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SHORT COMMUNICATION

First record of the epibiont barnacle *Platylepas coriacea* Monroe & Limpus, 1979 (Cirripedia: Platylepadidae) in Tunisian's waters

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Abstract

The barnacles of the family Platylepadidae are specialized crustaceans that live as obligate symbionts of motile marine animals, with some species occurring solely on sea turtles. In this note, we document the first record of *Platylepas coriacea* as a leatherback turtle epibiont in the Mediterranean Sea off the coast of Tunisia. The species was taken from two stranded leatherback turtles: on July 29, 2008, in Ghrannouch (Gabès, southern Tunisia), and on December 29, 2011, in Ras Angla (Bizerte, northern Tunisia).

Keywords: *Platylepas coriacea*, leatherback turtle, Tunisia, Mediterranean

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Epibiosis is a phenomenon where marine propagules (epibionts) colonize the external surfaces of other organisms (basibionts) due to competition for space (Frick and Pfaller 2013). In sea turtles, epibiosis is a common occurrence that is thought to be nearly universal for these marine reptiles (Robinson and Pfaller 2022).

Sea turtles have diverse types of epibiont communities, including macro, meio, and micro-epibionts (Loghmannia *et al.* 2021). A variety of sea turtle species have been the subject of extensive research on the macro-epibiont communities, which include cirripeds, polychaetes, hydrozoans, bryozoans, poriferans, tunicates, algae, and some motile organisms (eg. Fuller *et al.* 2010; Lazo-Wasem *et al.* 2011; Domènech *et al.* 2015; Karaa *et al.* 2016; Robinson *et al*. 2019). Additionally, meiofaunal species such as copepods and nematodes, and micro-epibiota such as diatoms, have been the subject of current research (eg. Robinson *et al.* 2016; Domènech *et al*. 2017; Karaa *et al.* 2019; Ingels *et al.* 2020; Van de Vijver *et al.* 2020; Silver-Gorges *et al.* 2021; Kanjer *et al.* 2022; Kuschke *et al.* 2024).

Sea turtle epibionts are receiving increasing interest as potential natural data loggers of sea turtle migratory (Ten *et al.* 2019). Epibiont analysis may be combined with stable isotope information to identify taxa that can serve as indicators of sea turtle foraging and spatial ecology (Pearson *et al.* 2019; Silver-Gorges *et al.* 2021).

Given their unique anatomical and behavioural characteristics, leatherback turtles have lower levels of epibiont richness and variation than other turtles in the Cheloniidae family (Robinson *et al.* 2017). Their smooth skin, deep diving behaviour, and jellyfish-based diet restrict their exposure to shallow and coastal habitats, making them unsuitable for colonization and settlement of many epibiont species (Robinson and Pfaller 2022). Leatherback turtles' active nature and mobility reduces the epibiont colonization, while their abundance and population status may affect their epibiont richness in specific areas (Robinson *et al.* 2017; Zardus 2021).

Barnacles are the most prominent epibionts of sea turtles (Frick and Pfaller 2013). Turtle barnacles belong to the superfamily Coronuloidea and include three families: Chelonibiidae Pilsbry, 1916, Coronulidae Leach, 1817, and Platylepadidae Newman and Ross, 1976 (Ross and Frick 2011). Whereas coronulids are obligate phoronts of cetaceans (hence their vernacular name, whale barnacles), chelonibiids and platylepadids (collectively known as turtle barnacles) exhibit more generalist host habits, although most species live preferentially or exclusively on the skin, carapace or plastron of sea turtles (Collareta *et al.* 2019). Different methods are used by these barnacles for adhering to their hosts: chelonibiids, such as *Chelonibia testudinaria* (Linnaeus), usually attach superficially, whereas platylepadids encapsulate themselves entirely or partially within the host's tissues (Zardus and Balazs 2007) and commonly develop external wall elaborations that serve to anchor them in the host (Monroe and Limpus 1979).

