mm)

Table 1. Morphological measurements of the female *T. violaceus* specimen

Morphological features	**Measurement (mm)**
Dorsal mantle length	38
Mantle width	28
Head length	18
Head width	21
Ventral siphon length	8
Ventral siphon width	5
Total length	139
Arm I length (left/right)	*/79
Arm II length (left/right)	93/96
Arm III length (left/right)	44/40
Arm IV length (left/right)	56/*
Upper and lower beak	
Hood length (upper/lower)	2.12/1.56
Crest length (upper/lower)	6.74/3.33
Wing length (upper/lower)	4.28/2.65
Beak height (upper/lower)	5.99/*
Base length (lower)	*
Lateral wall (lower)	*

* - denotes that the measurement could not be taken due to damaged structure. All measurements were taken to the nearest mm except for the beak measurements.

Images of a second female *Tremoctopus* were posted on social media shortly after the Mellieħa specimen described, was collected. We traced the origin of these images and contacted the author for details. The octopus was captured on 30 August 2025, from off the south-east coast of Malta at approximate location 35.8148 N, 14.5549 E, at a depth of 3 m, over >50 m bottom. The specimen measured ~30 cm total length and weighed ~1.5 kg (Fig. 2). Unfortunately, the specimen had been discarded so identification was based solely on the images taken (Fig. 2). While it was clear that this was a female *Tremoctopus*, the species could not be determined as the diagnostic characters present on the mantle were not photographed. However, there are some indications that this specimen might not have been *T. violaceus* as in images that show part of the underside of the web, the chromatic pattern appears to be of groups of spots (Fig. 2b), a feature more characteristic of *T. gracilis* than *T. violaceus* (Relini, 2009). We consider the identity of this second specimen as undetermined and refer to it as *Tremoctopus* sp.

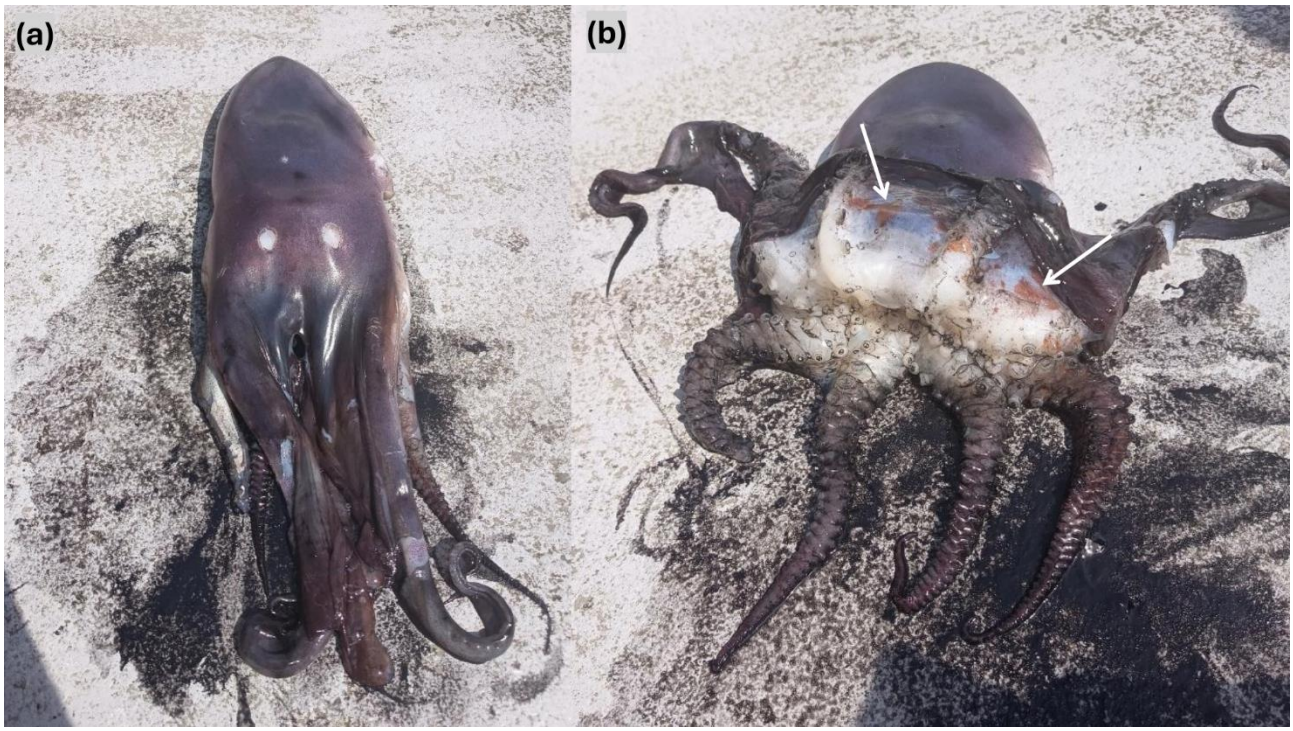

Figure 2. (a-b) Photos of the second *Tremoctopus* sp. recorded from Maltese waters in August 2025. (a) shows the specimen in dorsal view and (b) shows an oblique oral view with the dorsal arms and web partly folded over the head. The white arrows show the irregular groups of spots on the underside of the web. The specimen was ca 30 cm long. Images courtesy of Arnold Magro

