



Research Journal of  
**Parasitology**

ISSN 1816-4943



Academic  
Journals Inc.

[www.academicjournals.com](http://www.academicjournals.com)

## **Morphological Distribution of Pedunculate Barnacle *Octolasmis cor* (Aurivillius, 1892) found on Gill of Wild Mud Crab (Genus: *Scylla*) from Terengganu Coastal Waters, Malaysia**

<sup>1</sup>M.Z. Ihwan, <sup>1</sup>M. Ikhwanuddin and <sup>1,2</sup>H. Marina

<sup>1</sup>Institute of Tropical Aquaculture,

<sup>2</sup>School of Fisheries and Aquaculture Science, Universiti Malaysia Terengganu, Kuala Terengganu, 21030, Malaysia

*Corresponding Authors: M.Z. Ihwan and H. Marina, Institute of Tropical Aquaculture, Universiti Malaysia Terengganu, Kuala Terengganu, Terengganu, 21030, Malaysia*

### **ABSTRACT**

More than one species of pedunculate barnacle genus *Octolasmis* are found attached on the gill of wild mud crab in this study. For the gill preference study, *Octolasmis cor* prefers to attach on the gill G3 to G6. The areas of site infection are still in the middle part of the mud crab gill. These results are different with previous studies which prefer G7 as attachment. For the identification study, twenty good specimens, that have been mounted on glass slide, were taken for identification of morphological part. The general part of shape, carina and scutum were captured and drawn using lucida camera (Leica). Shape of carina ( $1.44 \pm 0.29$ ), capitular plates ( $3.04 \pm 0.53$ ), capitulum ( $1.74 \pm 0.35$ ) and peduncle ( $2.32 \pm 0.39$ ) of *Octolasmis cor* were measured, respectively. Data analysis using one-way ANOVA show that part of carina and scutum show significant difference ( $p > 0.05$ ) and can be used as identification tools. Studies on genus *Octolasmis* were not well-published. Most of previous literatures just explain the genus of *Octolasmis* but not into species because of no standard method for identification of this genus.

**Key words:** *Octolasmis cor*, carina, scutum, morphological characteristic

### **INTRODUCTION**

Most of potential cultured crustacean species are related to *Octolasmis* spp. i.e; mud crab, blue swimming crab, lobster, horseshoe crab etc. Most of the studies are focused on the observations of ecto-symbiont (Jeffries and Voris, 1979; Jeffries *et al.*, 1989, 2005; Hudson and Lester, 1994), life cycle (Jeffries *et al.*, 1995), orientation (Dinamani, 1964; Xue and Wu, 2002), attachment (Klepai and Barnes, 1975; Yap and Lim, 2011; Holm, 2012; Clare and Matsumura, 2000; Sullan *et al.*, 2009), physiological effect (Gannon and Wheatly, 1992), reproductive system (Yamaguchi *et al.*, 2012), interaction with host (Sherman *et al.*, 2008; Jeffries *et al.*, 1992) and distribution or population characteristic (Mushtaq and Mustaquim, 2009; Jeffries *et al.*, 1982; Voris *et al.*, 1994) of pedunculate barnacle but details information of morphological identification of species are lacking. Several information of species that have been identified generally are 42 done by Chan *et al.* (2011), Jeffries *et al.* (1982, 1991) and Jeffries and Voris (1996).

Genus *Octolasmis* or synonym to *Dichelaspis* and *Temnaspis* are commonly found ubiquitous in the host that have hard body carapace such as, crab and turtle etc. Thus, there are studies that

report the presence of *Octolasmis* spp. on snake's skin (Jeffries and Voris, 1979). According to Jeffries *et al.* (2005), the identification of this *Octolasmis* spp. is according to body shape and size, the presence or absence of calcareous plates, as well as variations in plate size, shape and disposition. Lerssutthichawal and Penprapai (2013) mention that the growth of pedunculate barnacle genus *Octolasmis* depends on the seasonal and host-parasite interaction especially for orange mud crab, *Scylla olivacea*. This species is not only attached on the mud crab, previous researches have been mention that *Octolasmis* spp. commonly attached on the outer body, gill chamber, maxillipeds and mouthpart. The objectives of this study are to identify pedunculate barnacle *Octolasmis cor* found on the gill in three species of wild mud crab (*Scylla olivacea*, *S. tranquebarica* and *S. paramamosain*) and to study the site preference study of this pedunculate barnacle species.

