



Case Report

Occurrence of Epibiont Barnacles *Chelonibia testudinaria* on Green Turtle *Chelonia mydas* at Brunei Bay

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Abstract

Background and Objectives: Barnacles are sessile organisms that attach themselves permanently to the surface of hard or living substrates. Turtle barnacles are also commonly found as epibionts on others marine organisms. Marine turtles are one example of living substrates colonised by barnacles. A sampling activity were conducted on April, 2016 objectively to observe the barnacles as an epibiosis on Green turtle (*Chelonia mydas*) of Brunei bay, located at Lawas, Sabah. This survey intended to identify the species of barnacle species infested on Green turtles in these areas and the specific location of attachment on the bodies of turtles. **Materials and Methods:** Turtle were sampled using netting trap which cover the feeding area. The sample were collected during low tide which is the turtle already stranded in the target location. The turtle were release after the data for carapace width and length, weight and barnacle attachment were recorded. Data were analyzed using standard analysis Microsoft Excel 2007 and the prevalence of the epibiont was calculated using standard methods. **Results and Discussion:** *Chelonibia testudinaria* were identified from 5 sea turtles (n = 5) which trapped. Due to the previous study, *C. testudinaria* is specific on marine turtle especially *C. mydas*. The site preferences for most of the barnacles were on the carapace (30.6%) of the turtles. **Conclusion:** From the observation, the environmental and habitat are the contributing factors that affect the prevalence of the barnacle attachment on the host body.

Key words: Site-specificity, *Chelonia mydas*, brunei bay, green turtle and South China sea

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

In the marine environment, ubiquitously, mentioned that any exposed or undefended surface will eventually be colonized by other marine propagules that called epibiota¹. *Chelonibia* is a genus of acorn barnacles in the monotypic family Chelonibiidae of the subphylum Crustacea². Its members are epizoic and live attached to other marine organisms in all tropical and subtropical oceans. Epibiosis is the most common form of symbiosis in the marine environment and may be classified into several types of associations i.e., mutualism, commensalism and parasitism and it are depending on the interactions between a host and its epibionts³. Sea turtles often act as hosts to a wide variety of epibionts, most of which are unspecialized organisms normally found associated with inanimate structures in the surrounding free living organisms that searching for site of attachment at certain of its lifecycles. *Chelonibia testudinaria* is specific on marine turtle especially *Chelonia mydas*. Najera-Hillman *et al.*⁴, reported the distribution patterns of the barnacle, *Chelonibia testudinaria*, on juvenile green turtles (*Chelonia mydas*) in Bahia Magdalena, Mexico with frequency of occurrence of *C. testudinaria* on juvenile green sea turtles was high (68%), similar to that found in other foraging populations of juvenile green turtles. Nevertheless, the solution of treatment of this not reported yet. But in previous study, reported that turtles were cleaned by dusky surgeonfish, *Acanthurus nigrofuscus* and striated surgeonfish, *Ctenochaetus striatus*⁵. Turtles inhabit and forage near to these turtles cleaning stations consequently having smaller number of barnacles while turtles inhabiting non-cleaning station environments have larger numbers of barnacles^{6,7}. The objectives of this study were to report the occurrence of barnacle attached on the sea turtle at Brunei Bay, Lawas.

MATERIALS AND METHODS

Five (n = 5) sea turtle species *Chelonia mydas* were trapped at Brunei Bay (4°54'27.9"N 115°20'22.4"E) on April, 2016 were examined. Turtle were sampled using netting trap which cover the feeding area. The sample were collected during low tide which is the turtle already stranded in the target location. The turtle were release after the data for carapace width and length, weight and barnacle attachment were recorded. Data were analysed using standard analysis Microsoft Excel 2007 and the prevalence of the epibiont was

Table 1: Data record for five sea turtle species *C. mydas* from brunei bay

	Body weight (kg)	Carapace length (cm)	Carapace width (cm)
Total (n = 5)	516	482	426
Mean±Standard Error	103±17	96±17	85±16

calculated using standard methods⁸. The body weight, carapace length and width were recorded (Table 1). The barnacle were sample at selective site of host body i.e., Head, Tail, Carapace front and back Flipper (Fig. 2). The numbers of barnacle attached on the host sample were recorded and 20 selected barnacles were preserved in 70% ethanol for further identification purposes. The morphological identification was referring to the previous study by Cheang *et al.*⁹, Collareta *et al.*¹⁰, Rizvi and Moazzarn¹¹.

