



First Observation of the Nocturnal Cleaning Relationship between Common Octopus *Octopus vulgaris* (Cuvier, 1797), and Indo-Pacific Palaemonid Shrimp, *Urocaridella pulchella* Yokeş & Galil, 2006 from the Iskenderun Bay, Eastern Mediterranean Coast of Turkey

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Abstract

During a Scuba survey in Iskenderun Bay at night time on November 2018, a female *Urocaridella pulchella* individual was observed with nocturnal cleaning on *Octopus vulgaris* at 16 m in depth. Some photos of the shrimp and its symbiont were taken. Although the nocturnal cleaning relationship between *U. pulchella* and various marine species has been reported in some studies, the nocturnal cleaning relationship between *O. vulgaris* and *U. pulchella* has been observed for the first time. In addition, in the present study, we first reported Indo-Pacific palaemonid shrimp *U. pulchella* which was encountered in its natural habitat during an underwater observation from Iskenderun Bay, and this report is the first observation for this area and fills a gap in the distribution range of this species.

Keywords: eastern Mediterranean, Iskenderun coast, nocturnal cleaning, Palaemonidae, Turkey.

1. Introduction

Cleaning symbiosis is considered mutualistic interaction under symbiosis. Cleaning symbiosis has been extensively documented in the marine environment over the past 55 years (Vaughan et al., 2016). Cleaning symbiosis was first defined by Feder (1966) as removing ectoparasites, bacteria, diseased and injured tissue, and unwanted food particles by cleaner organisms from host creatures.

The common octopus, *Octopus vulgaris* (Cuvier, 1797) is belonging to the Octopodidae family. This species is distributed worldwide and is found in tropical, subtropical, and temperate waters between the surface and at a depth of 200 meters (Roper et al., 1984). *O. vulgaris* is found in the Northeast Atlantic, Mediterranean, and western Atlantic (the Caribbean Sea and northern South America), South Africa, India, and East Asia (Norman et al., 2014). *O. vulgaris* is the best known of all octopus species. They commonly live in coastal waters and the upper part of the continental shelf. They are active predators that primarily feed on crustaceans, fish, mollusks, and polychaetes (Forsythe and Hanlon, 1997; Boyle and Rodhouse, 2005; García and Valverde, 2006).

Indo-Pacific shrimp *Urocaridella pulchella* Yokeş and Galil, 2006, is a Lessepsian migrant to the eastern Mediterranean Sea (Yokes and Galil 2006; Katsanevakis et al., 2020a), belonging to the Palaemonidae family, is a common

species in the Indo-Pacific region. However, information about the palaemonid genus *Urocaridella* is still limited (Đuriš, 2017). This species has been first time reported from the Kaş Peninsula coast (the southern part of Turkey) by Yokes and Galil (2006), and also it is the first representative of this genus from the Mediterranean Sea. Further reports of the occurrence of the species in the Mediterranean Sea was made from the Red Sea-Saudi Arabia (Đuriš, 2017), from Egypt (Horká et al., 2018), from Israel (Katsanevakis et al., 2020a), and Greece (Zenetos et al., 2018; Katsanevakis et al., 2020b; Digenis et al., 2021).

Cleaner shrimp *U. pulchella* shares a nocturnal cleaning symbiont relationship with various organisms in reef systems (Côté, 2000). They are also known as a cleaner and clean parasite of other organisms. This shrimp species is called cleaner shrimp because they exhibit a cleaning symbiosis with client marine creatures where the shrimp clean parasites from the marine creatures.

The present study is the first to report a symbiotic relationship between *O. vulgaris* and *U. pulchella* in Iskenderun Bay. Besides, this report is the first visual observation for this area and fills a gap in this species' distribution range.

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2. Material and Methods

2.1. Study area

Iskenderun Bay has a very high potential for fisheries. Iskenderun Bay is located at the Northeastern-Mediterranean Sea with an area of approximately 2275 km², and a width is 35 km. The Bay has a very wide continental shelf and the depth within this region does not exceed 90 m (Erguden and Turan, 2013). The base structure of the western parts of the Iskenderun Bay is mostly sandy and muddy, while the eastern parts have a more rocky habitat. Although several streams in the surrounding coastline, the most important fresh-water supplies into Iskenderun Bay is from the Asi and Ceyhan River. Therefore, this area is rich in biodiversity and fisheries

resources. In addition, a large increase in the number of alien species has been observed in this region in recent years.

On 29th November 2018, a female individual of *U. pulchella* was observed with *O. vulgaris* in a rocky crevice in the Iskenderun Bay (Keldag) at 16 m in depth during the night dive (Fig. 1). The nocturnal cleaning event between *U. pulchella* and *O. vulgaris* was recorded with photos and video using a digital underwater camera. Identification for *U. pulchella* was carried out using the information provided in Yokes & Galil (2006). Identification for *O. vulgaris* was made according to Sweeney et al. (1992). The distribution of *U. pulchella* in the Mediterranean is given in Fig. 2 according to previous capture records and the current report of Iskenderun Bay.



Figure 1. The nocturnal cleaning relationship between *O. vulgaris* and *U. pulchella* (female) in the Iskenderun Bay (Photo: Necdet Uyğur).



