Oceanological and Hydrobiological Studies

International Journal of Oceanography and Hydrobiology

Volume 45, Issue 4, December 2016
pages (600-604)

ISSN 1730-413X
eISSN 1897-3191

The first record of *Mytilus galloprovincialis* (Lamarck, 1819) on *Carcinus aestuarii* Nardo, 1847 in the Çardak Lagoon, Turkey

by

Seçil Acar*, A. Suat Ateş

DOI: **10.1515/ohs-2016-0049**
Category: **Short communication**
Received: **March 23, 2016**
Accepted: **May 16, 2016**

Çanakkale Onsekiz Mart University,
Marine Science and Technology Faculty,
17100, Çanakkale, Turkey

Abstract

This study deals with the presence of *Mytilus galloprovincialis* on the Mediterranean green crab, *Carcinus aestuarii* Nardo, 1847 as an epibiont. Crab samples were collected by means of single-entry fyke nets at 6 different locations selected in the Çardak Lagoon. A total of 22 specimens of *M. galloprovincialis* (1-9 ind. per crab) on different body parts of 4 crabs were recorded. This is the first report about the occurrence of *M. galloprovincialis* on *C. aestuarii*.

Key words: *Mytilus galloprovincialis*, *Carcinus aestuarii*, Epibiont, Çardak Lagoon, the Turkish Straits System

* Corresponding author: *secilkolsal@gmail.com*

DE GRUYTER

The *Oceanological and Hydrobiological Studies* is online at oandhs.ocean.ug.edu.pl

Introduction

Epibiosis is a common phenomenon observed between many sessile marine species (Wahl 1989). For many epibiont species it is very important to attach to the biological substrate in order to survive either through the adaptation of their morphological structures or the population dynamics. Most of the epibiont species are characterized by high growth rates, short life cycles and high reproductive rates (Jackson 1977; Seed 1985). This is an example of a model ecological development in the early stages of development. The exoskeleton of decapod crustaceans is well known as a substrate for epibionts/symbionts. Since many epibionts are mostly suspension feeders (e.g. barnacles, tube-dwelling polychaetes, bryozoans), this settlement is favorable for them because the movement of crabs and their feeding activity increase the availability of food. This relationship may have benefits to their hosts via camouflage and protect them from predators and parasites. Nevertheless, some relationships may negatively affect their hosts. Certain symbiotic organisms increase the host's attractiveness to predators and they may prey on eggs or embryos of their hosts (Dvoretsky & Dvoretsky 2010). Several species such as a rhizocephalan parasitic castrator, *Sacculina carcini*, can generally parasitize *C. aestuarii* (Kuris et al. 2003).

C. aestuarii has been known from all Turkish coasts (Bakır et al. 2014). There are no detailed data showing a parasite/host relationship between *M. galloprovincialis* and *C. aestuarii*. In this study, the occurrence of *Mytilus galloprovincialis* on the Mediterranean green crab *C. aestuarii* has been reported for the first time.

Materials and Methods

C. aestuarii samples were collected in April 2015 and March 2016 from 6 sites of the Çardak Lagoon (Fig. 1). The crab specimens were sampled using single-entry fyke nets at an average depth of 1.5-2 m. Firstly, crab specimens were grouped by sex. A digital caliper was used for morphometric measurements of the crabs (carapace width and length) and the mussels (shell length). Next, the body parts of the crabs with the Mediterranean mussels attached were separated. Mediterranean mussels observed in different parts of the crab body were photographed to determine whether their removal from the holding parts caused any damage to the crusts of *C. aestuarii* specimens. All the crab specimens carrying the mussels on their bodies were recorded.