Three species of sea turtles frequent the Mediterranean. The loggerhead turtle *Caretta caretta* (Linnaeus, 1758), and the green turtle *Chelonia mydas* (Linnaeus,

1758) nest here, while the leatherback turtle *Dermochelys coriacea* (Vandelli, 1761) is an occasional visitor (Karaa *et al.* 2013; Casale *et al.* 2018).

Both loggerhead and green sea turtles epibiontic communities have been investigated in the Mediterranean. These data come from research conducted on nesting, by-caught and stranded turtles (eg. Gramentz 1988; Kitsos *et al.* 2005; Fuller *et al.* 2010; Zakhama-Sraieb *et al.* 2010; Casale *et al.* 2012; Domènech *et al.* 2015; Karaa *et al.* 2023, 2024).

Researches on the epibionts of leatherback turtles in the Mediterranean are significantly fewer than that of loggerhead and green turtles, which are the most common in the region; these studies primarily focus on barnacles (Carriol and Vader 2002; Frick and Pfaller 2013; Robinson and Pfaller 2022). The barnacle *Stomatolepas elegans* appears to be the only leatherback turtle epibiont documented in the Mediterranean with two reports, one from Malta and the other from France (Lanfranco 1979; Duron-Dufrenne 1986). The species was found primarily attached to the softer folds of skin at the base joints of the forelimbs and hindlimbs (Carriol and Vader 2002).

The present study adds *Platylepas coriacea* to the cirriped epibionts of leatherback turtles in the Mediterranean and reports its first record in Tunisian waters.

This study is part of the work carried out within the National Stranding Network (RNE) for sea turtles and cetaceans created in 2004 in Tunisia (Figure 1) (SPA/RAC-UNEP/MAP 2020a). Information on stranding sea turtles was collected mainly by citizens on the beaches and following indications of the coast guards, fisheries authority and NGOs. The RNE is also involved in cases of sea turtles bycatch (SPA/RAC-UNEP/MAP 2020b).

For each sea turtle observation, a census form was filled out; this form contained various measurements, samples and other information on the animal (species, sex, measurements, place and date of observation, etc.). Measurements were taken using a flexible meter (± 0.5 cm); the main measurement used was the Curved Carapace Length (CCL, notch to tip; Bolten 1999).

For each turtle, the epibionts were carefully collected using a scalpel or a knife and were preserved in their entirety in 70% alcohol. In the laboratory, the samples were cleaned under running water, the epibionts were then separated under a binocular microscope. At the end of this operation, the washing water was sieved through a 0.3 mm diameter sieve to ensure that all the epibionts were collected. All epibionts were identified and counted. The barnacles were identified according to Monroe and Limpus (1979), Rizzo and Schembri (1997), and Relini (1980).