Figure 2. Map showing the capture areas of *Urocaridella pulchella* in the Mediterranean Sea. ▲, Previous record; ●, Present record; 1-2, Kas, Turkey 3-4-5, central and northern Israel; 6, Rhodes Island (Aegean Sea), Greece; 7, Coast of Cyclades, Greece; 8, southern Crete, Greece; 9, Kaş, Turkey; 10, Keldag, Iskenderun Bay, Turkey.

3. Result and Discussion

The carapace of *U. pulchella* is laterally compressed, transparent, and smooth with small red spots at the abdomen. Eye large and globular. Antennal scale broad, well-developed. Also, the anterolateral margin of the carapace rounded. A red bar across is found third abdominal segment. Uropodal exopods striped red and white. The rostrum is white and banded with red subterminally. Pereopods are also white, banded with red. The photographs of *U. pulchella* in the current Mediterranean sample are identical to the color patterns described by Yokes and Galil (2006). The previous scientific reports of the *U. pulchella* from the Mediterranean Sea are given in Table 1 together with the findings of the present study.

Cleaner organisms are considered in the majority of the literature as either obligate or facultative. This term namely as cleaning symbiosis is defined as the interaction to clean or to be cleaned, either through assertion or submission, resulting in cleaning through cooperation (Feder, 1966; Vaughan et al., 2017). Vaughan et al. (2017) expressed that cleaning symbiosis as a collaborative cross-species behavior in which a cleaner remove and consumes materials that negatively affect the customer and precede their interaction. In this mutual collaboration, the marine creatures benefit by having parasites removed from them, and the shrimp gain the nutritional value of the parasites. The shrimp also eats the mucus and parasites around the injured fish's wounds, reducing infections and healing.

Table 1

Visual observation records of *Urocaridella pulchella* from the Mediterranean Sea covering the period 2003-2020.

References	Number of Samples	Record Date	Location	Habitat	Cleaning Interactions	Depth (m)
Yokes and Galil (2006)	2	Aug. 2003 Nov. 2003	Güvercin Ada, Kaş, Mediterranean Sea, Turkey	Rocky bottom	Free movement Moray eel	12/10-15
Horka (2018)	1	2018	Egyptian waters, Egypt	-	Fimbriated moray	-
Katsanevakis et al. (2020a)	1	2014	Naharriya (northern Israel), Israel	Rocky reef	Free movement	-
	1	2015	Tel Aviv beach (central region of Israel)	-	Free movement	-
	3♀-2♂*	2016	Akhziv reservoir (northern Israel), Israel	-	Free movement	20
Digenis et al. (2021)	1♂	2020	Kastelorizo Island, Rhodes Pantieronisi	Marine caves	Free movement	12
	1♀	2020	Island, Cyclades, Greece	Marine caves	Free movement	14
	2	2020	Plakias area, southern Crete, Greece	Marine caves	Mediterranean moray	15
Present study	1♀	Nov. 2018	Cevlik (Keldağ), Iskenderun Bay, Eastern Mediterranean, Turkey	Rocky bottom	Common octopus	16

*♀; female, ♂; male

Many fish species use cleaning stations to remove ectoparasites by cleaner shrimps or fish (Cote, 2000; Bonaldo et al. 2015, Bshary and Schäffer, 2002; Chapuis and Bshary, 2009; Vaughan et al., 2016, Bos & Fransen 2018). In this way, cleaner fishes and shrimp obtain their food from cleaning and the wider environment.

Cleaner shrimps may have equally critical ecological roles to cleaner marine organisms (Becker & Grutter, 2004). These nocturnal cleaner shrimps, usually found in small

groups, in shallow water reef substrates and crevices (Anker and De Grave, 2016; Prakash and Baeza, 2018) and they are quite common occurring in small groups of five to six individuals. Bos and Fransen (2008) observed that the cleaner shrimp *U. antonbruunii* cleans a sleeping fish at night to avoid competition with other cleaners during the day. Similarly, Digenis et al. (2021) observed and reported that two *U. pulchella* individuals cleaning the Mediterranean moray *Muraena helena* at night in a crevice of Plakias area from southern Crete (Greece). However, in this study, it was

determined for the first time that common octopus receive this service from a cleaner shrimp at night time. According to the video record, the cleaner shrimp started cleaning the skin after getting on the octopus and continued to do so for about 5 minutes at dark.

Common octopus, *O. vulgaris* is classified as a nocturnal species in the Mediterranean (Meisel et al. 2003, de Beer & Potts 2013); therefore, the night cleansing event can be said to stem from the preference of symbiont. Cleaner shrimp tends to clean the common octopus at night because of avoiding competition with other cleaners or the preference for a symbiont. Baeza (2009) stated that for some shrimps, there is a possibility of symbiotic or free life equally or similar to the ancestral lifestyle.

4. Conclusion

Although the nocturnal cleaning relationship between *U. pulchella* and various marine species has been reported in some previous Mediterranean studies (Yokes and Galil, 2006; Horka et al., 2018; Digenis et al., 2021), the nocturnal cleaning relationship between *O. vulgaris* and *U. pulchella* has been observed for the first time. Besides, in this study, the existence of *U. pulchella* from Turkey's northeastern Mediterranean coast for the first time is reported together with a night cleaning sample of this species during underwater observation from Iskenderun Bay. Moreover, we also see that a new locality of the Indo-Pacific palaemonid shrimp in the Mediterranean coast of Turkey, and it's expanded to range extension of the west to the east side.

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