

**SHORT COMMUNICATION**

**First record of pearlfish (*Carapus acus*) in the western Algerian coast**

**Karim Mezali\*, Ihcene Khodja**

**ORCID IDs:** K.M. 0000-0002-7222-9002; I.K. 0000-0003-3905-974X

Protection, Valorization of Coastal Marine Resources and Molecular Systematics Laboratory, Department of Marine Science and Aquaculture, Faculty of Natural Sciences and Life, Abdelhamid Ibn Badis University - Mostaganem, PO Box 227, Route nationale N° 11, Kharrouba, 27000, Mostaganem, ALGERIA

**\*Corresponding author:** karim.mezali@univ-mosta.dz

---

**Abstract**

Commensalism between the pearlfish *Carapus acus* and the holothurian *Parastichopus regalis* is one of the most common associations between vertebrate and an invertebrate in the Mediterranean Sea. Seven individuals of *Carapus acus* were found inside the *Parastichopus regalis* coelomic cavity at three stations off the western Algerian coast with a depth of between 53 and 117 m. The wet weight of these individuals varied from 1.24 to 4.11 g and the total length from 12.30 to 16.60 cm. These values and other morphometric characteristics of *C. acus* individuals were compared with those reported on the Tunisian and Moroccan coasts.

**Keywords:** Carapidae, Stichopodidae, commensalism, morphometrics, Algeria

**Received:** 30.03.2021, **Accepted:** 27.07.2021

---

Echinoderms are infested by several organisms including bacteria, protozoa, plathelminths, annelids, molluscs, arthropods and fish. Fishes includes the species of Carapidae which consists of three genera (*Onuxodon*, *Carapus* and *Encheliophis*) (Eeckhaut *et al.* 2004). The species of the first two genera are commensals. They use respiratory trees, or holothurians coelomic cavity, as shelters they leave when looking for food. It causes only minor injuries such as the piercing the digestive wall when entering and leaving (Mezali 1998; Parmentier *et al.* 2000; Eeckhaut *et al.* 2015), while those of the genus *Encheliophis* are parasites (Parmentier and Das 2004; Parmentier and Michel 2013) that feed on the internal tissues (gonads and respiratory trees) of the host (Arnold 1953). In the Mediterranean Sea, *Carapus acus* (Brünnich, 1768),

commonly known as “pearlfish” (Markle and Olney 1990), is among the species that infest the sea cucumbers. They can live in association with several species of Holothuriida (*Holothuria tubulosa*, *H. poli*, *H. helleri*, *H. sanctori* and *H. stellati*); however, it has a preference for the species of the order Synallactida (*Parastichopus regalis*) (Meyer-Rochow 1977; Mezali 1998; Eeckhaut *et al.* 2004; Parmentier *et al.* 2006). The association between these two organisms is a typical relationship between an invertebrate host and a vertebrate (Trott 1970; 1981). It is common in the Mediterranean as reported in Spain, France, Italy, Sicily, Sardinia, Balearic Islands, Morocco, Tunisia and the Adriatic Sea (Arnold 1956; González-Wangüemert *et al.* 2014; Enajjar and Bradai 2016; El Aamri and Tamsouri 2018; Despalatović *et al.* 2020).

