

RESEARCH ARTICLE

New records of siphonophores and ctenophores in the Levant Sea

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Abstract

We present new records of siphonophores and ctenophores observed in the Levant Basin, Mediterranean Sea: *Rhizophysa filiformis* and *Ocyropsis maculata immaculata* are new records for the eastern Mediterranean, *Cestum veneris* for both Israel and the Turkish Levantine coast, and *Leucothea multicornis* for Turkish waters. A siphosomal fragment of a physonect siphonophore is identified as *Apolemia* sp., and a calycofhorid prayomorph provisionally identified as *Praya* sp. The recent increase in gelatinous zooplankton sightings in the easternmost region of the Mediterranean Sea is discussed.

Keywords: *Cestum veneris*, *Leucothea multicornis*, *Ocyropsis maculata immaculata*, *Rhizophysa filiformis*, *Apolemia* sp., *Praya* sp.

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Introduction

For much of the previous century little attention had been paid siphonophores and ctenophores in the Levant Sea. However, in the 1980s the rapid spread and injurious impacts of the invasive rhizostomid scyphozoan *Rhopilema nomadica* in the eastern and central Mediterranean, and the lobate ctenophore *Mnemiopsis leidyi* in the Black Sea and its subsequent introduction into the Mediterranean, helped raise awareness of the impacts of gelatinous organisms (Galil and Goren 2014; Shiganova *et al.* 2019). Recognizing the importance of monitoring, a network of researchers, lifeguards, commercial fishermen, environmental wardens, and recreational divers joined in 2001 the Mediterranean-wide JellyWatch Program (<http://www.ciesm.org/marine/programs/jellywatch.htm>, accessed 20 May 2020). These surveys proved to be a useful tool for monitoring

the occurrence of inshore gelatinous species, both native and non-native, especially since siphonophore and ctenophore records were few - mangled by conventional sampling devices and preservation methodology and overlooked through lack of regional taxonomic expertise. The reshaping of our knowledge concerning the Levantine gelatinous biota owes much to the advent of accessible gear that have drawn research and recreational divers to underwater photography.

We present recent photography-based records of siphonophores and ctenophores observed off the Mediterranean coasts of Turkey and Israel: *Rhizophysa filiformis* and *Ocyropsis maculata immaculata* are newly recorded in the eastern Mediterranean, *Leucothea multicornis* in Turkish waters, and *Cestum veneris* in the Levant Sea (Figure 1). A siphosomal fragment of a physonect siphonophore is identified as *Apolemia* sp., and a calycofhorid prayomorph provisionally identified as *Praya* sp.

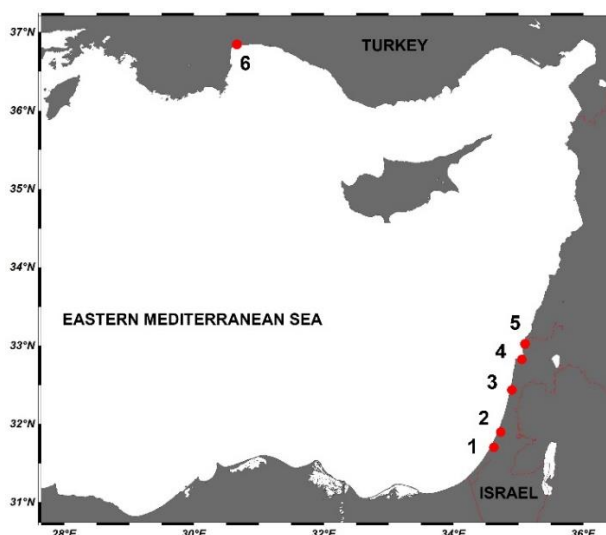


Figure 1. Map of the locations where the siphonophores and ctenophores were sighted. 1. Ashdod, 2. Yavne, 3. Mikhmoret, 4. Haifa Bay, 5. Nahariya, 6. Gulf of Antalya

Systematics

Phylum CNIDARIA Hatschek, 1888
Order SIPHONOPHORAE Eschscholtz, 1829
Suborder CYSTONECTAE Haeckel, 1887
Family RHIZOPHYSIDAE Brandt, 1835
Genus *Rhizophysa* Péron and Lesueur, 1807
Rhizophysa filiformis (Forsskål, 1775)
(Figure 2)



Figure 2. *Rhizophysa filiformis* (Forsskål, 1775). Israel, Mikhmoret, 12 April 2018
(Photograph: S. Chaikin)

Material examined

Mediterranean Sea: Israel, Mikhmoret, near fish cages at water depth 30 m, a single individual, about 20 cm in length, 12 April 2018, observed and photographed by S. Chaikin; Ashdod port breakwater, water depth 15-20 m, a single individual, about 5 cm in length when contracted, 24 November 2018, observed by R. Gevili; Haifa Bay, 6 m depth, 23 October 2019, observed and photographed by M. Mendelsohn. The voucher photographs were deposited in the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

Chaikin and Gevili (pers. com.) remarked on the painfully stinging sensation delivered by *R. filiformis*.