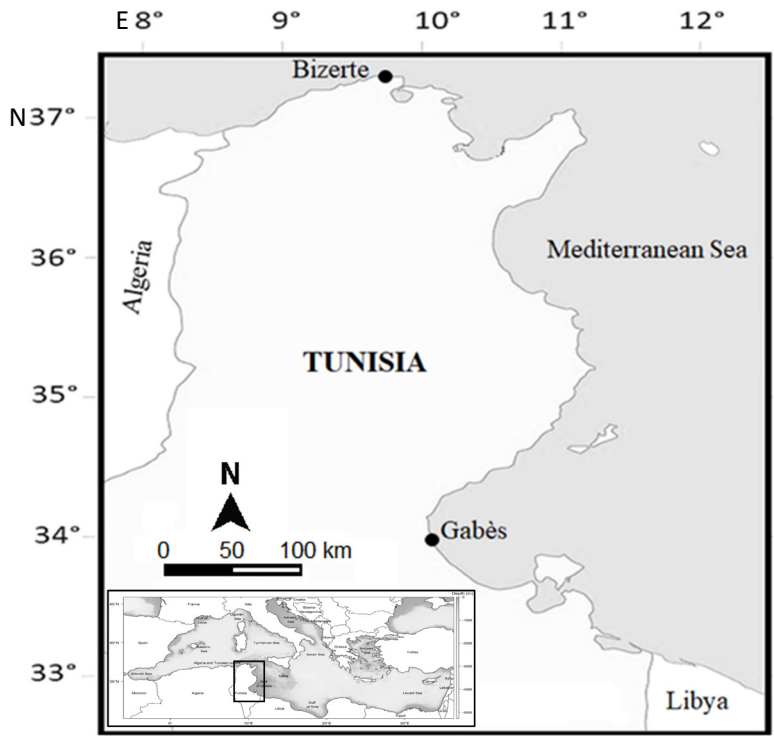

Figure 1. Locations of sampled leatherback sea turtles in Tunisia (black dots)

On 29 July 2008, a large decomposed leatherback turtle (CCL=132 cm) was reported stranded in Ghrannouch (Gabès, southern Tunisia, Figure 1). After examining the turtle, we found two barnacles embedded in the skin folds of the turtle at the level of the carapace (Figure 2). The species of barnacle was identified as *Platylepas coriacea*, according to Monroe and Limpus (1979). Four more specimens of this species were collected from a female adult leatherback turtle (CCL=172 cm) stranded at a depth of 0.5 meters on 29 December 2011, in Ras Angla (Bizerte) (Figure 2). In each case, *P. coriacea* was found to be superficially attached to the host turtles.

This study documents the first occurrence of the sessile barnacle *P. coriacea* as an epibiont of leatherback turtles in Tunisian waters. As of currently, only three epibionts have been identified as leatherback turtle epibionts in Tunisian waters: the sharksucker *Remora remora* (Karaa *et al.* 2013), *Chelonibia testudinaria* (Karaa *et al.* 2024) and the sessile barnacle *P. coriacea* presented in this study.

Monroe and Limpus (1979) were the first to mention and describe *P. coriacea* in northern Australia. Since then, the species has been reported in numerous

additional locations, such as Florida (Biasatti 2004), Venezuela (Velásquez *et al.* 2013), the Western North Atlantic (Frick 2015), Ireland (O'Reilly *et al.* 2022) and the Eastern Tropical Pacific, where it accounted for 85.1% of all the epibionts sampled from leatherback turtles (Robinson *et al.* 2017).

