INFLUENCE OF VARIOUS LIVE FEEDS ON SURVIVAL AND INTERMOULT DURATION OF THE LARVAE OF THE EDIBLE CRAB, THALAMITA CRENATA (LATREILLE)

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Complete development with 92% survival was observed when the larvae were fed with the mixed diet (DE) of Coscinodiscus sp. and Artemia nauplii in 23.18 days, which was followed by Artemia nauplii (E) alone (89.6%) in 24.95 days, Coscinodiscus sp. (D) alone (2.1%) in 29.11 days, the mixture (ABCDE) of Thalassiothrix longissima, Nitzschia sp., Skeletonema sp., Coscinodiscus sp., and Artemia nauplii (90%) in 25.22 days and the mixture (CD) of Skeletonema sp. and Coscinodiscus sp. (25.6%) in 29.66 days. Incomplete development was observed i.e. upto third zoeal stage, when larvae fed with Thalassiothrix longissima (A) and Nitzschia sp. (B) (12% and 18%) in 12.6 and 14.05 days, respectively. It was followed by Skeletonema sp. (C) and mixture of Thalassiothrix longissima and Nitzschia sp. (AB), Skeletonema sp. and mixture of Thalassiothrix longissima, Nitzschia sp. and Coscinodiscus sp. (ABCD) (16.6%, 13.3% and 18%) in 16.09, 18.77 and 13.64 days, respectively, in which the development is only up to fourth zoeal stage.

INTRODUCTION

Available information on the larval development of the estuarine edible crab Thalamita crenata indicates that there is considerable variation in survival and intermoult duration according to the feed fed (Krishnan and Kannupandi, 1990; Godfred et al., 1995 and 1997). Since this species has a great potential for farming, it is attempted in the present study to rear the larvae mainly on different phytoplankton along with brine shrimp nauplii to investigate their effect on survival.

MATERIAL AND METHODS

Ovigerous females of T. crenata were collected from the Vellar estuary (11° 27' N and 79° 47' E). They were maintained in a small plastic trough containing the filtered estuarine water (habitat water). The water was changed daily. After hatching, the larvae were transferred to glass bowls (113 mm dia x 43 mm depth) containing filtered estuarine water. Daily the major physico-chemical parameters such as salinity, temperature, dissolved oxygen and pH were monitored and maintained at 25 ± 1 ppt, 29 ± 2°C, 4 ± 0.25
ml/l and 7-7.5, respectively, throughout the period of study (Krishnan and Kannupandi, 1990).

Diatoms collected from the mouth of the Vellar estuary were isolated through serial dilution technique (Lewin, 1959) and cultured in the Guillard’s F2 medium (Guillard, 1975).

Ten different feed combinations were prepared to evaluate their efficiency: 1) *Thalassiothrix longissima* (A), 2) *Nitzschia* sp. (B), 3) *Skeletonema* sp., (C) 4) *Coscinodiscus* sp. (D), 5) Artemia nauplii (E), 6) mixture of *Thalassiothrix longissima* and *Nitzschia* sp. (AB), 7) mixture of *Skeletonema* sp. and *Coscinodiscus* sp. (CD), 8) mixture of *Coscinodiscus* sp. and Artemia nauplii (DE), 9) mixture of *Thalassiothrix longissima*, *Nitzschia* sp., *Skeletonema* sp., *Coscinodiscus* sp. and Artemia nauplii (ABCDE).

Forty newly hatched zoal larvae were introduced into 4 bowls each for 10 different feeds tested. The bowls were examined daily for dead larvae and moults. Only live larvae were then transferred to bowls with fresh medium and were fed with appropriate test feeds. All the feeds were added in excess based on the knowledge acquired during the preliminary feeding experiments. The survival percentage for each stage in all the test feeds was observed daily and the standard error in the replicated trials was calculated. Further, the data were subjected to ANOVA to test the statistical significance (Zar, 1974).

