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Note

First record of the barnacle Conchoderma virgatum Spengler 1789 on *Belone belone* (Linnaeus, 1760) caught from Tunisian Central Mediterranean

Menel KRAIEM *, **Afif OTHMEN**, **Ahmed AFLI**

University of Carthage. National institute of marine science and technology (INSTM).
Laboratory of Marine Biodiversity, Tunisia.

***Corresponding author**: menelkraiem@gmail.com

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Abstract: A group of *Conchoderma virgatum* (Spengler, 1789) was observed attached to a mature specimen of *Belone belone* (Linnaeus, 1760), captured in May 2023 in the central Tunisian Mediterranean (Gulf of Chebba). This constitutes the second documented case of direct barnacle attachment to this host species (garfish). These observations confirm that C. virgatum is capable of establishing itself on the surface of garfish, using them as mobile substrates for feeding and reproduction. The collected data indicate that barnacle colonization is particularly prevalent during specific seasonal periods, suggesting that host selection is influenced by a combination of environmental factors (e.g., water temperature, currents) and host-related traits, such as surface morphology, motility, and availability. These findings underscore the need for further investigation into the ecological consequences of such associations, especially in terms of host physiology and the broader dynamics of marine ecosystems.

Keywords: Epibiosis, Conchoderma, Beloniforme, Central Mediterranean

1. Introduction

The goose barnacle *Conchoderma virgatum* (Spengler 1790) is a pelagic peduncle barnacle found in most world oceans and seas with records on tropical water, polar sea, eastern Indo-pacific and temperate northern and tropical eastern pacific (Alonso et al., 2010).

As sessile organisms incapable of independent movement, *C. virgatum* disperses by attaching itself to floating or mobile substrates (Thiel and Gutow 2005). While most attachments occur on inanimate objects such as buoys, debris (pumice, wood, and plastic), and ship hulls, *C. virgatum* has also been documented adhering to various marine vertebrates and invertebrates (Ramos, 2010; Nagasawa, 2020). These include slow-moving and near-surface pelagic species such as seaweed, jellyfish, crabs, sea snakes, marine turtles, whales, marlins, sharks, *Mola mola*, *Diodon hystrix*, and an increasing number of fish species, which are susceptible to *C. virgatum* as an epibiont. Furthermore, *this barnacle has been recorded attaching to*

parasitic copepods and isopods (Hastings, 1972) as well as marine birds, including Magellanic penguins (Do Nascimento et al., 2010). Gaucha & Ktari (1978) then Garibaldi & Relini (2003) reported the first presence of *C. Viragatum* on fishes in the Mediterranean Sea; since it, rare observations we reported. Concerning the Tunisian coast, the first observation of the cirriped *C. Virgatum* associated to *Belone Belone garcilis* where in the Tunisian's north coast (Rafrafi–Nouira 2019).

This study presents a data by reporting the occurrence of peduncule barnacle *Conchyoderma virgatum* attached to *Belone Belone Garcilis* fish in the central eastern Tunisian coast.

2. Material and methods

The fish specimen was captured on May 2023 during the local fishing season from May to August for this species at Chebba (35.09°N, 11.12°E) in the Tunisian's central east coast (Figure 1) with trammel nets at a depth of 4 meters. We identified all the collected barnacles following Pilsbry (1907, pl.IX, Fig1). We took the measurement (mm) with vernier caliper. The specimen has a weight of 700 gr and a total length of 74cm.

Figure 1. The fishing area of Belone Belone Garcilic (Lowe 1839) from Chebba (✱), in the central south Mediterranean Sea

3. Results

The barnacles extracted from the specimen's skin (located behind the pectoral fin) comprised a group of five individuals, with capitulum lengths ranging from 10.3 mm to 29.4 mm (Figure 2A). The collected barnacles were identified as *Conchoderma virgatum*, based on descriptions of Pilsbry (1907); Bernard (1924); Alonso et al (2010) and Chan (2021). The detailed taxonomic classification of this barnacle species is presented below:

- Phylum: ARTHROPODA
- Superorder: Thoracicalcarea (Gale, 2015).
- Order: Scalpellomorpha (Buckeridge & Newman, 2006).
- Family: Lepadidae (Darwin, 1851).
- Genus: Conchoderma (von Olfers, 1814).
- Species: *Conchoderma virgatum* (Hoek, 1883).

Conchoderma virgatum is distinguished by three prominent longitudinal dark bands extending from top of capitulum to the base of peduncle, an uncurved tergum, and a mandible with five distinct large teeth. In contrast, the closely related *C. hunteri* is characterized by fine, narrow stripes and a bent tergum at its distal quarter. These diagnostic features effectively differentiate the two species.

The peduncle and the capitulum are fused, lacking distinct separation (Figure 2C). The peduncle is flexible, flattened, and light gray, Whereas the capitulum exhibits a trapezium-shaped morphology, it appears dark gray in preserved specimens (light blue when alive), features five highly reduced shell plates consisting of a single carina, a pair of scuta trilobed Y-shaped, and a pair of long and thin terga, T-shaped. It is also equipped with six pairs of retracted biramous cirri used for feeding.

The attachment of *C. virgatum* to *Belone belone* exhibits localized skin irritation, indicating an inflammatory response (Figure 2B).