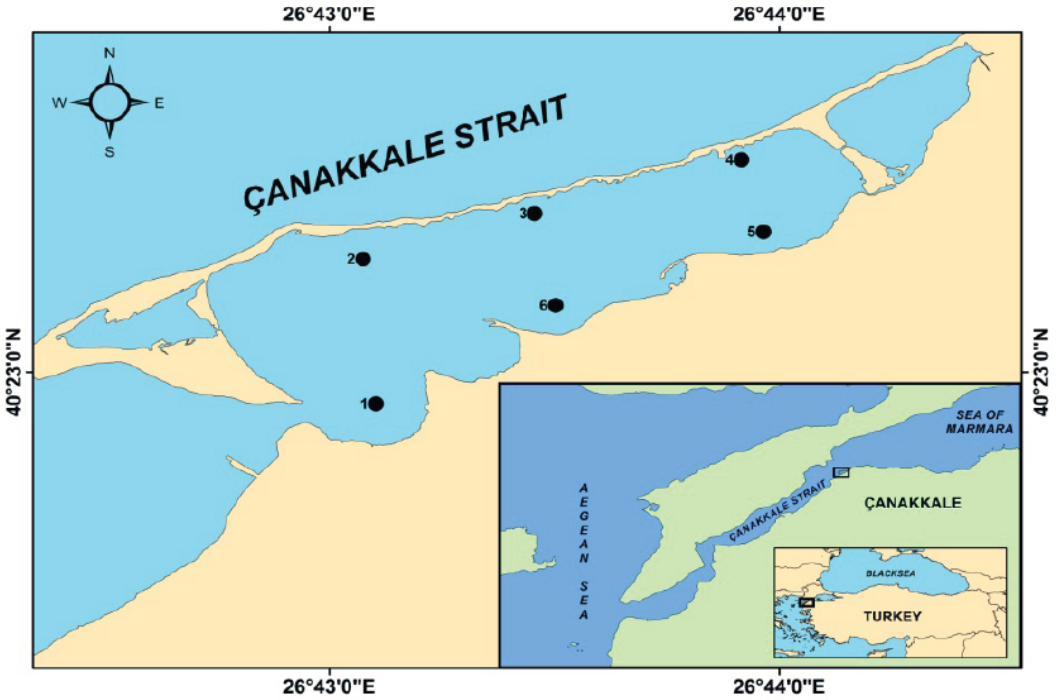

Figure 1

Sampling locations in the Çardak Lagoon

Results

A total of 125 female and 469 male crabs were collected in the Çardak Lagoon. Specimens carrying epibiont mussels were encountered only at station 3 in samples collected in August and September 2015. Only four male individuals (average carapace width 38.5±4.69 mm, carapace length 44.82±5.76 mm) of *C. aestuarii* with carapaces infested by the mussels were collected in the sampling area. A total of 22 mussel specimens (1-9 ind. per single crab) were observed on the body parts of *C. aestuarii*. The mean length of the mussels observed as epibionts on different parts of the crab body was 8.77±0.40 mm. Specimens of *M. galloprovincialis* were found attached mainly to the abdomen, eyestalk, maxilliped, mouth, and propods of pereiopods (Fig. 2). These mussels were attached to the crab specimens by their byssus. All crab specimens collected in this study were males. Table 1 shows the number of mussel species and their frequency on the crab body.

Table 1

The total number of specimens (Σ) of *M. galloprovincialis* and frequencies (f) of their occurrence

Body parts of *C. aestuarii*	Σ	f
Abdomen	9	0.41
Sternum	4	0.18
Eye stalk	1	0.05
Propods	2	0.09
Maxilliped	1	0.05
Gills	4	0.18
Gonads	1	0.05
Total	22	1

Discussion

Barnacles, bryozoans, hydrozoans, and bivalves are common epibionts attached to different body parts of the crabs (Dvoretsky & Dvoretsky 2008). Successful larval settlement and metamorphosis of Mytilidae depend on the availability of appropriate substrate (Branch & Steffani 2004). Branch et al. (2004) reported that *M. galloprovincialis* larvae lead to mass mortalities of the swimming crab *Ovalipes trimaculatus*. Larvae settled onto the eyestalks and mouthparts of the crab specimens can lead to their starvation or even death. It is not known whether large populations of the Mediterranean mussel may be similarly affected by other crab species (Branch et al. 2004). Wahl et al. (1997) studied the effects of epibiosis by *Carcinus maenas* preying on the mussel *Mytilus edulis*. Epibenthic species have strong effects on the community dynamics and this direct and indirect effects are involved in determining these epibiont prey-consumer interactions. Some epibionts strongly affect the feeding behavior of the consumers. When epibionts are more attractive than their host, the consumer pressure on the former increased (Wahl et al. 1997). Isaeva et al. (2001) have also recorded that *Mytilus trossulus* and *Hiatella arctica* are epibionts on the crab *Hemigrapsus sanguineus* in Vostok Bay, the Sea of Japan. The same authors described these species as facultative epibionts on the crab body. In the same study, the authors have reported that these species were found attached to the sacculinized crabs rather than the unsacculinized ones. We couldn't find any *Sacculina* individuals on the crabs. The sex of the crabs has the major effect on the attachment places of the mussels. McGaw (2006) has reported another mytilid, *Mytilus californiensis*, on the crabs *Cancer magister* and *Cancer productus*. McGaw has also found a large number of species as epibionts on the male crabs. Similarly, we have observed the epibiont mussels only on the male specimens of *C. aestuarii*. Gili et al. (1993) performed a study on epibionts found on the deep sea crab *Bathynectes piperitus* and found only 4 male specimens invaded by epibionts of a total of 318 males. Similarly, we observed the male dominance in the male/female ratio, i.e. 3.75:1. Therefore, the epibiosis among crab males could be higher because they significantly dominated among the collected specimens.