Both records occurred in summer, aligning with seasonal patterns observed elsewhere in the Mediterranean (Petrić *et al*., 2023). The apparent rarity of *Tremoctopus* spp. may reflect a combination of genuine scarcity and under-reporting. In the Central Mediterranean, records of *T. violaceus* have increased in recent decades (Biagi & Bertozzi, 1992; Mereu *et al*., 2012; Agus *et al*., 2022; Famulari *et al*., 2022; Battaglia *et al*., 2023; Petrić *et al*., 2023) although whether this reflects population expansion, climate-driven shifts, or improved reporting remains unclear.

To tap local ecological knowledge (LEK) on the occurrence of species of *Tremoctopus* in Maltese waters, photographs of *T. violaceus* and other similar-looking octopods have been showed to ten local veteran artisanal fishers from Marsaxlokk, the main fishing village in Malta, each with over 50 years of experience, and asked if they had encountered such species. Eight did not know the species or confused it with *Argonauta argo* and *Eledone* spp. The other two reported encountering *Tremoctopus*, once in 2022 when fishing with bottom longlines, and more than once, but very rarely, when trawling for shrimp between 2010-2015. Encounters during trawling or longlining, suggest occasional benthic interactions despite the genus' epipelagic habits. The fact that 20% of interviewed fishers had encountered *Tremoctopus* sp. indicates it may be less rare than literature suggests, although careful species-level verification remains essential. The concentration of these observations within the past 15 years may indicate increased occurrence, potentially linked to warming seas, given the thermophilic affinity of the group.

Often, rare and poorly documented species such as *Tremoctopus* spp. are collected by fishers and later handed over to scientists (Agus *et al*., 2022; Battaglia *et al*., 2023; Petrić *et al*., 2023). However, based on available

literature, no studies from the Mediterranean Sea appear to have investigated fishers' local and traditional ecological knowledge (LEK and TEK). Biagi & Bertolozzi (1992) reports that fishers consumed 10 to 20 subadult females of *T. violaceus* across just 20 days of fishing, which highlights the importance of exploring such knowledge. During conversation with the Maltese fishers, some mentioned the unappetising appearance of the species and therefore its absence from the market, consistent with Biagi & Bertolozzi′s (1992) observations. These fishers reported that when encountered, specimens were discarded at sea (personal communications, 2025). Evidently, LEK plays a critical role in advancing research on cephalopods, as fishers and other sea-users often possess first-hand, long-term observations that can reveal seasonal occurrence patterns, habitat preferences, and behavioural traits not easily captured by conventional scientific surveys. Their anecdotal records and practical experience provide valuable context for interpreting sporadic scientific sightings, enabling researchers to complement formal scientific studies. Integrating LEK into cephalopod research not only enriches baseline data but also fosters collaborative science that bridges traditional ecological knowledge with modern methodologies, ultimately improving knowledge of elusive marine species.

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Prvi potvrđeni nalaz vrste *Tremoctopus violaceus* Delle Chiaje, 1830 (Cephalopoda: Tremoctopodidae) u malteškim vodama (centralni Mediteran)

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SAŽETAK

Bobuljak (*Tremoctopus violaceus*) je rijetko zabilježeni argonautidni glavonožac sa malim brojem potvrđenih nalaza u Mediteranu. U ovom radu je predstavljen prvi potvrđeni nalaz vrste *T. violaceus* u malteškim vodama još od nesigurnog nalaza iz 1914. godine. Jedna jedinka ženskog pola je pronađena u zalivu Melieha (severna Malta) i identifikovana je na osnovu morfoloških karakteristika po kojima se razlikuje od srodne vrste *Tremoctopus gracilis*. Druga jedinka, takođe ženskog pola, roda *Tremoctopus* je naknadno dokumentovana putem fotografija, ali identifikacija do nivoa vrste nije bila moguća jer je jedinka odbačena. Ovi nalazi proširuju znanja o rasprostranjenju roda *Tremoctopus* u centralnom Mediteranu i naglašavaju značaj saradnje sa ribarima iz malog obalnog ribolova i rekreativnim ribarima u identifikaciji rijetkih taksona.

Ključne riječi: Glavonošci, Argonautoidea, bobuljak, lokalno ekološko znanje, Malta