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# Assessment of pedunculate barnacle infestation on two non-commercial crab species of the genus Charybdis from the Alappuzha region of Arabian Sea, Kerala, South India

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**ABSTRACT**

The marine crab species *Charybdis annulata* (Fabricius 1798) and *Charybdis smithii* (Türkay& Spiridonov 2006) were selected for assessing the infestation rate of pedunculate barnacle, Octolasmis. Both of them are commercially less important because of their lower meat content. They are found abundantly in some seasons and are mostly discarded. *C. annulata* (n=54) was collected during the post-monsoon and *C. smithii* (n=84) during the monsoon and pre monsoon period from the Arattupuzha and Valiyazheekkal region of Alappuzha District, Kerala. The rate of barnacle infestation based on their size, sex and site of attachment were evaluated. Among the 138 crabs, 36.2% were infested with 297 barnacles, and most were 5 to 10mm in size. The barnacles preferred the hypobranchial surface and were mostly attached to the medial regions of the gills. The rate of infestation was higher in males. Pedunculate barnacles of three species, *Octolasmis angulata, O. bullata* and *O. tridens*, were identified from the collected crabs. The higher rate of infestation affects the normal respiration of the host crab.

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## 1. Introduction

Crabs are one of the ecologically and economically important decapod crustaceans. They have a significant role in the food webs of marine ecosystems, and they are mainly habitat-specific. Most of the marine crabs belonging to the family Portunidae are considered as valuable seafood resources and are mainly utilized for human consumption, while some other species acquire less commercial value and are discarded along the coastal region. Crabs commonly inhabit marine ecosystems at a depth of 6000 m to the coastal line, and their distribution mainly depends on the salinity and temperature (Ng and Davie,2002).

The genus Charybdis (De Haan, 1833) consists of four subgenera with more than 60 species (Ng *et al.,* 2008) and are the most common crab species distributed on the west coast of India(Roy, 2013). C*harybdis annulata* (Fabricius, 1798), commonly known as "Banded leg swimming crab", inhabit mainly on the rocky intertidal zones, and they are identified as one of the edible species along different coastal areas of India (Radhakrishnan *et al.,* 2007). The Indian Ocean swimming crab, *Charybdis smithii,* became a significant component of the trawl catch from the southwest coast of India, and their abundance reached 15,000 individuals/km$^2$ during the southwest monsoon along the equatorial Indian Ocean(Romanov *et al*., 2009) beyond 100m depth(Yogesh *et al.,*2019). Even though they have the potential to be recognized as a safe human food (Balasubramanian and Suseelan, 2001), a huge quantity of *C. smithii* are found in trawl discards(Dineshbabu *et al.,* 2012). Compared to the other edible crab species of the southwest coast, *C. annulata* and *C. smithii* were found to have no commercial value.

Octolasmis species are epibionts in the gill chamber of decapods, where they complete their entire life cycle (Blomsterberg *et al*., 2004). The presence of a large number of these pedunculate barnacles in the gill chambers severely impairs host respiration (Jeffries and Voris, 1983), causes high mortality, and adversely affects their fishery (Gannon and Wheatly, 1992). The present study was carried out to examine the intensity and spatial distribution of Octolasmis in *C. annulata* and *C. smithii*, collected from the Alappuzha coast of the Arabian Sea, Kerala.

## 2. Materials and Methods

*Charybdis annulata* (n=54; Fig. 1) were collected from the Arattupuzha (9.22770°N 76.42462°E) and Valiyazheekkal (9.19873°N 76.45003°E) region of the Arabian Sea and were observed in catches during October-November, 2020-2021 whereas *C. smithii* (n=84; Fig. 2) were collected from the Valiyazheekkal region in February and July of 2021-22 (Fig. 3). The carapace length, carapace width, total weight, and sex of the collected crabs were determined. The barnacle distribution and rate of infestation were examined thoroughly on the carapace, branchial chambers and gills. In gills, the site of attachment, especially the inside (hypobranchial) and outside (hyperbranchial) surface, proximal, medial and distal regions were assessed using hand lenses and dissection microscopes. The number of barnacles and their exact site of attachment concerning gill chamber were noticed (Jeffries and Voris, 1983). The barnacles were removed from crab's body and preserved in ethyl alcohol (Ihwan *et al*., 2014) for further identification (Chan *et al*., 2009). The prevalence (number of hosts infested with the epizoic barnacles/number of hosts examined, expressed as a percentage) and mean intensity (Total number of barnacles in a sample /total number of infested hosts) (Margolis *et al.,* 1982; Yan *et al.,* 2004) were calculated. The size of the barnacles was also determined to the nearest mm. The relationships between crab size, sex and infestation rate were estimated using Pearson's correlation test. The sex ratio was determined using the Chi-square test.


