Seasonal variations in the distribution of pedunculate barnacle Octolasmis spp. on Scylla serrata (Forskal, 1775) from the Ayiramthengu mangroves, Kerala

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Present study is to understand the seasonal distribution and infestation rate of pedunculate barnacles Octolasmis spp., in S. serrata. Altogether 103 crabs were analysed and a total of 2070 barnacles were obtained from 87 infested crabs. Barnacle infestation was more prevalent on the gills and was found to differ significantly by season, size and sex. They are more abundant during the premonsoon months when salinity is higher in the estuarine waters. The mean intensity of infestation was less in monsoon compared to pre-monsoon and post-monsoon, which registered a very high incidence of 18.33 and 40.21 respectively. Larger crabs host more barnacles than younger ones. The less active, bottom seeking females are more vulnerable to the infestation and the barnacle load was higher in them. Barnacles cause respiratory obstruction in the host and heavy infestation leads to high mortality.

[Key words: Mud crab, Scylla serrata, barnacle, Octolasmis spp., Ayiramthengu mangrove]

Introduction
Mud crabs are the most valuable crab species in the world, with the bulk of their commercial production sent live to market1. Both Scylla serrata and Scylla tranquebarica are valued for their delicious meat and export potential2. Live crabs are mainly exported to the South-East Asian countries as they are highly palatable and having nutritive quality3. They are a very good alternative for shrimp in brackishwater aquaculture. Their culture in the coastal areas of India especially among the weaker sections of the society strengthens the production base of this species for export in live and value added products4. Several studies have been reported on their distribution from portunid crabs around the world5-9. Presence of large number of these barnacles in their gill chambers severely impair host respiration10 and heavy infestation leads to physiological stress and mortality11. Rhizocephalan barnacles are reported to induce sterilisation in portunids and other brachyuran12,13 and thus have a detrimental impact on its production and fishery. Information on the relation between barnacle and host (prevalence, seasonality etc.) is therefore a prerequisite to any predictions on the effect on aquaculture yields and to counter measures against barnacle epibiosis that might be set to work. The present study was based on the seasonal variations in the infestation of Octolasmis spp. in S.serrata collected from the Ayiramthengu mangrove region of the Kayamkulam estuary.

Material and Methods
Monthly samples of S.serrata were collected with the help of traps from the Ayiramthengu mangrove region of the Kayamkulam Lake, an estuarine system dotting the coast of Kerala (9° 09´- 9°15´ N and 76° 02´ -76° 28´ E), during 2010-2011 and were brought to the laboratory in live condition for analyzing the infestation of barnacles. Samples were taken at random. A total of 103 crabs were examined and their body dimensions including carapace width (CW, greatest width between the epibranchial spines), total weight (WT) and sex were assayed. The carapace was then cut opened using scissors. The dorsal and ventral body surfaces, wall of branchial chamber and gills in each chamber were carefully examined to record the attachment site of the barnacles when present14,15. Only barnacles settled in the inner wall of the gill chambers and gill surfaces were included in the study. The exact site of barnacle attachment with respect to gill chamber, inside (hypobranchial) or outside (epibranchial) gill surface, proximal or distal gill region were recorded10. Hand lenses and dissecting microscopes were used for this. Barnacles present on the gills and adjacent areas were removed and preserved in alcohol, separately for making the
identification easier. Then, prevalence (number of hosts infested with the epizoic barnacle/number of hosts examined, expressed as a percentage) and mean intensity (total number of barnacles in a sample/total number of infested hosts) were also calculated. Interaction amongst the variables a) season b) sex c) maturity and d) frequency of infestation were examined.

Physicochemical parameters such as salinity(ppt.), temperature(°C), pH and dissolved oxygen(mg.L⁻¹) of the two selected locations of the lake (site I – freshwater area, site II – estuary) were measured using standard procedures. Seasons were divided into pre-monsoon (PRM, February to May), monsoon (MS, June to September) and post-monsoon (PTM, October to January). Rate of infestation during different seasons were analysed and compared with the physicochemical parameters prevailing at that time.