RESULTS AND DISCUSSION

The population studies of the barnacle attachment were not reported due to the limit of sea turtle samples that were collected (Table 1). These studies further report the occurrence of barnacle attachment on the sea turtle *Chelonia mydas* at Brunei bay. As a result, this study shows that the prevalence of infestation of barnacles from five samples of sea turtle *Chelonia mydas* at Brunei bay were 100%. John and George¹² reported that two species of barnacles identified as *Stomatolepas elegans* and *Platylepas decorata*, both species live embedded in the soft skin of the limbs, neck and tail of their host different with this study that report on the species of barnacle genus *Chelonibia*. Sample GT6 shows the highest infestations (47.3%) compared to other host samples (Fig. 1). In this study, the percentage of barnacle attachment was not significant due to the sex and length of carapace because the number of barnacle attached on the male sea turtle were slightly similar to female. This data adequate to know the factors of barnacle attachment were related to the habitat and environment of the host.

Furthermore, the site preferences of the barnacle attachment on the host body can be determined in the Fig. 2. Most of the barnacle is more prefer to attach on the carapace area compared to other site of attachment. The reports of attachment in the carapace were report by Pereira *et al.*¹³ but not specifically mention about the site-specificity of the epibiont. The selections of the attachment area were due to the large space of attachment. This study supported with previous study that have been done by Najera-Hillman *et al.*⁴ with general attachment position of

C. testudinaria on green turtles of Bahia Magdalena was consistent with barnacles were more abundant in the carapace.

From this study, *Chelonibia testudinaria* is the only species of barnacle that have been observed. This species showed the highest number of abundance in the sample of sea turtle. This species of barnacles was morphologically identified with shell in conical shape and body depressed, massive, heavy and oval in outline (Fig. 3). Surface looks smooth with dirty white in colour. Parities extremely thick, membranous vertical septa of varying length is extend interrupted from outer lamina to the broad solid inner lamina, flattened cavities (tubes shape) extend up the length of parities. Radii more narrow, with teeth like notches on both

sides along the length of parities, pinnacles horizontal. Sheath is long, extend down to basal membrane with loop-holes for the entrance of corium ribbon on the sutural edge and in the middle of each compartment. Opercula valves connected with a strong opercula membrane. Labrum shows the shape with a long row of teeth on each side of notch. Inner side of its body contain with two types of Maxilla and Cirrus or cirri. First pair of cirri with unequal rami, separated from other cirri by a gap. Second pair of cirri is shorter and thicker. Third pair cirri were almost as long as the posterior pair. Cirri IV and VI is a tuft of fine spines between two pairs of main spines on each segment. Mandible with 5 teeth, last four laterally double. Pedicel of penis is broad girdle in shape with wavy lower margin. Have long narrow lateral processes and carinal processes also long. These morphological detail explanations of characteristic were according to Rizvi and Moazzam¹¹.

As an effect to the barnacle attachment in sea turtle, previous study by Najera-Hillman *et al.*⁴ been reported that the attachment of barnacles were effectively increase body weight and gives water dragging to juvenile sea turtles during swimming activities. The attachment also can cause to the loss of energetic costs of hosting epibionts when turtles undertake long-distance migrations and least when turtles remain relatively sedentary (e.g., females during inter-nesting periods)^{6,14-16}. Epibiosis may also be burden to host turtles when certain epibionts detrimentally affect the

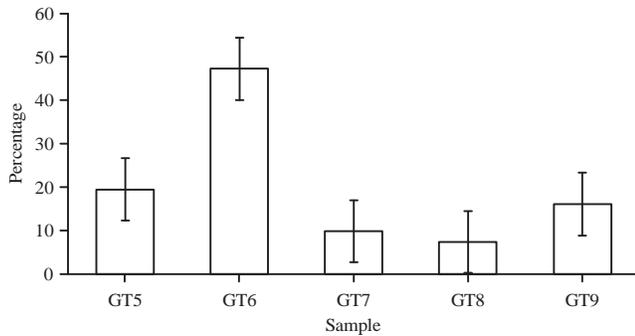


Fig. 1: Percentage of barnacle attachment on Sea Turtle that caught during the study