Rhizophysa filiformis is considered uncommon yet widely distributed in the world oceans and present in the western Mediterranean (Pagès and Gili 1992; Bouillon *et al.* 2004). Three specimens were collected in the southern Alboran Sea in 1991, at depths ranging from 706-833 m (Mills *et al.* 1996), but nowhere else in the Mediterranean Sea. A pair of surveys of the Levantine zooplankton conducted in the late 1960s failed to collect the species (Alvariño 1974; Kimor and Wood 1975). The present records from the southern Levant Sea are the first to document its presence in the eastern Mediterranean, and may indicate the existence of a sparse, cryptic, self-propagating population off the Israeli coast.

Suborder CALYCOPHORAE Leuckart, 1854
Family PRAYIDAE K lliker, 1853
Genus *Praya* Quoy and Gaimard in de Blainville, 1834
Praya sp.
(Figure 3)

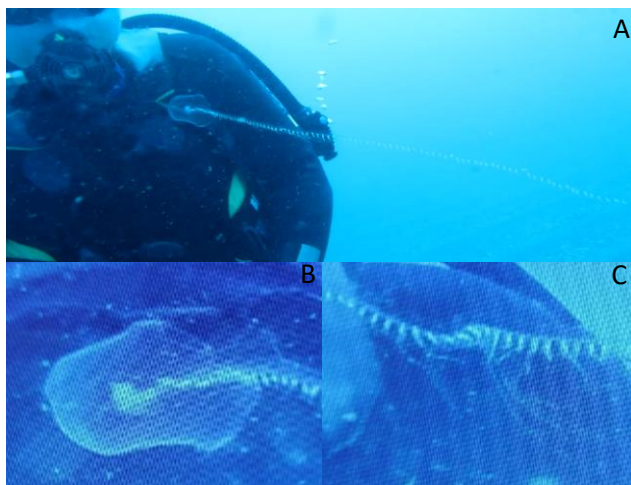


Figure 3. *Praya* sp. Turkey, Gulf of Antalya, 15 April 2018; **A.** entire individual, **B.** nectophores, **C.** siphosome bearing cormidia with extended tentacles (Photograph: M. Gokoglu)

Material examined

Mediterranean Sea: Turkey, Gulf of Antalya, near old harbor, water depth 6-8 m, a single individual, 15 April 2018. A specimen was observed and photographed, though not collected. The voucher photographs were deposited in the senior author's collection and the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

The recorded specimen (Figures 3A-C) was a typical prayomorph with an apposed pair of rounded nectophores and a very long siphosome bearing dozens of cormidia with extended tentacles. Yet, identification would wait until a specimen is available for thorough morphological and molecular analysis.

Suborder PHYSONECTAE Haeckel, 1888
Family APOLEMIIDAE Huxley, 1859
Genus *Apolemia* Eschscholtz, 1829
Apolemia sp.
(Figure 4)

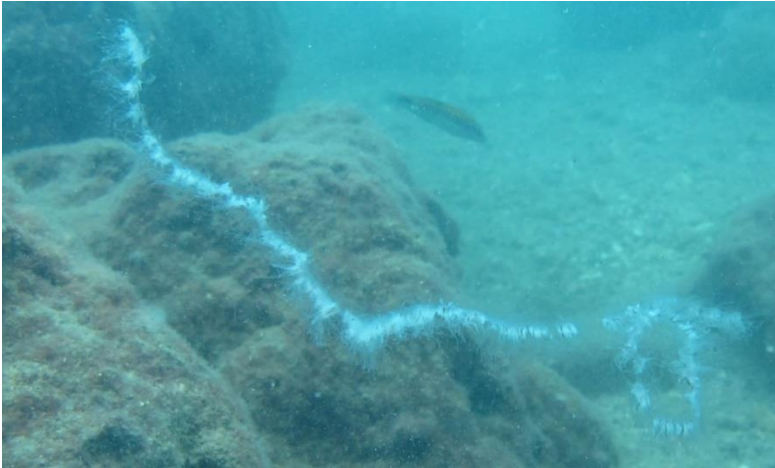


Figure 4. *Apolemia* sp. Turkey, Gulf of Antalya, 15 April 2018
(Photograph: M. Gokoglu)

Material examined

Mediterranean Sea: Turkey, Gulf of Antalya, near old harbor, water depth 6-8 m, a single individual, 15 April 2018. Specimens were observed and photographed, though not collected. The voucher photographs were deposited in the senior author's collection and the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