Attaching to crabs is a useful strategy for many epibionts to feed and avoid predators (Wahl 1989). Mussel individuals found in this study were observed to attach to different parts of the crab specimens such as the abdomen and pereipods of the crab. Nevertheless, the mussels observed on eyes and maxillipeds of crabs may affect the feeding and orientation capacity of the crab specimens.

We believe that mussels attaching to *C. aestuarii* specimens as epibiont is a rare behavioral pattern. Despite the large number of crabs caught, the number of mussels observed on crabs was small. Therefore, it can be assumed that this observation may be coincidental. The reproduction period of mussel specimens was observed in spring. Based on the shell length of the analyzed mussels, it seems that they were ca. 6 month old. It is most likely that the mussels had attached to crabs already in their veliger stages and grew together with them. However, it is

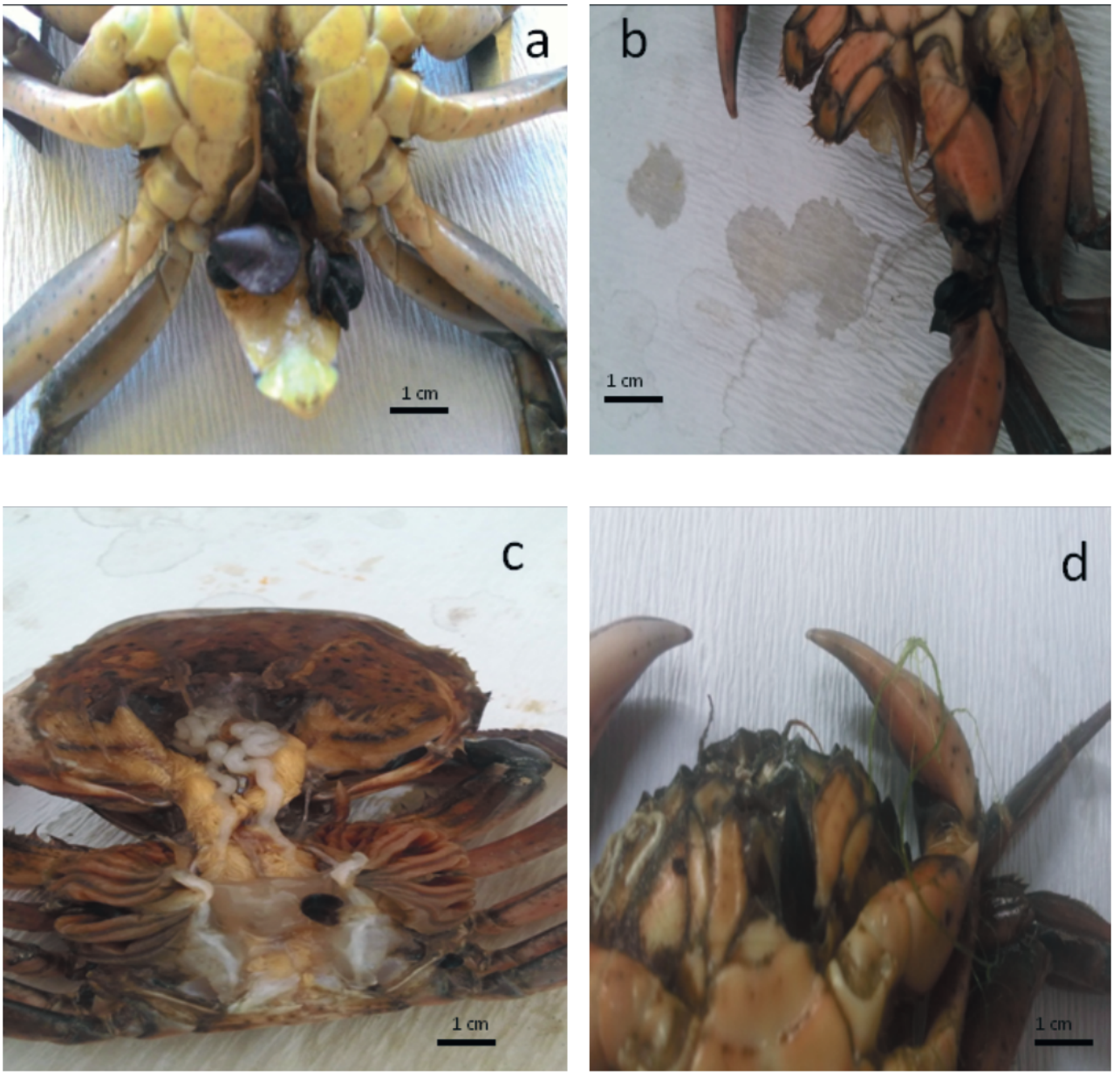

Figure 2

Epibiont specimens of *M. galloprovincialis* found on various body parts of *C. aestuarii* (a: abdomen, b: pereipods, c: gonads, d: maxilliped)

also possible that the duration of epibiosis would be shorter if juvenile bivalves, not veligers, settled on crabs. According to Ompi (2010) small specimens of Mytilidae are able to move until they finally settle on the proper substrate. The size is a significant factor in the movement of other mollusk species – smaller individuals tend to move greater distances than the larger ones (Uryu et al. 1996). On the other hand, crabs with epibionts were of medium size, therefore it is likely that they may get rid of them during the next molt. A higher incidence of epibionts on larger crabs, which do not molt so frequently, appears to be a common pattern among these crustaceans (Key et al. 1999).