Results

A total of 103 crabs (size range: 6.4-13.4cm) were examined, of which 49 were males and 54 were females. Their CW and WT ranges 6.5 cm - 13.4 cm and 58g - 590g respectively (Table 1). Among them 87 crabs (46% males and 54% females) were found to bear pedunculate barnacles of Octolasmis spp. in the branchial chamber. They were frequently found attached on the gills (Fig. 1a,b). Crabs exhibited an overall prevalence of 84.5% during the study period and mean intensity of infestation was 23.8. Prevalence of infestation varied significantly with season, size and sex.

Even though infestation was found in all months, two distinct period of occurrence were discernible. The percentage of infestation showed a gradual decrease from pre-monsoon to monsoon (Fig.2) in correlation with the salinity of the lake. Seasonal variations in physico-chemical parameters of the lake were recorded in table 2. It shows a remarkable variation in salinity, temperature, pH and Dissolved Oxygen (DO) of the two sites during different seasons. Salinity and temperature were low during monsoon. There was a marked reduction in the barnacle distribution during this time. The mean intensity of infestation during monsoon, was much less (7.11) when compared to pre-monsoon and post-monsoon, which registered a very high incidence of 18.33 and 40.21 respectively.

In the collected samples, even though Octolasmis spp. was attached on the gills and anterior wall of the

<table>
<thead>
<tr>
<th>Season</th>
<th>N*</th>
<th>Male: Female</th>
<th>CW (cm) Range</th>
<th>Mean±SD</th>
<th>WT(g) Range</th>
<th>Mean±SD</th>
<th>n*</th>
<th>Range</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRM</td>
<td>37</td>
<td>18:19</td>
<td>7.0-13.4</td>
<td>9.14±1.37</td>
<td>58.0-590.0</td>
<td>139.14±99.35</td>
<td>1367</td>
<td>1-200</td>
<td>36.95±49.44</td>
</tr>
<tr>
<td>MS</td>
<td>37</td>
<td>17:20</td>
<td>7.0-12.7</td>
<td>9.14±1.36</td>
<td>50.0-250.0</td>
<td>117.28±48.12</td>
<td>263</td>
<td>1-36</td>
<td>7.11±9.02</td>
</tr>
<tr>
<td>PTM</td>
<td>29</td>
<td>14:15</td>
<td>6.5-10.7</td>
<td>8.52±1.06</td>
<td>60.0-210.0</td>
<td>101.49±36.71</td>
<td>440</td>
<td>1-74</td>
<td>15.17±20.26</td>
</tr>
</tbody>
</table>

*N: total number of crabs; n: total number of barnacles
branchial chambers, their number was more on the hypobranchial surface of the gills rather than the epibranchial (Fig. 3). Only 11% were found in the branchial chambers. The proximal surface of the gills displayed higher prevalence of Octolasmis. A total of 2070 Octolasmis were found inside the branchial chambers of the sampled crabs. Heavily infested crabs contain barnacles of different size groups. Maximum number of Octolasmis found in the gill chamber of a single crab was 200.

There was a positive correlation between prevalence and C_W. High prevalence and mean intensity of infestation observed with host size in the range 8.5 - 10.5cm carapace width (Fig.4a). Infestation was comparatively higher in larger size groups where as in the younger ones it was negligible. Intensity of infestation in larger crabs of size between 12-14cm were only few in number and 50% of them were collected in monsoon. No relationship was observed between body weight and prevalence (Fig.4b). Barnacles obtained during June- July were mostly juveniles. Two molted female crabs (8.5cm and 13.4cm) harbors barnacles (n= 7 and 70 respectively) of size less than 2mm. Intensity of infestation shows a remarkable variation in the two sexes during different seasons (Fig. 5, Table 3). Females sampled in pre-monsoon displayed significantly higher infestation rate (95%) compared to male (89%). Mean intensity of infestation was also higher in females (29.1) than males (17.6).