**Fig. 1&2.** Crab species examined for barnacle infestation

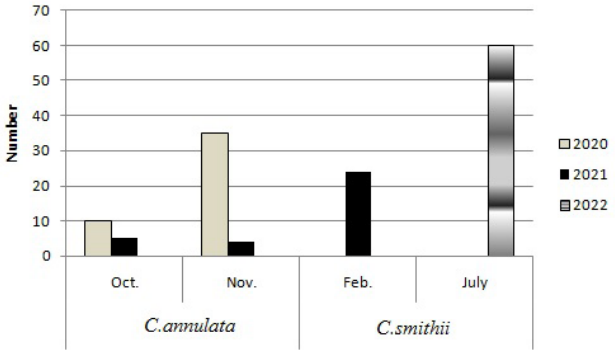


**Fig. 3.** Sampling details of *C.annulata* and *C.smithii* from the Alappuzha coastal region(2020-2022)

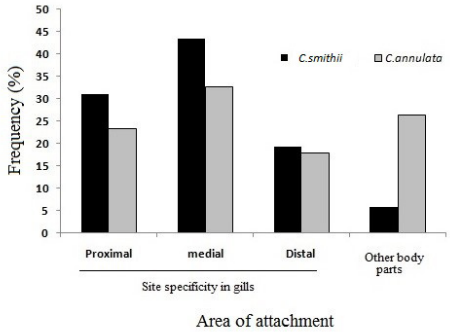


**Fig. 4.** Spatial distribution of barnacles on the gills and other parts of the branchial chamber

## 3. Results and Discussion

The carapace width, carapace length and total weight of *C. annulata* and *C. smithii* were given in Table 1. Out of 138 crabs, 47.83% were males and 52.17% were females. The infestation rate was 36.23%, with a total of 297 Octolasmis. Males (65%) were dominated in *C. annulata* (Sex ratio 1.84:1.0, df=1, $\chi 2$ =4.6, $p< 0.05$) and the females included both ovigerous (20%) and non-ovigerous (15%) crabs, whereas in *C.smithii*, females were higher(63%) than males (Sex ratio 1.0:1.7, df=1, $\chi 2$ =5.6, $p< 0.05$) with 12% ovigerous and 51% non-ovigerous individuals (Table 2). The Chi-square values indicated a significant difference between female and male crabs ($P < 0.05$) of both species. The prevalence of infestation was 51.85% and 26.19%, the mean intensity was 4.46 and 7.82, and the maximum number of barnacles observed in a single crab was 21 and 29 in *C. annulata* and *C. smithii,* respectively.

In *C. annulata*, the infestation rate was higher in males (64.28 %) and among the female crabs, ovigerous females (25%) have the highest rate of infestation than non-ovigerous females(10.71 %). In *C. smithii,* the infestation rate in male crab was 63.63% followed by ovigerous (27.27 %) and non-ovigerous female (9.09 %). The susceptibility of ovigerous females to infestation may be due to their inactive and bottom-dwelling nature for longer periods than males, enabling cypris larvae to enter the branchial chamber of berried females (Bindu, 2018). The infested crabs became sluggish and dwelled at the bottom.

The barnacles were attached to the crabs using their peduncle and most of them concentrated on the internal regions, especially the gills. They were found to be selective in their site of attachment on the host body (Voris *et al.,* 1994). Settlement was nonrandom and mostly concentrated in ventilated locations (Gaddes and Sumpton, 2004; Bastami *et al*.,2012). In the present study, the barnacles mostly concentrated on the hypobranchial surface of the gills, and its medial region hosted a larger number of barnacles than the proximal and distal portion(Fig. 4). In *C. annulata,* 84% of barnacles were found in the gills and remaining in branchial lining (4.8%), gill raker (9.6%) and cleaners (1.6%). The highest number of barnacles were concentrated in the medial portion (40%) of the gills than in the proximal (38%) and distal region (22%). The present study agrees with Shazia and Javed (2017) and Marina *et al*.(2019) that the Octolasmis was concentrated on the proximal and medial parts of the gills rather than distal and certain Octolasmis spp. only specified to certain part of the gill. In *C. smithii,* 95% of barnacles are found in the gills and 5% in the cleaners. The medial region (41%) of the gills has more barnacles than the proximal (40%) and distal portion (19%). The larger crabs are more susceptible