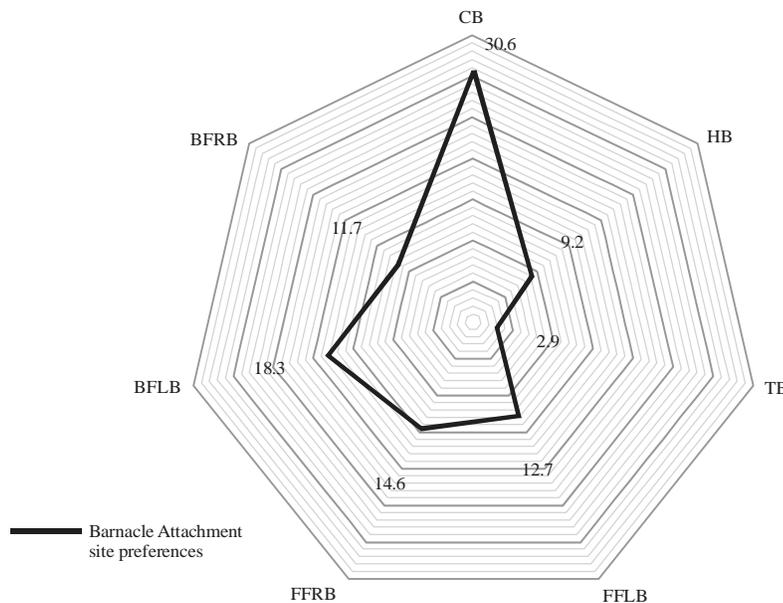


Fig. 2: Percentage of the barnacle that prefers certain part of the host body as a site of attachment. Appendix-[Carapace (CB), Head (HB), Tail (TB), Front Flipper Left (FFLB), Front Flipper Right (FFRB), Back Flipper Left (BFLB), Back Flipper Right (BFRB)]