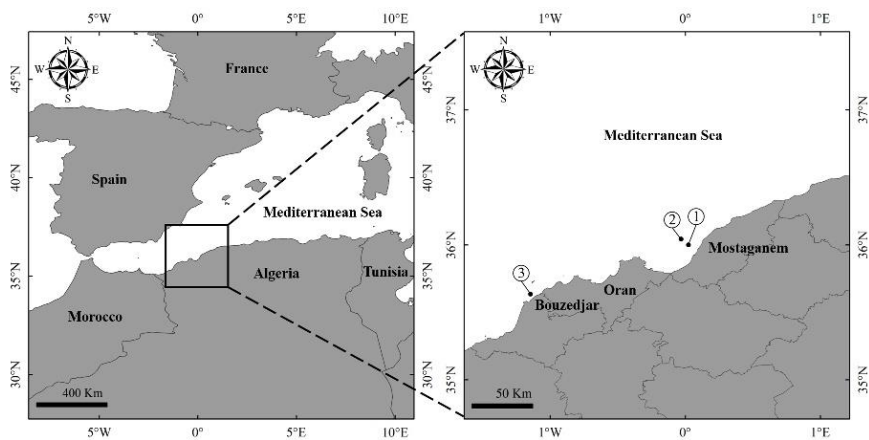
One of the characteristics of sea cucumbers is the production of saponins, which are cytotoxic triterpene glycosides (Kalinin *et al.* 2008). However, the carapid fish are resistant to these toxins (Parmentier and Vandewalle 2005; Eeckhaut *et al.* 2015) due to their ability to produce six to ten times more mucus, functioning as a mechanical barrier against toxins (Brasseur *et al.* 2016).

In our present work, we report for the first time the association of the species *Carapus acus* with its host *Parastichopus regalis* in the western region of the Algerian coast.

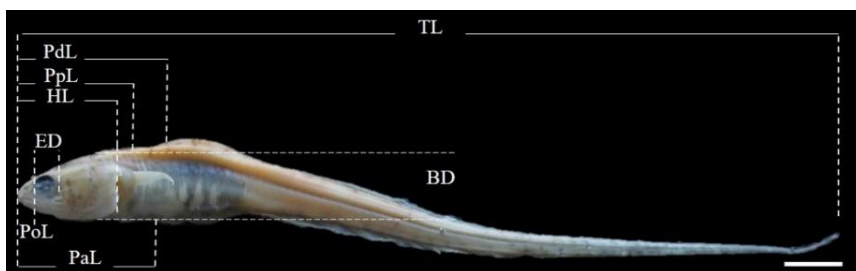
For this, seven *Carapus acus* individuals from three different regions of the western Algerian coast were studied. Two individuals were collected in February 2019 at station 1 (Mostaganem) as bycatch during a fishing trip on professional trawler. Five individuals were collected during an Oceanographic campaign aboard the “Grine Belkacem” Oceanographic Research Vessel, within the MEDITS program (International bottom trawl survey in the Mediterranean), using the GOC73 fishing gear rigged with morgere bottom doors in July 2019 [two individuals from station 2 (Mostaganem) and three individuals from station 3 (Bouzedjar)] (Figure 1).

Individual of *C. acus*, were found inside the coelomic cavity of *Parastichopus regalis* captured as bycatch. Each individual of *P. regalis* collected from the fishing-net was immediately placed and isolated into small container filled with seawater. The specimens of *C. acus* found outside their host's coelomic cavity, possibly due to stress, were collected and stored in ethanol. For others found in their host, the ethanol was injected inside the holothuroid's coelomic cavity.

The collected specimens were weighed and measured after the dissection of the sea cucumbers. Eight morphometric measurements were rated, total length (TL), body depth (BD), head length (HL), eye diameter (ED), pre-orbital length (PoL), pre-pectoral length (PpL), pre-dorsal length (PdL) and pre-anal length (PaL) (Enajjar and Bradai 2016) (Figure 2).



**Figure 1.** Sampling stations of *Carapus acus* (small circles represent sampled stations – Depth 1: 53m; 2: 117m; 3: 96m)