**RESULTS**

**Survival**

When the larvae were fed with mixed diet of *Coscinodiscus* sp. and Artemia nauplii (DE), the survival rate was found to be 92%, which was followed by 90% in the mixture of *Thalassiothrix longissima*, *Nitzschia* sp., *Skeletonema* sp., *Coscinodiscus* sp. and Artemia nauplii (ABCDE), 89.6% in Artemia nauplii (E), 25.6% in the mixture *Skeletonema* sp. and *Coscinodiscus* sp. (CD) and 2.1% in *Coscinodiscus* sp. (D). When the larvae were fed with the diets A and B, 12% and 18% survival rates were recorded, respectively, at the end of third zoal stage. But at the same time the larvae successfully completed the fourth zoal stage also when fed with the diets C, AB and ABCD with a survival of 16.6%, 13.3% and 18%, respectively.

Figure 1 shows the survival of larvae reared using different diets viz., A, B, C, D, E, AB, CD, DE, ABCD and ABCDE.
Fig. 1. Survival of larvae of *T. crenata* reared using different diets A) *Thalassiothrix longissima*, B) *Nitzschia* sp., C) *Skeletonema* sp., D) *Coscinodiscus* sp., E) *Artemia* nauplii, AB) Mixture of *Thalassiothrix longissima* and *Nitzschia* sp., CD) Mixture of *Skeletonema* sp. and *Coscinodiscus* sp., DE) Mixture of *Coscinodiscus* sp. and *Artemia* nauplii., ABCD) Mixture of *Thalassiothrix longissima*, *Nitzschia* sp., *Skeletonema* sp. and *Coscinodiscus* sp. and ABCDE) Mixture of *Thalassiothrix longissima*, *Nitzschia* sp., *Skeletonema* sp., *Coscinodiscus* sp. and *Artemia* nauplii.

Intermoult duration

Table 1 shows the mean intermoult duration and the duration taken for the complete larval development in each tested diet.

The results clearly indicated that the mixture of *Coscinodiscus* sp. and *Artemia* nauplii (DE) fed larvae completed their development in 23.18 days. The larvae fed with *Artemia* nauplii (E) completed their development in 24.95 days, while those fed with the mixture of all the diets tested (ABCDE) completed their development in 25.22 days. Those fed with *Coscinodiscus* sp. (D) took 29.11 days to complete their development, followed by those fed with mixture of *Skeletonema* sp. and *Coscinodiscus* sp. (CD) in 29.66 days. However, the larvae could not survive beyond third and fourth zoeal stages when fed exclusively on A & B and C, AB and ABCD diet groups, respectively. The larvae fed with diet groups A and B took 12.6 and 14.05 days, respectively, for the development upto the third zoeal stage. Similarly, the larvae fed with diet groups C, AB and ABCD took 16.09, 18.77 and 13.64 days, respectively, for the development upto the fourth zoeal stage. The results were subjected to analysis of variance and were found to be significant (p < 0.05).
Table 1. Intermoult duration (mean ± standard deviation) of zoeal development (in days) of T. crenata to different individual and mixed diets

<table>
<thead>
<tr>
<th>Group</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
<th>Stage IV</th>
<th>Stage V</th>
<th>Megalopa</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.26 ± 0.61</td>
<td>9.36 ± 0.83</td>
<td>12.6 ± 0.98</td>
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<tr>
<td>B</td>
<td>5.66 ± 1.20</td>
<td>9.88 ± 1.25</td>
<td>14.05 ± 1.39</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>C</td>
<td>4.34 ± 0.75</td>
<td>7.70 ± 1.21</td>
<td>12.33 ± 1.30</td>
<td>16.09 ± 1.34</td>
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<td>-</td>
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<tr>
<td>D</td>
<td>3.28 ± 0.85</td>
<td>6.71 ± 6.54</td>
<td>9.45 ± 1.01</td>
<td>12.17 ± 0.59</td>
<td>19.21 ± 1.36</td>
<td>29.11 ± 1.25</td>
</tr>
<tr>
<td>E</td>
<td>3.22 ± 0.55</td>
<td>6.23 ± 0.57</td>
<td>9.49 ± 0.89</td>
<td>12.47 ± 0.73</td>
<td>17.64 ± 0.93</td>
<td>24.95 ± 1.41</td>
</tr>
<tr>
<td>AB</td>
<td>4.26 ± 0.72</td>
<td>8.33 ± 0.85</td>
<td>13.66 ± 6.37</td>
<td>18.77 ± 0.94</td>
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<td>-</td>
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<tr>
<td>CD</td>
<td>3.18 ± 0.55</td>
<td>6.90 ± 1.06</td>
<td>11.57 ± 1.46</td>
<td>15.57 ± 1.46</td>
<td>21.35 ± 1.59</td>
<td>29.66 ± 1.53</td>
</tr>
<tr>
<td>DE</td>
<td>3.06 ± 0.31</td>
<td>5.06 ± 0.31</td>
<td>7.12 ± 0.51</td>
<td>9.12 ± 0.51</td>
<td>14.12 ± 0.51</td>
<td>23.18 ± 0.74</td>
</tr>
<tr>
<td>ABCD</td>
<td>3.14 ± 0.54</td>
<td>7.37 ± 0.73</td>
<td>10.64 ± 1.20</td>
<td>13.64 ± 1.20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ABCDE</td>
<td>3.22 ± 0.73</td>
<td>6.22 ± 0.73</td>
<td>10.24 ± 0.81</td>
<td>13.29 ± 0.89</td>
<td>18.18 ± 0.62</td>
<td>25.22 ± 0.73</td>
</tr>
</tbody>
</table>