The physonect siphonophore *Apolemia uvaria* (Lesueur, 1815) is the only apolemiid species recorded in the Mediterranean Sea (Bouillon *et al.* 2004). It was collected by both surveys of the Levantine zooplankton conducted in the late 1960s (Alvariño 1974: figure 7; Kimor and Wood 1975), but not Turkish waters. Apolemiids break apart easily, the nectosome detaching from the siphosome, leaving the siphosomal stem adrift (Hiscock *et al.* 2010, figures 1, 2). It is tempting to identify the siphosomal fragment consisting of groups of cormidia separated by bare stem as *A. uvaria*. Yet, Siebert *et al.* (2013) considered the apolemiids “among the most poorly known groups of siphonophores”, and Mapstone *et al.* (2014, Table 4) acknowledged that “A number of other species are known to exist and await full description”. Until such time, we consider it prudent to refrain from naming the species.

Phylum CTENOPHORA Eschscholtz, 1829
Order CESTIDA Gegenbaur, 1856
Family CESTIDAE Gegenbaur, 1856
Genus *Cestum* Lesueur, 1813
Cestum veneris Lesueur, 1813
(Figure 5)



Figure 5. *Cestum veneris* Lesueur, 1813. Israel, Nahariya, 30 April 2016
(Photograph: S. B-S. Rothman)

Material examined

Mediterranean Sea: Israel, off Nahariya, water depth 10-20 m, 30 April 2016, 28 April 2020. Turkey, Gulf of Antalya, water depth 10-12 m, several individuals, 10-20 m apart, 18 March 2020. Specimens were observed and photographed, though not collected. The voucher photographs were deposited in the senior author's collection and the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

Described from a specimen collected in shallow waters off Nice, France, in 1809 (Lesueur, 1813) Venus' girdle, *Cestum veneris*, is widely distributed in tropical and subtropical seas worldwide. Though known for occasional swarming and massive stranding in the western Mediterranean and Adriatic Sea (Lesueur 1813; Benovic and Lucic 2001), it has seldom been recorded in the eastern Mediterranean. Gulsahin and Tarkan (2013) documented the species' presence (September 2011-October 2012) in Gokova Bay, on the southeast Aegean coast of Turkey, Topcu *et al.* (2017) observed a single specimen in May 2015, off Doğanbey, on the central Aegean coast of Turkey, and Çinar *et al.* (2014) list the species from the Levantine coast, *vide* Gözcelioğlu (2011). This is the first verified record of *C. veneris* from the Levant Sea.

Order LOBATA Eschscholtz, 1825
Family LEUCOTHEIDAE Krumbach, 1925
Genus *Leucothea* Mertens, 1833
Leucothea multicornis (Quoy and Gaimard, 1825)
(Figure 6)



Figure 6. *Leucothea multicornis* (Quoy & Gaimard, 1825). Turkey, Gulf of Antalya, 18 March 2020 (Photograph: M. Gokoglu)

Material examined

Mediterranean Sea: Turkey, Gulf of Antalya, water depth 10-12 m, several individuals, 40-50 m apart, 18 March 2020. Specimens were observed and photographed, though not collected. The voucher photographs were deposited in the senior author's collection and the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

The warty comb jelly, *Leucothea multicornis* is widely distributed in subtropical and temperate waters (Oliveira and Migotto 2006). Though recorded multiple times in the western and central Mediterranean Sea, only in 2014, on different dates and locations, were specimens of *L. multicornis* noted along the Israeli coastline, that being the first record of the species in the eastern basin (Galil *et al.* 2014b). Recently in December 2018-April 2019, the species was observed off the Syrian coast (Mamish *et al.* 2019), and in July 2019, off Kefalonia I., Greece (Digenis and Gerovasileiou 2020). The presented photograph is the first documented record off the Turkish coastline and fills the distribution gap between the northern Levant Sea and the eastern Ionian.

Family OCYROPSIDAE Harbison and Madin, 1982

Genus *Ocyropsis* Mayer, 1912

Ocyropsis maculata immaculata Harbison and Miller, 1986

(Figure 7)

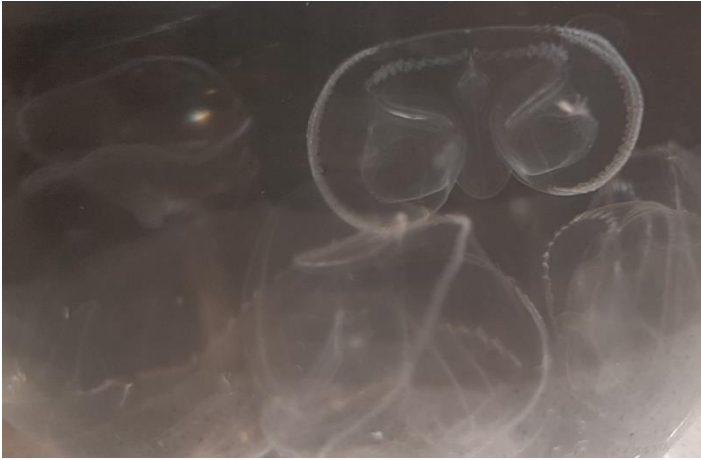


Figure 7. *Ocyropsis maculata immaculata* Harbison & Miller, 1986. Israel, Yavne, September 2019 (Photograph: R. Gevili)