## **MATERIALS AND METHODS**

Sixty wild mud crabs were sampled from Setiu Wetland (5°40'47.93"N, 102°42'45.04"E) of Terengganu coastal water, Malaysia (from September 2011 to March 2012) which consist of three mud crab species i.e; *Scylla olivacea*, *S. tranquebarica* and *S. paramamosain*. The crab were brought back to the Parasitological Laboratory at Institute of Tropical Aquaculture, Universiti Malaysia Terengganu and kept maintain on aerated aquaria fill with brackish water. The Carapace Width (CW) and Body Weight (BW) were measured by using caliper (vernier) and electronic balance (Sartorius), respectively.

Identification of mud crabs species was described by Keenan *et al.* (1995). Wild mud crab samples were kept in the chiller to kill the crab. Observations of ecto-symbiont were started from outside of its body by using dissecting microscopes (Leica AZ100). All pedunculate barnacles from external body of the mud crab were collected. Then the carapaces were pulled out and the gills were sorted and separated in the petri dish (the arrangements of gill were maintained for pedunculate barnacles on gill specification study).

The numbers of ecto-symbiont were count for further analysis. Crab was dissected using methods by Shields (1992) and modifying general method by Berland (2005) for ectoparasites and endoparasites. The counting process is according to Ihwan *et al.* (2013). The basis of a direct count is the actual counting of every organism (or every living organism). Direct counts include a direct microscopic count which is a determination of the number of ecto-symbiont found within a demarcated region of a slide. By using this total count method, all barnacles were counted whether dead or alive (Ihwan *et al.*, 2013). The samples that have been collected were directly fixed in bijou bottle with 70% alcohol for further study (Berland, 2005). The pedunculate barnacles were mounting using glycerin jelly to make permanent slide. Every mounting slide was cover with plain nail polish to make sure the samples were not collapse. The procedures for mounting pedunculate barnacle were modified from Berland (2005) because till now, there are not specific procedure for fixing the barnacle. Then, the drawing process was done using the prepared slide.

Ten good specimens were selected for drawing process and every part of the specimen was illustrated. All drawings were made by using compound microscope attached with lucida camera tube (Leica) on a drawing paper or A4 paper. The sketching on the drawing or A4 paper was traced on a tracing paper. The drawing measurements of important organs or part for identification were measured in micron ( $\mu\text{m}$ ). Digital shots of pedunculate barnacles were taken using Advanced Compound Microscope (Nikon Eclipse 80i) and Advanced Stereo Microscope (Nikon AZ100).

The highest prevalence of pedunculate barnacles from wild mud crabs were chosen as a main species for identification. For identification, method for parasitology techniques (fixing, capturing using advanced compound and stereo microscope and drawing) was applied. Mean for pedunculate barnacles and important part or organs for identification were drawn and counted. The digital pictures facilitated identification easily. The gills of wild mud crab were labeled with G1, G2, G3, G4, G5, G6, G7 and G8 especially for gill preference study and three species of wild mud crab were labeled as SO for *Scylla olivacea*, ST for *S. tranquebarica* and SP for *S. paramamosain*. All barnacles were identified based on their morphological features of capitular, scuta/scutum, carina and terga. The important morphology that has to take into counter was body size and shape, the presence or absence of calcareous plates as well as variation in plate size, shape and disposition. Other than that, most of the morphological studies are described by Jeffries *et al.* (2005) and Chan *et al.* (2011).

## RESULTS AND DISCUSSION

From the previous study by Mushtaq and Mustaqim (2009), it is shown that *Octolasmis cor* prefer gill number 7 whereas, *Octolasmis angulata* prefer to attach in gill number 4. This may be because of that the habitat of wild mud crab is major factor that contribute to the reason of highly infection of barnacle. Normally, wild mud crab habitat is in mix sandy and muddy area which is suitable for pedunculate barnacle growth.

For the gill preference study, *Octolasmis cor* prefers to attach on the gill G3-G6 (Fig. 1). The areas of site infection are still in the middle part of the mud crab gill. These results are different with previous studies which prefer G7 as attachment. It was assume that G7 are already dominated by other barnacle species. For this barnacle, most of the species barnacles did not show any significant difference ( $p>0.05$ ) with other mud crab species. It means that this species did not show any site preferring compared to others.