DISCUSSION

The present investigation indicated in general, that the diatoms tested were not suitable feed for the larvae of T. crenata as they did not promote complete development, except the feed D (Coscinodiscus sp.) which also showed a poor survival of 2.1%. Similar observations were reported by Godfred et al. (1997). The feed groups A, B, C, AB and ABCD were not adequate for completing the larval development and showed a varying survival rates of 12%, 18%, 16.6%, 13.3% and 18%, respectively. These values were comparable with that of Godfred et al. (1997) in which they have also reported the incomplete development (upto 3rd Zoea), when fed with Skeletonema sp. alone (25%) and Skeletonema sp. plus Chaetoceros sp. (21%). This could be due to the lack of some essential nutrients in these feeds (Godfred et al., 1977) and the particle size (Mock et al., 1980) apart from the fact that the ingested algae were largely defecated.

The larvae reached the first crab stage with a small percentage of survival when fed with the feeds D(2.1%) and CD (25.6%) and with a good survival when fed with the feed groups DE (92%), E (89.6%) and ABCDE (90%). Thus, when the larvae were fed with the feeds D and CD, the results showed not only a poor survival, but also a significant delay in the successive moulting to reach first crab stage.

In the present study, the high survival rates were obtained with the feeds DE (92%) and ABCDE(90%), which may be due to conditioning of the culture medium by
removing the metabolites and releasing oxygen by the diatoms as suggested by Brick (1974), who observed that when larvae of *S. serrata* fed with mixture of *Chlorella* sp. and *Artemia* nauplii, *Chlorella* enhanced the growth or condition the culture medium by removing the metabolites like ammonia and releasing oxygen.

In the present study, the shortest period for larval development was 23.18 days for the feed DE (*Coscinodiscus* sp. and *Artemia* nauplii), whereas it was 24.95, 25.22, 29.11 and 29.66 days for feeds E, ABCDE, D and CD, respectively. Krishnan and Kannupandi (1990) reported that the larval development in *T. crenata* was completed in 25 days when *Artemia* was given as feed, while Godfred *et al.* (1995) recorded 16.00 days for the same species when fed with the *Artemia* nauplii and rotifers. The possible reason for the zoa surviving for long intermoult period in the present investigation may be due to the phytoplankton which could have conditioned the rearing media as mentioned above.

The present study clearly showed that a mixed feed of phytoplankton combination of *Coscinodiscus* sp. and *Artemia* nauplii (feed DE) and *Thalassiorhrix longisimma*, *Nitzschia* sp. *Skeletonema* sp., *Coscinodiscus* sp. and *Artemia* nauplii (feed ABCDE) yielded best survival (90%) and complete larval development, thus confirming the observations of Lumare and Gozzo (1972). These mixed feeds could be very well recommended for inexpensive mass larval culture of *T. crenata*. However, further study on the biochemical composition and nutritional quality of the live feeds used in the present study will throw more light in this line.

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REFERENCES