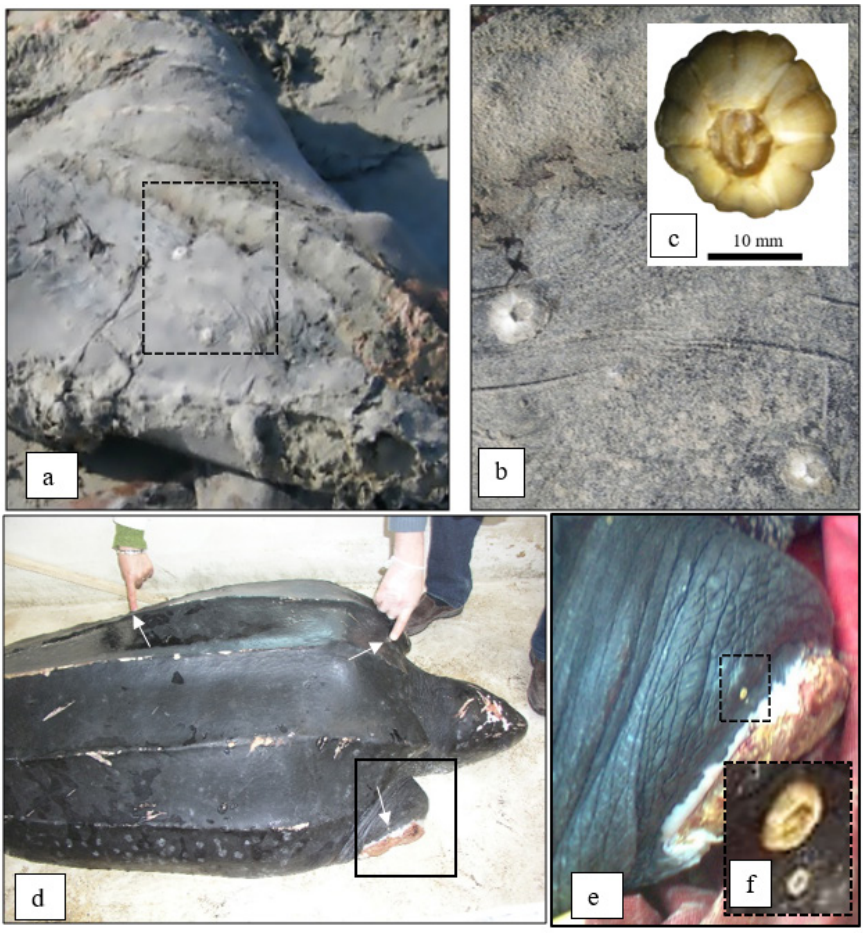

Figure 2. *Platylepas coriacea* from a leatherback sea turtle in Tunisian's waters
a-c: specimens collected from Gabès; d-f: specimens collected from Bizerte

According to Zardus (2021) and Robinson and Pfaller (2022) leatherbacks' epibionts tend to either be oceanic/pelagic specialists or taxa found only on sea turtles, including two species of barnacle (*P. coriacea* and *Stomatolepas dermochelys*) that are essentially exclusive to leatherbacks.

The *P. coriacea* specimens identified in this work were found superficially attached to the host turtles and conformed *sensu stricto* to those described from

leatherbacks in Australia by Monroe and Limpus (1979). Three additional species of the Platylepadidae family have been identified as epibionts of green and loggerhead sea turtles in Tunisian waters: *Stomatolepas elegans* (Costa, 1838), *Stephanolepas muricata* (Fischer, 1886), and *Platylepas hexastylos* (Fabricius, 1798). These species are usually found either deep within turtle tissues (*S. muricata* and *S. elegans*) or shallowly within turtle tissues (*P. hexastylos*) (Karaa *et al.* 2012 a, b; Chaieb *et al.* 2018; Karaa *et al.* 2024).

To date, only a five species of barnacles have been identified as leatherback sea turtle epibionts. Among them are *Platylepas coriacea*, *Stephanolepas dermochelys*, *Stephanolepas elegans*, *Platylepas hexastylos* and *Chelonibia testudinaria* (Monroe and Limpus 1979; Eckert and Eckert 1987; Rees and Walker 1993; Carriol and Vader 2002; ERC 2007; Zardus 2021). As far as we know, this is the first time that a sessile barnacle species *P. coriacea* was found in the Mediterranean as a leatherback turtle epibiont. The species was previously recorded only once in the Mediterranean on the carapace of loggerhead turtles in Malta (Gramentz, 1988). This is an important result given the limited knowledge of leatherback turtle epibionts worldwide as only 15 taxa have been documented to far (Robinson and Pfaller 2022). According to the later authors the low variety of epibiont taxa in leatherback sea turtle can be attributed to a number of causes, primarily inhospitable surface properties (i.e., leathery skin) and sampling gaps in leatherback turtles, which are mostly caused by the geographical distribution, habitat type, and their oceanic lifestyle of the leatherback turtle (Robinson and Pfaller 2022).

Given the continuous variation of the marine environment conditions caused by a variety of factors including climate change, acidification, pollution…etc, one would think about the dispersal behaviour of *P. coriacea*, and hypothesize whether it is a newfound species in the Mediterranean, resulting from a recent invasion phenomenon or there could be simply a lack of historical documentation. Genetic analyses would be interesting in order to determine possible routes of invasion into the Mediterranean Sea and to better understand the transmission and potential gene flow in these barnacles between populations and pathways of colonization between turtle species. Comparison of specimens found in Tunisia with their conspecifics from other seas would be determinant to identify the origin of the new found turtle epibiont in Tunisian waters. In light of recent research showing that native North Atlantic leatherback turtles use Tunisia's east coast as a feeding ground (Lalire and Gaspar 2019), more research is required to find other epibionts not seen on these chelonians in Tunisian seas.

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