**Discussion**

Earlier studies on these epibionts on *S.serrata* generally deals with their association, occurrence and systematics. Salinity, temperature, suspended matter and the amount of pollutants affect the distribution and abundance of these organisms at a particular locality. In addition, host factors like moult stage, size and maturity status contribute significantly to their infestation dynamics. The distribution pattern varied significantly during different months and different exposure periods. Infestation in all months reveals the nature of the species. The increased intensity during December - May can well be related to the environmental factors mainly salinity and temperature, which would be normally high during pre-monsoon months. Salinity act as a master factor in the settlement and successful survival of the barnacles. The high prevalence of infestation noticed in the present investigation suggests the greater susceptibility of the host during this period. Similar to the present observation several marine parasites and symbionts are limited by low salinities and low temperatures. Seasonal analysis helps to evaluate the interaction between host and epibionts. Many barnacles are killed and sloughed off due to the low salinity prevailing at that time. The surface salinity and temperature of the Kayamkulam lake was reported to vary from 3.22 ppt to 35ppt and 28°C to 35°C respectively. Regular freshwater treatment in the aquaculture system assists...
in the eradication of barnacles without deleterious effect on the crabs. The cypris larvae cannot survive or grow below certain salinity.

Barnacles of Octolasmis spp. are frequently found attached to the gills of S.serrata. Three species of these sessile barnacles viz., Octolasmis angulata, O.lowei and O.cor were reported from the gills of S.serrata. Infestation by more than one barnacle per gill was common among adult crabs and they are lost at each time the host moults. They were found more on the hypobranchial side than the gill surface and diminishes the area available for gas exchange and take advantage of the respiratory currents to bring in planktonic food. The broader lateral margin of the gill offers sufficient space for cementing its peduncle. The intensity of infestation increased with crab’s size and immature crabs are unsuitable host for barnacles due to their short intermoult period. More number of epizoic barnacles in the adult crabs are attributed to correspondingly larger gill area and longer inter molting period. It get attached to the host, metamorphosed, and then grows into the filter feeding adult. This is due to the facilitated nutrient acquisition and the protection provided by the

Table 3 — Seasonal variations in prevalence and mean intensity of infestation by Octolasmis spp. in Scylla serrata

<table>
<thead>
<tr>
<th>Season</th>
<th>N*</th>
<th>n*</th>
<th>Prevalence (%)</th>
<th>Mean intensity</th>
<th>N*</th>
<th>n*</th>
<th>Prevalence (%)</th>
<th>Mean intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRM</td>
<td>16</td>
<td>386</td>
<td>88.89</td>
<td>24.13</td>
<td>18</td>
<td>981</td>
<td>94.74</td>
<td>54.50</td>
</tr>
<tr>
<td>MS</td>
<td>13</td>
<td>92</td>
<td>76.47</td>
<td>7.07</td>
<td>16</td>
<td>171</td>
<td>80.00</td>
<td>10.69</td>
</tr>
<tr>
<td>PTM</td>
<td>11</td>
<td>225</td>
<td>78.57</td>
<td>20.45</td>
<td>13</td>
<td>215</td>
<td>86.67</td>
<td>16.54</td>
</tr>
</tbody>
</table>

N*: Total number of infested crabs; *n: No. of barnacles

Fig. 4 — Infestation in different size groups of S.serrata (a) in relation to length and (b) body weight (N=103)

Fig. 5 — Seasonal variation in the mean intensity of infestation (a) on male and female S.serrata and (b) on total cabs
branchial chamber of the host crabs. Hurley reported that the barnacles, that colonise an unstable habitat reach early maturity than that of the same species occupying a stable habitat. In *Scylla serrata* individuals having less than 12 instars were unsuitable hosts for *Octolasmis* because the short inter-moult period does not allow barnacle reproduction. The epibionts are not able to settle and develop quickly enough to complete their life cycle on juvenile crabs. Significantly higher abundance of juvenile barnacles attached to the gills during June – July months indicated either the crab is a post moult one or the low saline environment affects the growth of the barnacle.

The mud crabs are commonly found buried in mud and feeds mainly on detritus, molluscs and worms. The reason for higher prevalence of these barnacles in female population might be due to the availability of more number of females in the environment and it also suggests the susceptibility of the females to infestation. Berried females become inactive and dwelling at the bottom for longer time than males. *Octolasmis* species is a continuous breeder and the cypris larvae easily enter in to the branchial chamber of the inactive female crabs than that of males. In some species of crabs the female usually migrates to high saline off-shore regions where she releases her eggs and larvae and the larvae become infested with epizoites.

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References