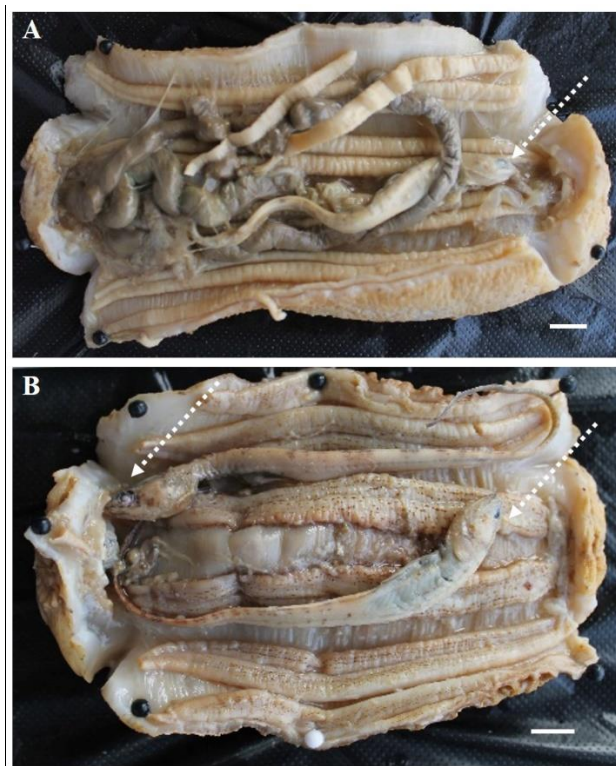
**Figure 2.** Measurements on *Carapus acus* specimens. The scale bar represents 1 cm.

*Carapus acus* is a fish with an elongated, slender, scaleless, and eel-shaped body (Figure 2). It has long dorsal and anal fins that join at the end of the tail. Alive, the body is translucent and reddish with about 14-15 silver iridescent dots located on the flanks. The snout is round with a wide opening of the mouth. According to Parmentier *et al.* (1998; 2000), *C. acus* has conical teeth and several small internal ones.

Table 1 summarizes the measurements of the seven specimens of *C. acus*. The wet weight varied from 1.24 to 4.11 g, and the total length from 12.30 to 16.60 cm. Our results were close to those observed by Enajjar and Bradai (2016) on the Tunisian coast and El Aamri and Tamsouri (2018) on the Moroccan coast. Based on the body and head lengths reported by Arnold (1956), the individuals in this study were all adults.

**Table 1.** Range of the morphometric measurements of the seven individuals of *Carapus acus* caught in the Mostaganem region (Algeria) and compared to those of the Tunisian and Moroccan coasts

	Enajjar and Bradai (2016) (Tunisia)	El Aamri and Tamsouri (2018) (Morocco)	Present study
Number of individuals	1	10	07
Wet Weight (Ww) (g)	-	-	0.47-4.11
Total length (TL) (cm)	13.61	14.50-21.00	9.00-16.60
Body depth (BD) (cm)	0.54	1.20-1.90	0.59-1.50
Head length (HL) (cm)	1.61	1.30-1.60	1.10-2.20
Eye diameter (ED) (cm)	0.34	0.30-0.50	0.20-0.40
Pre-orbital length (PoL) (cm)	0.33	0.30-0.50	0.20-0.40
Pre-pectoral length (PpL) (cm)	1.77	1.70-2.40	1.00-2.25
Pre-dorsal length (PdL) (cm)	2.16	2.90-4.20	1.50-3.80
Pre-anal length (PaL) (cm)	1.91	1.50-2.60	1.00-3.20



**Figure 3.** *Parastichopus regalis* hosting *Carapus acus*. The arrow points the head of the fish. The scale bar represents 1 cm. **A:** One individual of *C. acus*, **B:** Two individuals of *C. acus*.