**Table 1.** Morphological measurements of collected *C. annulata* (N=54) and *C. smithii* (N= 84)

| Crab species | Width (cm) | | Length (cm) | | Weight (g) | |
|---|---|---|---|---|---|---|
| | Range | Mean ± SD | Range | Mean ± SD | Range | Mean ± SD |
| *C. annulata* | 4.3-7.1 | 5.774±0.616 | 3.1-4.8 | 3.956±0.409 | 12.49-65.71 | 33.72±11.798 |
| *C. smithii* | 4.5-6.7 | 5.625±0.463 | 3.3-4.8 | 4.05±0.357 | 12.23-64.4 | 26.921±9.589 |

**Table 2.** The rate of infestation (%) in accordance with species -wise and sex-wise distribution

| Crab species | Total No. | Male (%) | Female (%) | Total infestation | Infested male | Infested female | Number of barnacles | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Total | Mean ± SD |
| *C. annulata* | 54 | 65 | 35 | 51.8 | 51.4 | 52.6 | 125 | 4.46 ±4.83 |
| *C. smithii* | 84 | 37 | 63 | 26.2 | 45 | 15 | 172 | 7.81±6.884 |

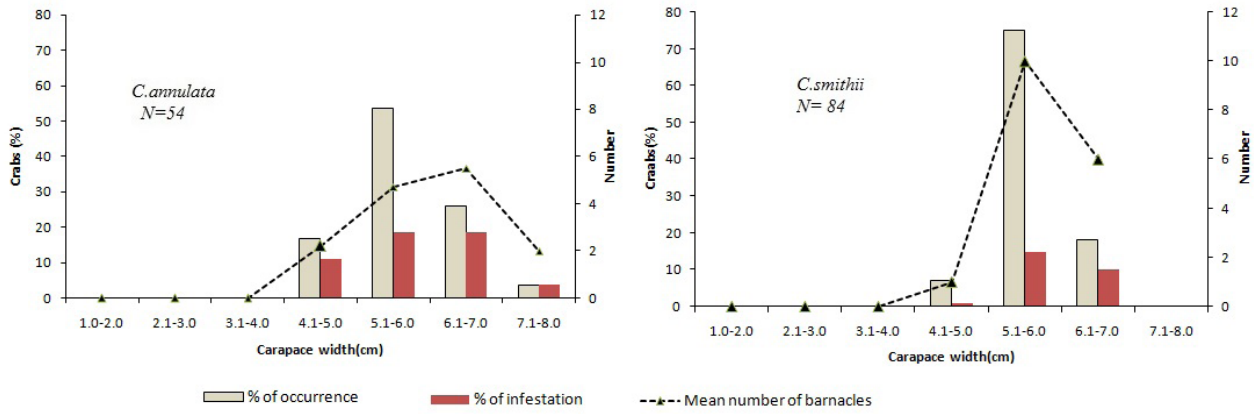


**Fig. 5.** Percentage of occurrence of infested crabs in various-sized (carapace width, CW) *C. annulata* and *C. smithii*. Dotted line represents the number of barnacles present in each size groups

to infestation by Octolasmis than smaller ones (Fig. 5). As the immature crabs moult regularly, settled barnacles were extruded with the moult and they didn't get enough time to complete their life cycle(Walker, 1974). Most of the barnacles come under the size group of 5-10mm (Fig. 6) and these filter feeders are dependent on their host for the continued renewal of ventilatory water(Walker, 1974). In the present study, *Charybdis annulata* hosted 4% of *O. angulata*, 30.4% of *O. bullata* and the remaining barnacles were smaller and unidentified, while from *C. smithii,* only O*ctolasmis tridens* (58.13%) was identified.

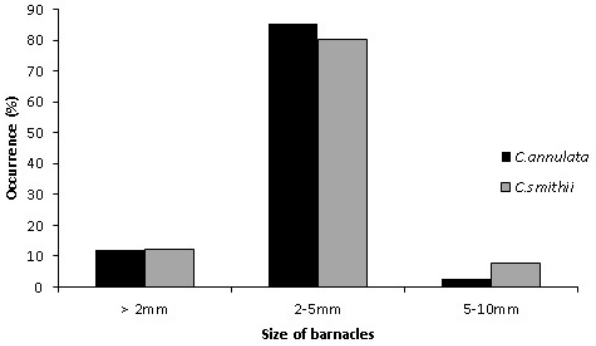


**Fig. 6.** Distribution of different sized barnacles in two selected crabs

## 4. Conclusion

This study aimed to evaluate the susceptibility of the two less commercial marine crabs, *Charybdis annulata* and *C.smithii,* to the infestation of pedunculate barnacles. Both of these species are not so common and available only occasionally. They are used as food in some parts of the country. The infestation of barnacles at a smaller rate will not harm the host, but severe infestation affects the respiration of crabs; they became inactive, which will affect their fishery.

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