*Octolasmis cor* can be identified from the shape of their scutum and carina (Fig. 2). The pedunculate barnacle commonly attached with the oriented of its aperture margin facing the current and the carina margin away from the water current. This is particularly evident in those pedunculate barnacles growing on the gill filament properly. The situations of the pedunculate

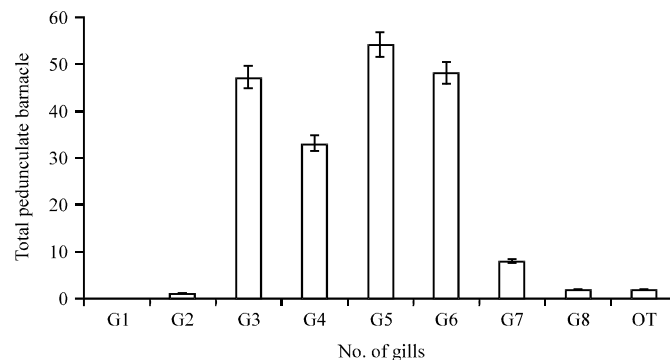


Fig. 1: Bar chart showing the result of pedunculate barnacle species *Octolasmis cor* with gill preferences study for three species of wild mud crab. Data was analyzed by using one-way ANOVA

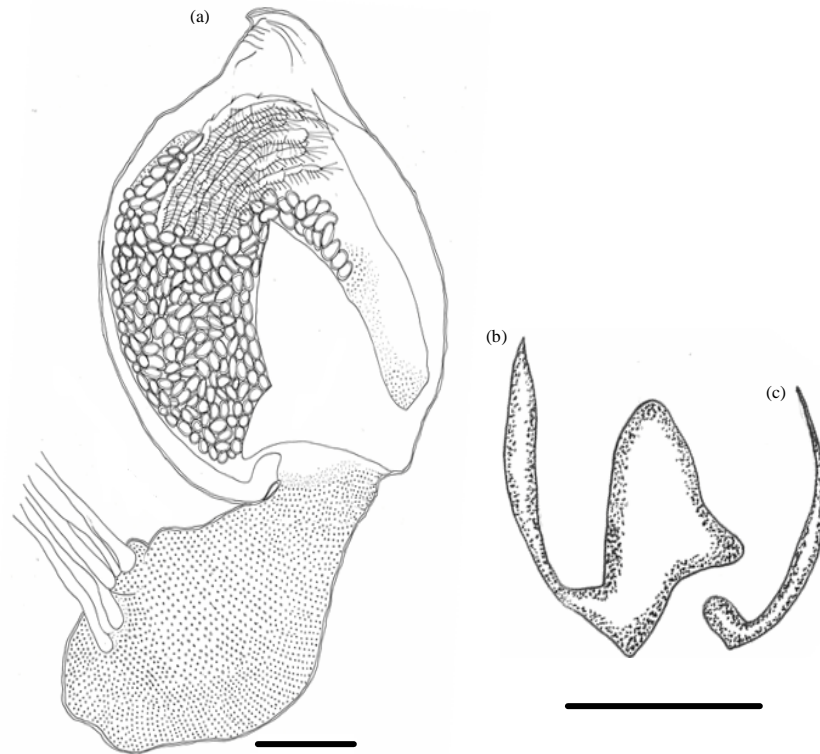


Fig. 2(a-c): Technical drawing of *Octolasmis cor*, (a) Whole body of barnacle, (b) Scutum and (c) Carina (scale bar = 50  $\mu$ m)

Table 1: Comparison measurement of *Octolasmis cor* in this study with the previous study by Jeffries *et al.* (2005)

Parameters	Previous study	This study
Capitular length (mm)	2.53 $\pm$ 0.43	1.74 $\pm$ 0.35
Capitular plates	3	3
Capitular plates length	N/A	3.04 $\pm$ 0.53
Peduncle length (PL)	N/A	2.32 $\pm$ 0.39
No. of scutum	2	2
Presence of carina	-	-
Length of carina	N/A	1.44 $\pm$ 0.29
No. of terga	N/A	N/A

N/A: Not available

barnacles are based on the gill because their aperture margin directed either anteriorly or ventro-laterally. Thus, these pedunculate barnacles are face into the current flowing past to the base of the appendages or the current drawn up into the branchial chamber. Table 1 show the comparison of species from Jeffries *et al.* (2005) with this study.