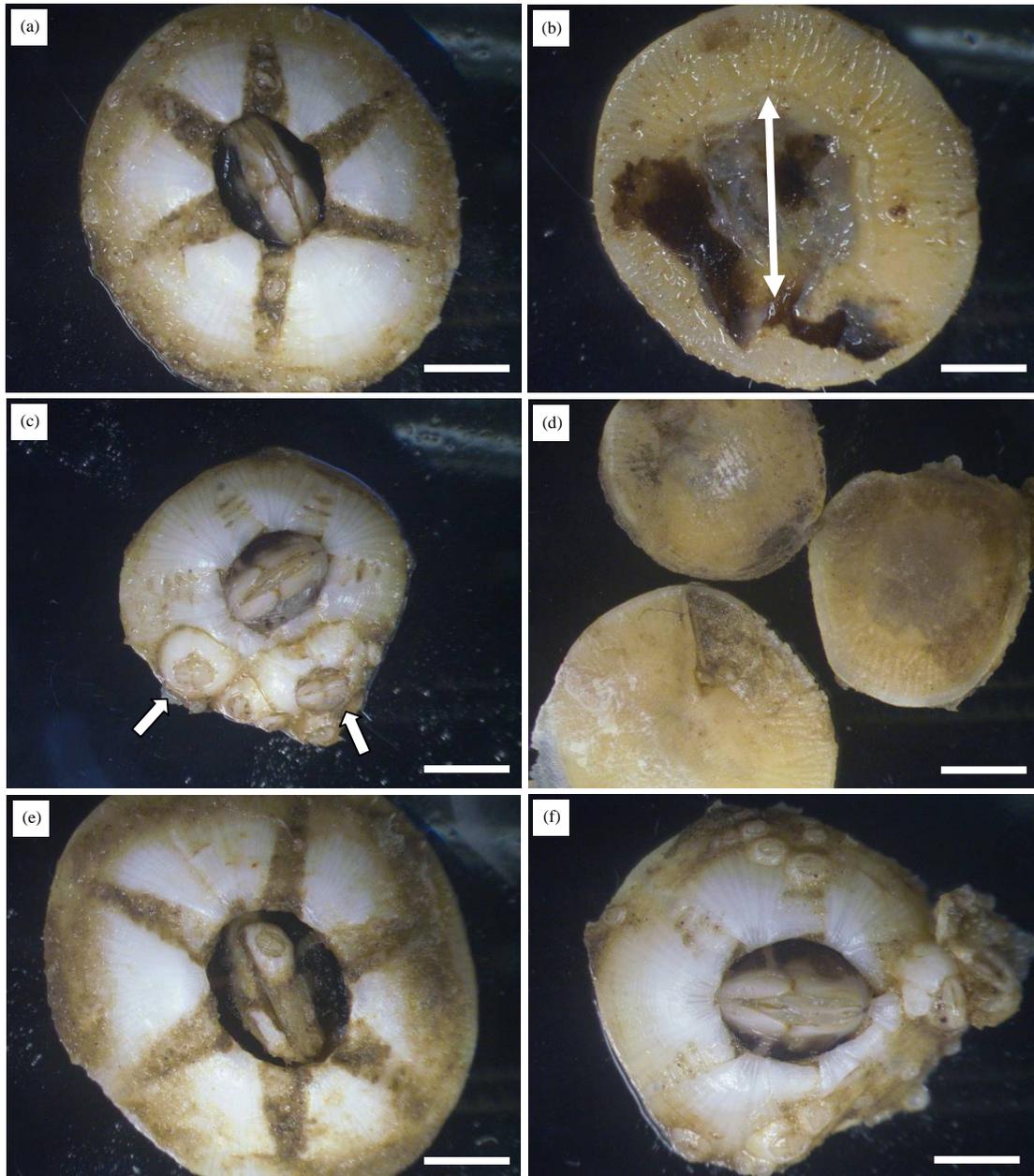


Fig. 3(a-f): Shows the *C. testudinaria* found in this study. (a) Anterior view, (b) Orifice length, (c) Dwarf males (indicated by arrows) settled on the oval depression in the radii of the shell wall plates, (d) Posterior view, (e) Showing the six wall plates and (f) Large number of dwarf male attached on the wall plates of other large barnacles. Micrograph were captured using Nikon Microscope [Bar = 1 cm]

health of host turtles^{3,5,6}. Najera-Hillman *et al.*⁴ indicate that in Bahia Magdalena barnacle abundance is not correlated with turtle size as previously observed in other *C. testudinaria* populations by Hayashi and Tsuji¹⁵. However, previous study also mention that small turtles spend the first portion of their lives (from hatchling to sub adult, 5-30 cm) in oligotrophic oceanic waters¹⁷, which is not

unsuitable habitat for this filter-feeding barnacle species to live and spread^{18,19}. Frick *et al.*¹, Frick and Slay²⁰ and Frick *et al.*²¹ also stated that many factors influence sea turtle behaviour, such as predation, physical stress, disturbance and competition and because turtle behaviour certainly influences the occurrence of *C. testudinaria* on sea turtles.

CONCLUSION

From the study, 100% of *C. mydas* sampled were infested by these species of barnacles which *Chelonibia testudinaria* reported the most abundance species of infest the host. The differentiation of the infestation by sex were not confirm due to the lack of sample for surveillance studies. These species of barnacle were classified as epibiosis. Nevertheless, if the infestations of this epibiota were effectively high, it can caused effluent factors that affect the health status of the host. Further study is needed to elaborate the solution of this natural activity to protect this endangered sea turtle.

Declaration of animal ethics by the institutions nominated authority:

The Universiti Malaysia Terengganu Animal Ethics Committee (UMTAEC) was satisfied that the Primary Applicant for the study of "Occurrence of Epibiont Barnacles *Chelonibia testudinaria* on Green Turtle *Chelonia mydas* at Brunei Bay" has the appropriate qualifications and experience to carry out the work with minimum distress to the animals. Committee also believe this study meets the requirements of the Malaysian Code of Practice for the care and use of animals for scientific purposes and the Malaysian Animal Welfare Act 2015 and its regulations. The Authority have read the application and satisfied that this work is of sufficient scientific merit for the department to be involved in it and sufficient and adequate resources will be available to undertake the proposed study.

SIGNIFICANCE STATEMENT

Moreover, this report is specifically mention the site specificity of the attachment of the barnacles. Previous journal just report the findings of the organisms but not specify the site of attachment. This novel finding can be a guide to the future research of this endangered species. This report is the latest report especially in the South China Sea (SEA) and the results is totally show that this problem is not solves till now. The conservationist should cover this problem in the annual survey of this species of turtles. This action should be taken otherwise this problem can become one of the factors that contribute to the extinctions of the turtle species.

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