Two individuals of *Parastichopus regalis* were preserved with the fish inside and ethanol was injected into their coelomic cavity to prevent their escape. The dissection revealed that the first individual of *P. regalis* contained only one fish (Figure 3A) while the second one contained two (Figure 3B). The individual observed alone was oriented head towards the sea cucumbers oral cavity, while the other two observed together were in opposite direction. The presence of several fish individuals in the same host had already been observed in this species by González-Wangüemert *et al.* (2014) and other species of the genus *Echeliophis*. In most cases, there is only one fish per host. However, specimens of *Encheliophis* (*E. gracilis*, *E. vermicularis* and *E. sagamianus*) and *Carapus* (*C. homei*, *C. mourlani* and *C. bermudensis*) were reportedly sexually paired in various holothuroids (Aronson and Mosher 1951; Trott and Trott 1972; Meyer-Rochow 1977; Murdy and Cowan 1980; Smith *et al.* 1981; Trott 1981). In this study, the fish found alone measured 12.3 cm in a host (length 20 cm and weight 118 g), while the two found together measured 14.20 and 14.40 cm in a host (25 cm and 143 g). According to González-Wangüemert *et al.* (2014), the correlation between fish size and host weight is not significant; the fish probably does not choose its host based on its size.

### Acknowledgment

Authors express their gratitude to the research team of the National Center for Research and Development of Fisheries and Aquaculture (NCRDFA) and the local fishermen of the Mostaganem region for their help in sampling. The authors are grateful to the editor and two anonymous reviewers for providing critical reviews. We also thank Ms Danya Hammoudi for the manuscript English revision.

### References

- Arnold, D.C. (1953) Observation on *Carapus acus* (Brünnich) (Jugulares, Carapidae). *Pubblicazioni della Stazione Zoologica di Napoli* 24: 152-166.
- Arnold, D.C. (1956) A systematic revision of the fishes of the teleost family Carapidae (Percomorphi, Blennioidea), with description of two new species. *Bulletin of the British Museum (Natural History)* 4: 247-307.
- Aronson, L.H., Mosher, C. (1951) Observations on the behaviour and ecology of the West Indian pearlfish. *Anatomical Record* 111: 489.
- Brasseur, L., Parmentier, E., Caulier, G., Vanderplanck, M., Michez, D., Flammang, P., Gerbaux, P., Lognay, G., Eeckhaut, I. (2016) Mechanisms involved in pearlfish resistance to holothuroid toxins. *Marine Biology* 163: 129. doi: /10.1007/s00227-016-2901-3
- Despalatović, M., Cvitković, I., Žuljević, A., Žunec, A., Bogner, D., Nejašmić, J., Isajlović, I. (2020) Incidence of commensalism between the pearlfish *Carapus*

*acus* (Brünnich, 1768) and the holothurian *Parastichopus regalis* (Cuvier, 1817) in the eastern Adriatic Sea. *Journal of Applied Ichthyology* 36(6): 834-836.

Eeckhaut, I., Caulier, G., Brasseur, L., Flammang, P., Gerbaux, P., Parmentier, E. (2015) Effects of holothuroid ichthyotoxic saponins on the gills of free-living fishes and symbiotic pearlfishes. *Biological Bulletin* 228: 253-265.

Eeckhaut, I., Parmentier, E., Becker, P., Gomez da Silva, S., Jangoux, M. (2004) Parasites and biotic diseases in field and cultivated sea cucumbers. In: *Advances in Sea Cucumber Aquaculture and Management*, (eds., Lovatelli, A., Conand, C., Purcell, S., Uthicke, S., Hamel, J.-F., Mercier, A.), FAO Fisheries Technical Paper 463, pp. 311-325.

El Aamri, F., Tamsouri, M. N. (2018) First finding of rare Pearlfish, *Carapus acus* (Brünnich, 1768) (Ophidiiformes : Carapidae) from Mediterranean coasts of Morocco. *Journal of Materials and Environmental Science* 9(11): 3134-3136.

Enajjar, S., Bradai, M. N. (2016) First record of *Carapus acus* (Osteichthyes: Carapidae) in the Gulf of Gabès (southern Tunisia, central Mediterranean Sea). *Marine Biodiversity Records* 9(7). doi: 10.1186/s41200-016-0015-8

González-Wangüemert, M., Maggi, C., Valente, S., Martínez-Garrido, J., Rodrigues, N. V. (2014) *Parastichopus regalis*- The main host of *Carapus acus* in temperate waters of the Mediterranean Sea and northeastern Atlantic Ocean. *SPC Beche-de-Mer Information Bulletin* 34: 38-42.