The length of capitulars from the previous study are quite large (2.53 $\pm$ 0.43) compared with the present study (1.74 $\pm$ 0.35). Data that was analyzed using one-way ANOVA show that the shape of carina and scutum show significant difference ( $p > 0.05$ ) and can be used as a morphological identification tools.

## CONCLUSION

This is the first published confirmation of *Octolasmis cor* (Aurivillius, 1894) from the East Coast of Peninsular Malaysia and it is first record found in the 3 species of wild mud crab genus *Scylla* spp. The important part i.e., shape of carina and scutum can be used as morphological identification method especially for genus *Octolasmis* species identification. Generally, *Octolasmis cor* did not show any specific gill preference compared to the previous study. Selection of site preference depends on the water current through the gill and the abundance of other *Octolasmis* spp. which conquered specific gill. From this study, we can conclude that wild mud crabs are common infected by pedunculate barnacle. The natural environment of the growth of barnacle contribute to the highly infestation on the mud crab especially in the gill of this crab species. Nevertheless, all the wild mud crab species in this study infested with pedunculate barnacle *Octolasmis cor*. This factor may be because of the barnacle larvae are already developed in the natural environment.

## ACKNOWLEDGMENT

We would like to extent our peaceful thanks to Institute of Tropical Aquaculture (AKUATROP) Laboratory management for giving the opportunity to use the facility to support this study. Also special thanks to Mrs. Wahidah Wahab for helping especially for handling the chemicals and equipment during this study. Last but not least for Ministry of Science, Technology and Innovation (MSTI) for their funding through Prototype Research Grant (PRGS 54234).

## REFERENCES

- Berland, B., 2005. Whole mounts. Occasional Publication No. 1, Institute of Oceanography, Kolej Universiti Sains Dan Teknologi Malaysia, Malaysia, pp: 1-54.
- Chan, K.K., R. Prabowo and K.S. Lee, 2011. *Octolasmis angulata* (Aurivillius, 1894). Taiwan Barnacles, Biotaiwanica. <http://barnacle.taibif.tw/pages/1063>.
- Clare, A.S. and K. Matsumura, 2000. Nature and perception of barnacle settlement pheromones. Biofouling: J. Bioadhesion Biofilm Res., 15: 57-71.
- Dinamani, P., 1964. Variation in form, orientation and mode of attachment of the cirriped, *Octolasmis stella* (Ann.), symbiotic on the gills of lobster. J. Anim. Ecol., 33: 357-362.
- Gannon, A.T. and M.G. Wheatly, 1992. Physiological effects of an ectocommensal gill barnacle, *Octolasmis muelleri*, on gas exchange in the blue crab *Callinectes sapidus*. J. Crustacean Biol., 12: 11-18.
- Holm, E.R., 2012. Barnacles and biofouling. Integr. Comp. Biol., 52: 348-355.
- Hudson, D.A. and R.J.G. Lester, 1994. Parasites and symbionts of wild mud crabs *Scylla serrata* (Forsk.) of potential significance in aquaculture Aquaculture, 120: 183-199.
- Ihwan, M.Z., F. Shaharom-Harrison, H. Marina and W. Wahidah, 2013. A comparative prevalence study of ectoparasites in wild and cultured grouper before and after transportation. J. Sustainable Sci. Manage., 8: 121-125.
- Jeffries, W.B. and H.K. Voris, 1979. Observations on the relationship between *Octolasmis grayii* (Darwin, 1851) (Cirripedia, Thoracica) and certain marine snakes (Hydrophiidae). Crustaceana, 37: 123-132.
- Jeffries, W.B. and H.K. Voris, 1996. A subject-indexed bibliography of the symbiotic barnacles of the genus *Octolasmis* Gray, 1825 (Crustacea: Cirripedia: Poecilasmatidae). Raffles Bull. Zool., 44: 575-592.