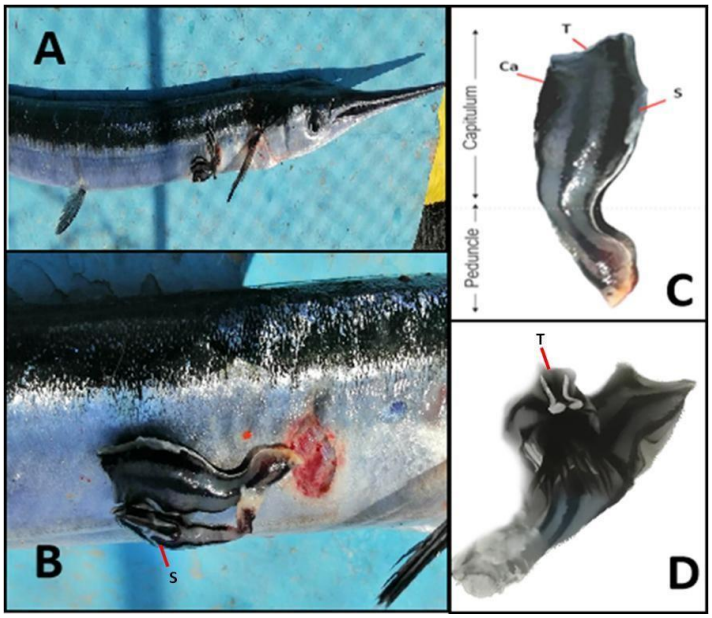

Figure 2. *Belone belone, hosting the cirripeda Conchoderma virgatum* Splenger, 1789 behind the pelvic fin. B. *Conchoderma virgatum* removed from its host. **C.** *A whole individual* of *C. virgatum* showing the shell plates insertions, *Carina (Ca) ; Scutum (S) et Tergum (T)*. D. Capitulum membrane pulled to show the pair of terga.

4. Discussion

Direct attachment of *C. virgatum* to fish is rare, and its occurrence on intact skin has been reported only rarely (Jones et al., 1968; Goucha & Ktari, 1978). This uncommon occurrence is probably attributed to the suppressive influence of the fish's external mucus secretions. (Balakrishnan, 1969; Dulcic et al., 2015) and the species' preference for smooth, hard substrates. Furthermore, since *Belone belone garcilis* is an epiphyseal and highly mobile species, its attachment to the skin of rayfish is uncommon.

Previous observations have gee rally documented attachment to slower individuals early in life (Rafrafi-Nouira et al., 2019). Under certain conditions, Belone belone can be directly colonized when pathological factors such skin lesion (Williams & Bunkley Williams, 2021) or physical trauma compromise its swimming efficiency, reducing its ability to evade epibiont attachment. During extended migratory journeys, exposure to factors like food limitation, rising Mediterranean Sea surface temperatures and

environmental pollution, can induce physiological stress and fish become more susceptible to parasitism by periphyton, similar to other documented cases of hosts (Do Nascimento et al., 2010).

In fact, warmer waters (fact increasingly noticeable) accelerate barnacle reproduction, increasing parasitic infestations on fish (Fong et al., 2019). Also, heavy metal contamination weakens fish immune systems, making them more vulnerable to barnacle attachment (Singh & Sharma, 2024). Barnacles act as biomonitors of coastal pollution and accumulate trace metals from polluted waters (Yap et al., 2020).

Concerning attachment preference, the larger barnacle, with a capitulum length of approximately 30 mm, was attached to the fish's skin via a nodular anchoring structure located in the anterior abdominal region and at the level of the pelvic fin. Once established, the barnacle maximizes its exposure to water currents (Roskell, 1969; Hastings, 1972) and maintains an optimal position for feeding efficiency, with its mantle aperture oriented anteriorly.

A small individual was seen affixed to the larger barnacle's peduncle, measuring around 12 mm in capitulum length. Ongoing cypris larval colonization is indicated by the presence of individuals at various developmental stages on the same host (MacIntyre, 1966).

Based on these observations, *C. virgatum* likely colonizes its host during the larval stage and can attain sexual maturity on the fish body during the migration period, which lasts about three months. Species of Conchoderma exhibit rapid growth during both their planktonic phase (Dalley, 1984; Moyse, 1963) and their sessile phase once attached to a host (MacIntyre, 1966; Newman, 1980). For example, one specimen of *C. virgatum* attained a capitulum length of 13 mm in 33 days (Darwin, 1851), while MacIntyre (1966) reported that the species reach 20 mm in capitulum length in only 17 days.

A total of five individuals of *C. virgatum* were observed, displaying considerable variation in size and developmental stage. This variability suggests that barnacle larvae attach to the host at different times, a process likely facilitated by the firm, matrix-like properties of the fish's skin (Nagasawa et al., 2019). This hypothesis is further supported by the epibiont's documented preference for rough, irregular surfaces when attaching to floating debris (Foster, 1979; Mesaglio, 2021; 2022).

5. Conclusion

Barnacles, including *Conchoderma virgatum*, exhibit phenotypic plasticity, enabling them to adjust their morphology and attachment strategies in response to hydrodynamic forces. This adaptability makes them potential bioindicators of water movement and environmental conditions, particularly in relation to host species and marine habitat stability. *C. virgatum* may indirectly reflect host ecology, migratory patterns, and broader oceanographic conditions. Additionally, barnacles bioaccumulate trace metals, making them effective indicators of marine pollution. Further research is needed to quantify the bioindicator potential of *C. virgatum.*

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