Kalinin, V.I., Aminin, D.L., Avilov, S.A., Silchenko, A.S., Stonik, V.A. (2008) Triterpene glycosides from sea cucumbers (Holothurioidea, Echinodermata). Biological activities and functions. In: *Studies in Natural Products Chemistry (Bioactive Natural Products)* Vol. 35, (ed., Atta-ur-Rahman), Elsevier Science Publisher, pp. 135-196.

Markle, D.F., Olney, J.E. (1990) Systematics of the pearlfishes (Pisces: Carapidae). *Bulletin of Marine Science* 47(2): 269-410.

Meyer-Rochow, V. B. (1977) Comparison between 15 *Carapus mourlani* in a single holothurian and 19 *C. mourlani* from starfish. *Ichthyological Notes* 3: 582-584.

Mezali, K. (1998) Contribution à la systématique, la biologie, l'écologie et la dynamique de cinq espèces d'holothuries aspidochirotes [*Holothuria* (*H.*) *tubulosa*, *H.* (*L.*) *polii*, *H.* (*H.*) *stellati*, *H.* (*P.*) *forskali* et *H.* (*P.*) *sanctori*] de l'herbier à *Posidonia oceanica* (L.) Delille de la Prèsqu'île de Sidi-Fredj. Thèse de Magister. Ecole National des Sciences de la Mer et de l'Aménagement du Littoral (Ex- ISMAL), Alger, Algérie, 192 pp.

- Murdy, E.O., Cowan, M.E. (1980) Observation on the behaviour and symbiotic relationship of the pearlfish *Encheliophis vermicularis* (Osteichthys: Carapidae). *Kalikasan, Philippine Journal of Biology* 9(2-3): 309-312.
- Parmentier, E., Castro-Aguirre, J. L., Vandewalle, P. (2000) Morphological comparison of the buccal apparatus in two bivalve commensal Teleostei, *Encheliophis dubius* and *Onuxodon fowleri* (Ophidiiformes, Carapidae). *Zoomorphology* 120: 29-37.
- Parmentier, E., Chardon, M., Poulicek, M., Bussers, J. C., Vandewalle, P. (1998) Morphology of the buccal apparatus and related structures in four species of Carapidae. *Australian Journal of Zoology* 46: 391-404.
- Parmentier, E., Das, K. (2004) Commensal vs. parasitic relationship between Carapini fish and their hosts: Some further insight through  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  measurements. *Journal of Experimental Marine Biology and Ecology* 310: 47-58.
- Parmentier, E., Fine, M., Vandewalle, P., Ducamp, J.J., Lagardère, J.P. (2006) Sound production in two carapids (*Carapus acus* and *C. mourlani*) and through the sea cucumber tegument. *Acta Zoologica* 87: 113-119.
- Parmentier, E., Michel, L. (2013) Boundary lines in symbiosis forms. *Symbiosis* 60: 1-5.
- Parmentier, E., Vandewalle, P. (2005) Further insight on carapid-holothuroid relationships. *Marine Biology* 146: 455-465.
- Smith, C., Tyler, J.C., Norma Feinberg, M. (1981) Population ecology and biology of the pearlfish (*Carapus bermudensis*) in the lagoon at Bimini, Bahamas. *Bulletin of Marine Science* 31(4): 876-902.
- Trott, L.B. (1970) Contribution of the biology of carapid fishes (Paracanthopterygian: Gadiformes). *University of California Publications in Zoology* 89: 1-41.
- Trott, L.B. (1981) A general review of the pearlfishes (Pisces, Carapidae). *Bull Bulletin of Marine Science* 31: 623-629.
- Trott, L.B., Trott, E.B. (1972) Pearlfishes (Carapidae : Gadiforme) collected from Puerto Galera, Minobra, Philippines. *Copeia* 1972: 839-843.