This study includes the first data on epibiosis patterns of *M. galloprovincialis* attached to *C. aestuarii* found in the Çardak Lagoon.

Acknowledgements

This study was supported by the Scientific Foundation of Çanakkale Onsekiz Mart University project code 2015/406. We are also grateful to Dr. Yesim Buyukates for her language critiques on the previous versions of the manuscript.

References

Bakır, A.K., Katağan, T., Aker, H.V., Özcan, T., Sezgin, M. et al. (2014). The marine arthropods of Turkey. *Turkish Journal of Zoology* 38: 765-831. DOI: 10.3906/zoo-1405-48.

Branch, G.M. & Steffani, C.N. (2004). Can we predict the effects of alien species: A casehistory of the invasion of South Africa by *Mytilus galloprovincialis* (Lamarck). *Journal of Experimental Marine Biology and Ecology* 300: 189-215. DOI: 10.1016/j.jembe.2003.12.007.

Dvoretsky, A.G. & Dvoretsky, V.G. (2008). Epifauna associated with the northern stone crab *Lithodes maia* in the Barents Sea. *Polar Biology* 31: 1149-1152. DOI: 10.1007/s00300-008-0467-3.

Dvoretsky, A.G. & Dvoretsky, V.G. (2010). Epifauna associated with an introduced crab in the Barents Sea: a 5-year study. *ICES Journal of Marine Science*. 67: 204-214 DOI: 10.1093/icesjms/fsp243.

Gili, J.M., Abello P. & Villanueva R. (1993). Epibionts and intermoult duration in the crab *Bathynectes piperitus*. *Marine Ecology Progress Series* 98: 107-113.

Isaeva, V., Kulikova, V. & Kasyanov, V. (2001). Bivalve molluscs, *Mytilus trossulus* and *Hiatella arctica* as facultative epibionts of the crab, *Hemigrapsus sanguineus*, infested by the rhizocephalan, *Sacculina polygenea*. *Journal of the Marine Biological Association of the UK* 81: 891-892. DOI: 10.1017/S0025315401004787.

Jackson, J.B.C. (1977). Competition on marine hard substrata the adaptive significance of solitary and colonial strategies. *The American Naturalist* 11(1): 743-767. DOI: 10.1086/283203.

Key, M.M., Volpe, J.W., Jeffries W.B. & Voris, H.K. (1997). Barnacle fouling of the blue crab *Callinectes sapidus* at Beaufort, North Carolina. *Journal of Crustacean Biology* 17: 424-439.

Kuris, A.M., Goddard., J., Torchin, M.E., Murphy, N., Gurney, R. et al. (2003). Proceedings of the Third International Conference on Marine Bioinvasions, La Jolla, California, March 16-19, 2003.

McGaw, I.J. (2006). Epibiont of sympatric species of Cancer crabs in Barkley Sound, British Colombia. *Journal of Crustacean Biology* 26(1): 85-93. DOI: 10.1651/C-2601.1.

Ompi, M. (2010). Settlement behaviour and size of mussel larvae from the family Mytilidae (*Brachidontes erosus* (Lamarck, 1819), *Brachidontes rostratus* (Dunker, 1857), *Trichomya hirsutus* (Lamarck, 1819), and *Mytilus galloprovincialis* Lamarck, 1819. *Journal of Coastal Development* 13(3): 215-227.

Seed, R. (1985). Ecology patterns in the epifaunal communities of coastal macroalgae. In P.G. Moore, R. Seed (Eds.), *The ecology of rocky coasts* (pp. 22-35). Hodder and Stoughton, London.

Uryu, Y., Iwasaki, K. & Hinoue, M. (1996). Laboratory experiments on behavior and movement of a freshwater mussel, Limnoperna fortunei (Dunker). *Journal of Molluscan Studies* 62: 327-341. DOI: 10.1093/mollus/62.3.327.

Wahl, M. (1989). Marine epibiosis. I. Fouling and antifouling: some basic aspects. *Marine Ecology Progress Series* 58: 175-189. DOI: 10.3354/meps058175.

Wahl, M., Hay, M.E. & Enderlein, P. (1997). Effects of epibiosis on consumer-prey interactions. *Hydrobiologia* 355: 49-59. DOI 10.1023/A:1003054802699.