- Jeffries, W.B., H.K. Voris and C.M. Yang, 1982. Diversity and distribution of the pedunculate barnacle *Octolasmis* in the seas adjacent to Singapore. *J. Crustacean Biol.*, 2: 562-569.
- Jeffries, W.B., H.K. Voris and C.M. Yang, 1989. A new mechanism of host colonization: Pedunculate barnacles of the genus *Octolasmis* on the mangrove crab *Scylla serrata*. *Ophelia*, 31: 51-58.
- Jeffries, W.B., H.K. Voris and C.M. Yang, 1991. Species recognition among the pedunculate barnacles (Cirripedia: Thoracica) on the mangrove crab, *Scylla serrata*. *Raffles Bull. Zool.*, 40: 83-92.
- Jeffries, W.B., H.K. Voris and S. Poovachiranon, 1992. Age of the mangrove crab *Scylla serrata* at colonization by stalked barnacles of the genus *Octolasmis*. *Biol. Bull.*, 182: 188-194.
- Jeffries, W.B., H.K. Voris, S. Poovachiranon and L.C. Heil, 1995. The life cycle stages of the lepadomorph barnacle, *Octolasmis cor* and methods for their laboratory culture. *Phuket Mar. Biol. Cent. Res. Bull.*, 60: 29-35.
- Jeffries, W.B., H.K. Voris, P. Naiyanetr and S. Panha, 2005. Pedunculate barnacles of the symbiotic genus *Octolasmis* (Cirripedia: Thoracica: Poecilasmatidae) from the Northern Gulf of Thailand. *Nat. Hist. J. Chulalongkorn Univ.*, 5: 9-13.
- Keenan, C.P., D.L. Mann, S. Lavery and P. Davie, 1995. Genetic relationships, morphological identification and taxonomy of mangrove crabs, genus *Scylla*, from throughout the Indo-Pacific. ACIAR Project Report, Australian Centre for International Agricultural Research (ACIAR), QDPI, Brisbane, Australia.
- Klepal, W. and H. Barnes, 1975. A histological and scanning electron microscope study of the formation of the wall plates in *Chthamalus depressus* (Poli). *J. Exp. Mar. Biol. Ecol.*, 20: 183-198.
- Lerssutthichawal, T. and N. Penprapai, 2013. Seasonal distribution and host-parasite interaction of pedunculate barnacle, *Octolasmis* spp. on orange mud crab, *Scylla olivacea*. *Walailak J. Sci. Technol.*, 10: 113-119.
- Mushtaq, S. and J. Mustaqim, 2009. The occurrence and distribution of stalked barnacles of the genus *Octolasmis* on the gills of mud or mangrove crab, genus *Scylla*. *Crustaceana*, 82: 53-61.
- Sherman, T.D., E. Boone, A.B. Morris, A. Woodard and E. Goldman *et al.*, 2008. Investigations of internal interactions between the parasitic barnacle *Loxothylacus texanus* (Rhizocephala: Sacculinidae) and its host *Callinectes sapidus* (Brachyura: Portunidae) using PCR techniques. *J. Crustacean Biol.*, 28: 220-227.
- Shields, J.D., 1992. Parasites and symbionts of the crab *Portunus pelagicus* from Moreton Bay, Eastern Australia. *J. Crustacean Biol.*, 12: 94-100.
- Sullan, R.M.A., N. Gunari, A.E. Tanur, Y. Chan and G.H. Dickinson *et al.*, 2009. Nanoscale structures and mechanics of barnacle cement. *Biofouling*, 25: 263-275.
- Voris, H.K., W.B. Jeffries and S. Poovachiranon, 1994. Patterns of distribution of two barnacle species on the mangrove crab, *Scylla serrata*. *Biol. Bull.*, 187: 346-354.
- Xue, J. and H. Wu, 2002. Orientation, attachment and population characteristics of the goose barnacle *Octolasmis neptuni* living on the gills and mouth appendages of the swimming crab *Portunus trituberculatus*. *Acta Ecologica Sinica*, 22: 2091-2095.
- Yamaguchi, S., E.L. Charnov, K. Sawada and Y. Yusa, 2012. Sexual systems and life history of barnacles: A theoretical perspective. *Integr. Comp. Biol.*, 52: 356-365.
- Yap, F.C. and L.H.S. Lim, 2011. Adhesive secretion from the cyprids of *Octolasmis* spp. inhabiting the gills of mud crabs, *Scylla* spp. Proceedings of the 16th Biological Sciences Graduate Congress, December 12-14, 2011, Singapore.