Material examined

Mediterranean Sea: Israel, Yavne, water depth 15 m, aggregation of individuals, September 2019. Specimens were observed and photographed by R. Gevili. The voucher photographs were deposited in the Steinhardt National Natural History Museum and Research Center, Tel Aviv University, Israel.

Remarks

Gevili (pers. comm) remarked on the lively thrashing movements of the specimens' oral lobes, similar to the observations documented by Harbison and Miller (1986).

Harbison and Miller (1986) considered *O. maculata immaculata* to be widely distributed in the tropical Atlantic and Pacific oceans. Eleven specimens of the subspecies were collected in the southern Alboran Sea in 1991 (Mills *et al.* 1996), but nowhere else in the Mediterranean Sea. The present record from the southern Levant Sea is the first to document its presence in the eastern Mediterranean, and may indicate the existence of a locally established population.

Discussion

In addition to decades-old regional hydrological changes (construction of the Aswan High Dam, diversion of many coastal streams), the Levant shelf has been subjected to ever-increasing multiple pressures stemming from rapid population growth and urbanization, coastal infrastructure, intensive agriculture and industrial activities. Residential, agricultural and industrial discharges contribute nutrients, heavy metals and toxic organic compounds through point (e.g. streams and outfalls) and non-point sources (agricultural runoff). The Levantine surficial

water mass (0-50 m), already characterized by the highest temperature in the Mediterranean Sea, has displayed long-term increase in temperature of $+0.12 \pm 0.07^{\circ}\text{C year}^{-1}$ (Ozer *et al.* 2017). The Levantine shelf, located down-current of the Suez Canal opening into the Mediterranean Sea, is under intense propagule pressure and consequently hosts the highest number of recorded non-native species in the Mediterranean Sea (Cinar *et al.* 2011; Galil *et al.* 2014a, 2018). The intensification of these anthropogenic activities has driven complex and fundamental alterations to the Levantine shelf ecosystem. Discussing the dynamics of jellyfish populations in the Mediterranean Sea, Brotz and Pauly (2012) postulated that man-induced changes to the marine environment appear to impact dynamics of both native and non-native cnidarian and ctenophoran populations. These changes tend to be more intense in the shallow neritic zone.

The long-term surveys of siphonophores and ctenophores from Levantine inshore waters (Lakkis and Zeidane 1995 (between 1969 and 1994); Zakaria 2006 (1966, 1970-71, 1984-85, 2000-01) failed to capture the species listed herein, possibly due to employment of standard plankton nets. Yet, assessing the bountiful crop of newly recorded cnidarians, ctenophorans and siphonophores along the Levant coastline published during a recent decade (Galil *et al.* 2009a, b, 2010, 2011, 2014b, 2017; Cevik *e al.* 2011; Durgham, 2011; Mamish *et al.* 2012, 2016, 2019; Galil and Gevili 2013; Siokou *et al.* 2013; Çinar *et al.*, 2014; Dalianis *et al.* 2016; Durgham *et al.* 2016), we propose that the inshore gelatinous populations did change since those earlier surveys. These changes may be attributed to the fast changing shelf environment and biota, as it is unlikely that relatively large organisms, markedly different from all commonly encountered species in shallow waters, would remain unnoticed for long.

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Doğ u Akdeniz'de (Levant Denizi) sifonofor ve kteneforların yeni kayıtları

Öz

Bu makalede, Akdeniz'in Levant havzasında sifonofor ve ktenefor gözlemleri ve yeni kayıtları sunulmaktadır. *Rhizophysa filiformis* ve *Ocyropsis maculata immaculata* doğ u Akdeniz, *Cestum veneris* hem İsrail hem de Türkiye suları, *Leucothea multicornis* Türkiye suları için yeni kayıtlardır. Bir physonect sifonoforunun, bir sifozomal parçası *Apolemia* sp., bir kalkophoridprayomorph *Praya* sp., olarak tanımlanmıştır. Akdeniz'in doğ u bölgesinde görülen jelatinimsi zooplanktonlardaki son artışların olası önemi bu makalede tartışılmaktadır.

Anahtar kelimeler: *Cestum veneris*, *Leucothea multicornis*, *Ocyropsis maculata immaculata*, *Rhizophysa filiformis*, *Apolemia* sp., *Praya* sp.

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